TEACHER COMPETENCY IN THE USE OF INFORMATION COMMUNICATION AND TECHNOLOGY AND STUDENT ACADEMIC ACHIEVEMENT IN PHYSICS IN MAKUENI COUNTY, KENYA.

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E60/89943/2016

A RESEARCH PROJECT SUBMITTED TO THE DEPARTMENT OF EDUCATIONAL COMMUNICATION AND TECHNOLOGY, SCHOOL OF EDUCATION IN PARTIAL FULFILMENT FOR THE AWARD OF MASTER OF EDUCATION DEGREE OF THE UNIVERSITY OF NAIROBI

NOVEMBER, 2020

DECLARATION

This research project is my original work and has not been submitted to any other university for examination.

Signature ---------- Date ----------

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This project has been submitted with my approval as the appointed university supervisor.

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DEDICATION

I dedicate this research project to my parents for their encouragement and persistent support throughout the study program. May God bless them abundantly.

ACKNOWLEDGEMENT

I would like to express my great appreciation to my supervisor, Dr. Muriithi Evanson for his valuable and constructive guidance throughout the project work. I too extend my gratitude to the entire University of Nairobi fraternity for providing the necessary permissions for this study to be done. All other bodies which gave permission for this research work to be conducted, NACOSTI and the ministry of education, Makueni County are highly appreciated. Special thanks go to my wife, son and siblings for supporting me throughout the study program and project work. To all the respondents in various schools who responded on the data collection tools, I give my sincere gratitude.

ABSTRACT

Information and Communication Technology (ICT) integration in teaching and learning has been a trending phenomenon in the contemporary classroom. Use of ICT in teaching has been found to create learning activities which lead to an improvement in the overall student achievement. For effective integration of technology in teaching, a teacher has to be ICT competent. Some of the ICT competencies include level of ICT training, operating ICT devices, creating information using ICT devices and accessing information on the internet. This study aimed at investigating the influence of teacher competency in the use of ICT on student academic achievement in physics in secondary schools in Makueni County. Stratified random sampling was applied to select a sample of 60 schools. The research used descriptive survey design where participants answered questions administered through interviews and questionnaires. Microsoft (MS) Excel (2010) was used to analyze the data. The objectives were analyzed through descriptive statistics and conceptual content analysis whereas analysis of variance (ANOVA) was used to test the hypotheses. From the study, it was observed that students taught by teachers with a high level of ICT training performed better than students taught by teachers with low level of ICT training. Similarly, teachers who were confident in operating ICT devices led to students achieving high scores than students taught by teachers who were not confident in operating ICT devices. It was also observed that teachers who were confident in creating information using ICT devices led to students achieving high scores than students taught by teachers who were not confident in creating information using ICT devices. Likewise, teachers who were confident in accessing physics content on the internet led to students performing better than students taught by teachers who were not confident in accessing physics content on the internet. Generally, the study found out that ICT competent teachers led to students achieving high scores in physics. In view of these findings, the researcher recommended that the government to connect all secondary schools with electrical power and provide ICT facilities to the schools, the ministry of education to set up ICT institutions or ICT training centers to train physics teachers and increase the frequency of in-service trainings (INSETs) so as to enable teachers acquire sufficient ICT competencies to integrate the same in teaching, the government to install Wi-Fi network connection to all secondary schools to enable teachers access physics content effectively on the internet and lastly, more research to be done on the frequency of ICT use in teaching and its influence on student academic achievement in physics.

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ABBREVIATIONS AND ACRONYMS

ANOVA: Analysis Of Variance

CD: Compact Disc

CEMASTEA: Centre for Mathematics, Science and Technology Education in Africa

d.p : Decimal places

DOI: Diffusion of Innovations

DVD: Digital Video Disc

ICT: Information and communication technology

INSET: In-service Training

IWB: Interactive White Board

KCSE: Kenya Certificate of Secondary Education

MS: Microsoft

NACOSTI: National Commission for Science, Technology and Innovation

PC: Personal Computer

SD: Security Digital

SMASE: Strengthening of Mathematics and Science Education

U.S: United States

UNESCO: United Nations Educational, Scientific and Cultural Organization

Wi – Fi: Wireless Fidelity

CHAPTER ONE: INTRODUCTION

1.0 Background information

Use of ICT in teaching has been found to create learning activities which lead to an improvement in the overall student achievement. According to Noor (2012), ICT use in the classroom revitalizes both teachers and students thereby providing an interactive and lively learning environment. For effective integration and use of ICT in pedagogy, the teacher should be competent enough on the application of ICT in the class setting and delivering content with. Studies have shown that teachers with higher levels of ICT competency demonstrated a higher level of ICT application in teaching and learning (Buabeng, 2012). A study done by Briones (2018) showed there is a moderate positive correlation between the teacher's level of competency in the use of ICT and the students' academic achievement in physics.

According to the United Nations Educational, Scientific and Cultural Organization (UNESCO, 2008) ICT competency is defined as knowledge, skills, and ability to take advantage of ICT for the purpose of gathering, processing and presenting information in support of activities among different groups of people. Some of the trends of ICT competency as defined by Bert and Theo (2010), are teacher training, operating ICT devices, accessing information on the internet and creating information using ICT devices. Computer training enables teachers to acquire more knowledge which in turn makes them more confident and improves their competency on ICT use in teaching (Abuhmaid, 2011).

Operating ICT devices takes various forms such as booting a computer, taking photos using a digital camera, operating a smart phone and mounting SD card on smart phone. These operations enable a teacher use ICT devices comfortably in class thereby leading to observable influence in

student achievement. Another ICT competency is creating information using ICT devices. This involves working with software such as MS word for typing, editing and formatting text, MS publisher, Photoshop and paint for creating photos and images, MS PowerPoint for presenting documents such as text, videos and animations. These skills enable a teacher to create and present the desired and favorable content for students to learn better leading to an influence in their achievement. Briones (2018) on her study in Philippines found that teachers emphasized ICT facilities in teaching and learning since discussions of a certain topic becomes easier, teachers spend lesser efforts in explaining certain phenomena due to use of videos and simulations and there was lesser time spend in preparing lessons.

The other competency is ability to access information on the internet which involves the speed of access, downloading text, audio and video content and saving the content for editing and presentation. This competency enables a teacher to search for relevant physics content on the internet and present the same to learners for their effective learning and hence influence their achievement. According to Lima (2006), the Internet is a valuable channel to transmission of information and knowledge.

1.01 Physics

Physics is defined as the study of matter and its relation to energy (Munish, 2016). It covers several areas which include mechanics, electromagnetism, optics, hydrodynamics and atomic physics. In the current 8-4-4 curriculum, physics is taught as a science subject in Kenya secondary schools and tested as an elective subject in the Kenya Certificate of Secondary Education (KCSE) exam, which is the final exam to mark the end of four years in secondary school.

A good performance in KCSE enables students to secure places in institutions of higher learning (Musasia, Abacha and Biyoyo,2012). Swan, 2015 states that performance from standardized

national exams help stakeholders identify how schools and education systems are performing as measured by student learning outcomes. However, Mulambe (2017) observed that in Kenya, the national mean score in physics has been low over the years.

In another study by Muindi (2015), it was noted that performance by students in physics has persistently been poor in Makueni County while Muriithi (2013) in addition to students performing poorly nationally observed that there has been an increase in the number of students dropping physics at the second year of study in secondary schooling. With the poor performance in the subject, it means very few do qualify for physics courses in tertiary learning institutions and thereby leading to scarcity of physics related personals in the job market.

1.02 ICT and academic performance in physics

The use of ICT in teaching and learning has been found to have diverse advantages. Although not all forms of ICT influence performance, Sosin et al, (2004) found that some ICT seems to be positively correlated to performance while others are not. According to Gianluca et al, (2015), ICT related teaching increases student performance if they help teachers to get further materials. Briones (2018) on her study in Philippines found that teachers emphasized ICT facilities in teaching and learning since discussions of a certain topic becomes easier, teachers spend lesser efforts in explaining certain phenomena due to use of videos and simulations and there was lesser time spend in preparing lessons. According to Noor (2012), ICT use in the classroom revitalizes both teachers and students thereby providing an interactive and lively learning environment while Gianluca et al (2015) states that ICT can introduce new ways of teaching and learning and opens up unexpected horizons in the student teacher relationship.

Contrary to the research which has given positive relation between ICT adoption and student performance, other researches have shown no relation at all between ICT integration in teaching

and students' academic achievement. Saqib et al, (2015) noted that there is no research at all which has given a clear consensus on the effect of ICT investment on students' academic performance while Writte and Rogge (2014) on their study on ICT influence on students' academic performance in Holland found no statistical significant difference between students taught using ICT and students that had no access to technology.

1.03 Physics Teacher's ICT competency

Several studies have shown that teachers with high levels of ICT competency demonstrated a higher level of ICT application in teaching and learning. Buabeng (2012), on his study on factors influencing teacher's adoption and integration of ICT use in teaching in Ghana found out that teachers' ICT use was highly related to their levels of competence. He further stated that if the teacher's attitude towards the use of technology was positive, the teacher can easily assimilate ICT in teaching. Another study by Huang and Liaw (2005) found that teacher's accepted the usefulness and use of ICT in teaching depending on the attitude they had towards technology. Briones (2018) further found out that there is a moderate positive correlation between the teacher's level of competency in the use of ICT and the students' performance in physics.

1.1 Statement of the problem

A lot of measures have been put in place to provide ICT facilities in schools and ICT integration in teaching emphasized as a means of improving student's achievement. Recent studies have shown that use of ICT in teaching has led to interactive and active classrooms and thereby an improvement in the overall students' performance. However the performance in physics in the national examination has been low in Makueni County as observed by Muindi (2015). Thus, there

is need to study on the relationship between physics teacher's competence in the use of ICT and students' achievement in physics.

1.2 Purpose of the study

This study aimed at investigating the relationship between teacher competency on the use of ICT and students' academic performance in physics in Makueni County, Kenya.

1.3 Research objectives

The specific objectives of the study were:

(i) To investigate the relationship between teacher's level of ICT training and students' academic achievement in physics.

(ii) To investigate the relationship between the teacher's level of operating ICT devices and students' academic achievement in physics.

(iii) To investigate the relationship between teacher's level of creating information using ICT devices and students' academic achievement in physics.

(iv) To investigate the relationship between teacher's level of accessing physics information on the internet and students' academic achievement in physics.

1.4 Research hypotheses

The following null hypotheses were tested in the research

(i) There is no statistical significant difference between the teacher's level of ICT training and students' academic achievement in physics.

(ii) There is no statistical significant difference between the teacher's level of operating ICT devices and students' academic achievement in physics.

(iii) There is no statistical significant difference between the teacher's level of creating information using ICT devices and students' academic achievement in Physics.

(iv) There is no statistical significant difference between the teacher's level of accessing physics information on the internet and students' academic achievement in Physics.

1.5 Significance of the study

The findings of the study will help stakeholders in the education sector to determine on which areas to adjust on the teacher's ICT competency in teaching so as to improve ICT integration in secondary schools. The research also will bring out the relationship between the level of ICT training of teachers and how it affects students' performance in physics thus enabling the government to know on areas to improve on training physics teachers. From the study, the ministry of education will be able to observe how various types of ICT hardware and their operations by teachers influence performance of students in physics therefore plan better on which ICT instruments to provide in schools. The study will also bring out the relationship between the teacher's level of accessing the internet and students' academic achievement in physics thereby enabling institutions like SMASE and CEMASTEA know how best to bring in-service training to teachers on internet usage.

1.6 Limitations of the study

Makueni County is a large county and using survey research, it was not possible to represent the real situation of all the schools within the county. The researcher only studied on the selected sample schools which may not reflect the ideal situation in all the schools within the county.

1.7 Delimitations of the study

The study was conducted in Makueni County and only focused on physics teachers in public secondary schools.

1.8 Basic assumptions

It was assumed that the schools were connected to electrical power and have made provisions for ICT facilities.

1.9 Definitions of key terms

Academic Achievement: In this study, academic achievement is taken to be the grades students score in physics in the assessments administered to them.

Information and Communication Technology (ICT): ICT is taken to mean the various ways of using technology in the teaching and learning process.

Physics: Reference to physics implies to a secondary school subject taught from form one to form four focusing on matter and its relation to energy.

Teacher competency in the use of ICT: This is taken as the skills, abilities, attitudes and knowledge applied to the use of information and communication systems in teaching to achieve success.

Teacher' level of accessing the internet: In the study, this is taken as the ability of the teacher to view physics content on the internet, download ad save it using the stated ICT device.

Teacher's level of operating ICT devices: Level of operating ICT devices refers to the ability of a teacher to comfortably work with the stated ICT device in preparing and delivering physics content

Teacher's level of creating information using ICT devices: This refers to the ability of a teacher to come up with new physics content using the stated ICT device.

Teacher's level of ICT training: This is taken to be the highest academic qualification a teacher has gained on ICT training.

1.10 Organization of the study

The research report contains preliminary pages made up of the tittle, declaration, dedication, acknowledgement, abstract, table of contents, list of tables, list of figures and abbreviations. Chapter one is introduction which will cover the background of the study, statement of the problem, purpose of the study, objectives of the study, research questions, significance of the study, assumptions made in the study, limitations, delimitations, theoretical frame work, conceptual framework, and definitions of key terms used in the study. Chapter two entails review of related literature. The concepts looked at are students' academic achievement in physics, use of technology in teaching physics, teacher's competency on the use of ICT in teaching physics, teacher training on the use of ICT in teaching, types of ICT used in teaching, WhatsApp use in teaching, internet accessibility and use in teaching, barriers of ICT use in teaching Physics, theoretical framework and conceptual framework. Chapter three is research methodology which covers the research design, study location, the target population, samples and sampling procedures, research instruments, reliability and validity of the instruments, data collection procedures and analysis of the data collected. Chapter four covers on data analysis, presentation and discussions of the findings. Chapter five gives the summary, conclusion and recommendations. The last section of the report includes references, appendices which contain the research instruments used, and the relevant permits obtained to conduct the research.

CHAPTER TWO: LITERATURE REVIEW

2.0 Introduction

This chapter deals with related literature on ICT, its usage in teaching physics, teachers' competency on the use of ICT in teaching, teacher training on ICT, types of ICT used in teaching physics, WhatsApp use in teaching physics, internet accessibility and use in teaching physics and the challenges teachers face in integrating ICT in teaching. The chapter will also look at students' achievement in physics, conceptual framework and theoretical framework.

2.1 Students' achievement in physics

A students' learning achievement can be seen in the grades the student scores in an assessment within the learning process. In Kenya, students are issued with a national examination after their four years in secondary school and their performance is used to place them in institutions of higher learning (Musasia, Abacha and Biyoyo, 2012). The national performance in physics has been low as observed by Mulambe (2017). A research by Muindi (2015) showed performance by students in physics has persistently been poor in Makueni County.

Student achievement in physics is affected by several factors. Some of the major factors which affect achievement in physics among students in secondary schools as identified in a study by Wachira (2014), are student characteristics such as their career goals, attitude towards the subject and their gender, school environment such as availability of well-equipped laboratories and teacher characteristics which include missing classes their relationship with students and their methods of teaching, which include use of ICT in teaching.

2.2 Use of technology in teaching physics

Technology in the education sector has found various applications ranging from managerial and administrative tasks, teaching and learning process and compiling results for examinations. According to Sarfo, Amankwah, Oti and Yidana (2016) ICT can be used in educational institutions for evaluating learners, planning, performing statistical data on learners, organizing and scheduling instruction, and collecting data on learners. In another study by Mwalongo (2011), ICTs are used by teachers for personal development, communication, research and entertainment. The research further revealed that ICTs are used for preparing school announcements, examinations and examination results, reports, letters, scheme of work and student registration.

Technology use in the classroom improves participation of learners and makes the learning more interactive. According to (Egemen, 2018), Use of curriculum that integrated lively interactive technology software and wireless linkages improves learners experience in the classroom thereby leading to an improvement in their performance. With technology use, there is also an improvement in algebra models such as practical and theoretical problems. According to the research, use of students' Interactive Whiteboard (IWB) produces significantly better learning experiences and increase positive attitude towards learning (Egemen, 2018).

2.3 Teacher's competency on the use of ICT in teaching physics

Teachers who are well equipped and prepared to use ICT tools are more successful in technology based teaching (Ghavifekr & Rosdy, 2015). In a study conducted by Hennessy et al., (2005), teachers who did not develop sufficient confidence in a school in Ireland avoided using ICT while in Canada, some teachers avoided using ICT since they worried they might be embarrassed that students knew more than them on technology matters. According to the study, most of the teachers

possess high competence level in ICT applications such as the Internet, word processing, and e-mail. However, the same teachers have low competency in multimedia and database application

software which are required for the design of activities related to classroom managemen. The study provided an insight to teachers to know they need to improve more on ICT skills geared towards improving and advancing learners' learning capabilities.

Besides the basic ICT skills, schools need to employ a variety of strategies to equip teachers with more advanced techniques on technology gadgets and enable them build more confidence on ICT usage in pedagogy. According to Warwick and Kershner (2008), teachers should be conversant with the significance and importance of ICT in order to conduct a meaningful lesson with the use of technology. Thus, schools can organize and send teachers to ICT seminars, conduct inset trainings, hold exchange programs and benchmarking sessions, or hold internal peer training and collaboration to strengthen their ICT skills.

In a study by Irfan and Mohamad, (2014), on Malaysian teacher's level of ICT skills and practices, and its impact on teaching and learning, most of the respondents were skillful in sharing information and accessing the internet. This shows that most Malaysian teachers are highly competent in using the internet. From the study, the respondents claimed that they were competent in basic ICT skills such as using spreadsheet, word processor and slide presentation.

The study by Irfan and Mohamad agreed with another one done by Lau and Sim (2008), which revealed that teachers have a higher level of competency in using word processing application, presentation tools in preparing teaching materials, teaching courseware, and presenting lessons. These are the basic and commonly used soft wares by many educators across the world in teaching and learning environment. The result from the study by Irfan and Mohamad (2014) also indicated that the respondents were highly competent on using ICT for communication through email, chat

rooms and social networking sites. However, they lacked advanced ICT skills such as animations, multimedia design and producing graphics.

2.4 Teacher Training on the use of ICT in teaching physics

To attain ICT skills and hence develop high competency levels on technology use in teaching, teachers should attend training courses on ICT integration in teaching and learning settings. According to Ghavifekr & Rosdy (2015), professional development and training programs for teachers play a key role in enhancing students' quality learning. Many schools however prefer peer tutoring programs where a more skillful teacher in ICT assists another teacher who is less experienced on ICT matters (Ghavifekr & Rosdy, 2015). In a study by Munanu (2014), it was observed that computer training influenced a teacher's readiness to use ICT in teaching. Training would enable the teacher acquire more knowledge, make the teacher more confident on ICT use and thereby ensuring faster coverage of the syllabus.

In other studies, it was observed that most teachers have the ability and training to use computers but their ICT skills are not well advanced. Goko (2012), conducted a research on factors affecting the use of information and communication technology in teaching and learning in secondary schools in Kangema- Murang'a County, and observed that 85.4% of the teachers have certificate in computer application packages while only 4.2% had a diploma in ICT while 10.4% did not disclose the level of ICT training.

Professional development courses for teachers help them to improve their ICT skills and knowledge. However, Abuhmaid (2010), highlighted challenges regarding the conduct and the nature of these courses including teachers believes, timing and modes of training, workload, follow-up, motivation and school culture. Computer training enables teachers to acquire more knowledge which in turn makes them more confident and improves their competency on ICT use

thus, there is need to have regular refresher courses (Abuhmaid, 2010). In a study by Munanu (2014), on factors influencing teacher's readiness to use ICT in teaching in public secondary

schools in Gatundu north district, Kiambu County, Kenya, all the respondents indicated that computer training influence a teacher's readiness to use ICT in teaching.

2.5 Types of ICT Used in teaching physics

Information and Communication technology refers not to one particular gadget but to a variety of several assets both tangible (hardware) and nontangible (software). Toomey (2001), describes ICT as those technologies that are used for gathering, accessing, manipulating, storing, presenting or communicating information. These include hardware (e.g. computers, cameras, radio, smartphones among others), software applications (e.g. access to the Internet, application packages like word processors, video conferencing among others) that can be used for educational purposes.

According to Elen et al., (2010), ICT encompasses several media to; record information e.g., magnetic tape/disk, optical disks (CD/DVD) and flash memory; technology used for communication both audio and visual like radio, television, microphone, camera, loudspeaker, projector; all of which can be used in creating, storing, processing and transmitting information in teaching and learning process. Corbeil and Valdes-Corbeil (2007), further noted that mobile technologies have penetrated into education although according to Motiwalla (2007), the use of mobile technology in education is still in its infancy.

2.51 WhatsApp use in teaching physics

WhatsApp is a social networking application which is mostly used in smartphones, iPad and PCs. In a research by Rosenberg and Asterhan (2018), Use of class WhatsApp groups was found to be the major channel used for conveying information on school-related topics. The app according to

the study is used to organize work such as sending and receiving updates and also used to manage learning activities. The research further indicated that teachers used WhatsApp for enforcing

discipline. Penning et al., (2014) support the importance of the app in learning since several educational purposes like organization, instruction and disciplinary tasks can be accomplished through WhatsApp-based, teacher-student groups. According to Egemen (2018), learners and tutors recognize WhatsApp as the most preferred channel of conveying information due to minimal disclosure of private information. However, other findings have shown challenges of using WhatsApp and other social sites. According to Rosenberg & Asterhan (2018), through sites there is communication overload and it's difficult for teachers to monitor student interactions in social media during class time.

2.6 Internet accessibility and use in teaching physics

Access to ICT facilities differs from across various places in the world. A research by Kodai (2013), showed that the U.S. teachers have a more access to the internet and use it more often for instruction than the Japanese teachers. According to Lima (2006), the Internet is a valuable channel to transmission of information, knowledge and through communication; opportunities for growth and development among nations in the world are realized. The integration of ICT tools such as laptops, desktops, mobile phone, iPad and the Internet effectively in instruction can facilitate the acquisition of 21st century skills (Sarfo, Amankwah, Oti & Yidana, 2016).

2.7 Barriers of ICT use in teaching physics

The major barriers preventing teachers to integrate ICT into the curriculum according to a study done by Salehi & Zeinab, (2012) include insufficient technical supports at schools and little access to Internet and ICT. Another study done by Bingimlas (2009), on Barriers to the Successful Integration of ICT in Teaching and Learning Environments indicate that most teachers have a

strong desire to integrate ICT into education but they were met by barriers such as lack of access to resources, lack of confidence and lack of competence. These barriers in addition to lack of suitable educational software, rigid structure of traditional education system and restrictive curricula were also highlighted by Buabeng (2012).

2.8 Theoretical frame work

This study is based on Diffusion of Innovations (DOI) Theory which was developed by Everett M. Rogers in 1962. The theory explains how an event or idea gains momentum over time and diffuses through a specified population. The result of the diffusion is that the population or the person does something differently that what they had previously. Dearing, James and Cox (2018), define diffusion as a social process that occurs among people in response to learning about an innovation such as a new evidence or approach for improving an action. This study investigated on the ICT competences of physics teachers and how the applications of these competences diffuse through student population to influence their academic achievement in the subject.

According to Lyytinen & Damsgaard (2001), DOI develops a predictive account of the diffusion phenomenon that helps technology implementers to advance the diffusion of selected technologies. From the study, the developers of ICT facilities in education and implementers will be able to determine how best to provide effective ICT amenities for developing more competency on students. According to James and cox (2018), diffusion changes a society through a wave of innovations and this study is based on how teacher ICT competencies affect students' achievements in physics. James and cox (2018), further state that when persons learn about an innovation that they think may have important consequences for them or those they serve, they tend to explore and research on how the innovation can be advanced further. From the literature review, most teachers concur that ICT adoption in contemporary teaching affects students'

academic achievement positively and thus they tend to research on how best to infuse the technology in the classroom.

2.9 Conceptual frame work

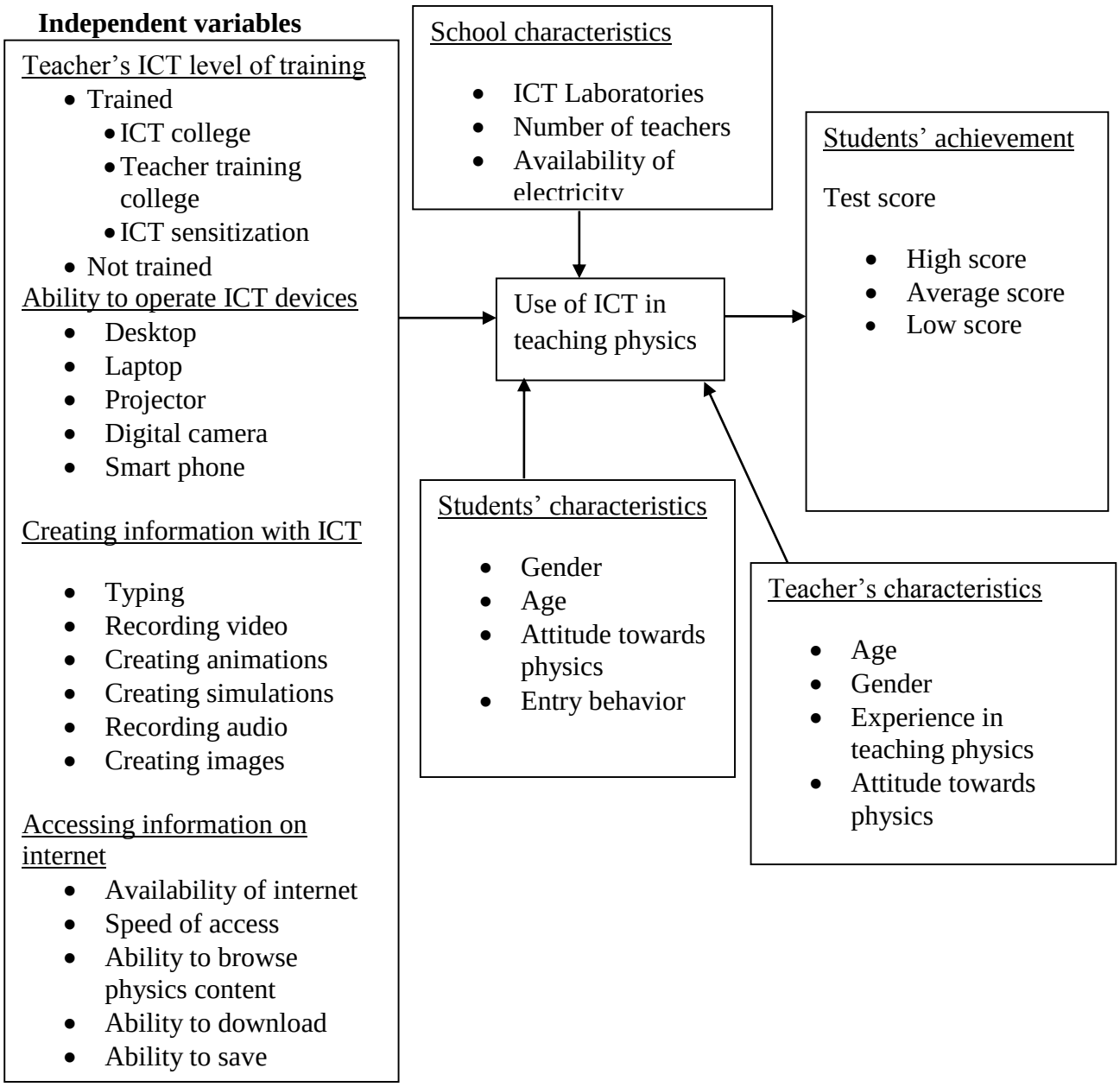

Fig 1. Relationship between teacher ICT competencies and students' performance in Physics.

The study investigated on the various factors concerning teacher ICT competency in teaching and how they affect students' academic achievement in physics. The teacher ICT competency factors investigated in this study are the teacher's level of ICT training, ability to operate ICT devices, ability to create information using ICT tools and ability to access physics information on the internet.

However, achievement in not affected nor determined by Teacher's ICT competencies alone but is affected by several other factors such as school characteristics which include available facilities like physics laboratories and availability of trained physics teachers. Academic achievement can also be affected by student characteristics which include attitude of students towards Physics subject, gender of the students and their attitude towards the physics teacher. Achievement can as well be affected by teacher characteristics such as the gender of the teacher, age, level of training in physics, attitude towards the physics and level of experience in teaching physics.

CHAPTER THREE: RESEARCH METHODOLOGY

3.0 Introduction

This chapter covers the research design, location of the study, target population, sample size and sample techniques, research instruments used, validity and reliability of the instruments, data collection procedure, method of data analysis and ethical considerations.

3.1 Research design

Research design according to Kothari and Garg (2014) is the arrangement of conditions and analysis of data in a manner that aims to combine relevance to the research purpose. This study used descriptive survey design. According to Koul (1984), descriptive research studies are designed to obtain precise information concerning the current status of a phenomenon with the intent of employing data to justify current conditions and practices. In descriptive survey, participants answer questions administered through interviews or questionnaires (Hale, 2018).

3.2 Study location

The study was conducted in Makueni County. The county was chosen for study due to its accessibility to the researcher and since most of the schools in the county have availability of ICT facilities according to a previous research by Mwiluli (2018). This provided appropriate setting for the researcher to investigate on the teacher's ICT competency level and its influence on students' academic achievement in physics in the county. The study on teacher ICT competency and its influence on student academic achievement had not been conducted in Makueni County and this created a study gap for the researcher to study on.

3.3 Target population

Population is entire group of persons or elements that have at least one thing in common (Kombo & Tromp, 2006). This study targeted physics teachers in the public secondary schools in Makueni

County. According to the ministry of education, Makueni County, there are 375 public and 24 private secondary schools in the county. The distribution of the public schools in each sub county as per each category is as in table 1 below.

Table 1: Category of public secondary schools in Makueni County.

SUBCOUNTY	CATEGORY				TOTAL
	NATIONAL	EXTRA COUNTY	COUNTY	SUB COUNTY	
MBOONI WEST	1	1	9	31	42
MAKUENI	1	4	4	33	42
NZAUI		3	7	43	53
MBOONI EAST		3	7	33	43
KATHONZWENI		1	4	31	36
KILUNGU		1	5	21	27
MUKAA		2	11	31	44
MAKINDU		1	4	18	23
KIBWEZI		3	14	48	65
Total	**2**	**19**	**65**	**289**	**375**

Source: Office of the County Director of Education, Makueni County

3.4 Sample size and sampling procedure.

Sampling is selecting a given number of persons from a defined population as representatives of the population (Kombo & Tromp, 2006). The researcher used stratified random sampling to select a sample from the entire population. The population was divided into strata of National schools, Extra County schools, County schools and Sub county schools. All the 2 National schools and 19 Extra county schools were selected for study. A sample was selected in the county and sub county schools in proportion to their number in the population (Kombo & Tromp, 2006). To ensure that sizes of the samples from the 2 strata were kept proportional to their number in population, the method of proportional allocation given by Kothari & Garg (2014), was used:

$P1 = n(x/N)$

Where; p1 is size of strata

n is the intended sample size

N is population size

X is strata size.

Purposive sampling was then employed to select the distribution of schools in each sub county on basis of Boys', Girls' and mixed schools on the category of county and sub county schools. This brought a total of 60 sampled schools which forms 16% of the population. As shown in table 2 below.

Table 2: Number of sampled schools per category

	CATEGORY				**TOTAL**
	NATIONAL	**EXTRA COUNTY**	**COUNTY**	**SUB COUNTY**	
No. of schools	2	19	65	289	375
Sample	**2**	**19**	**11**	**28**	**60**

According to Mugenda and Mugenda (2013), a sample size between 10% and 30% is a good representation if the study population is less than 10,000. The physics teachers in each sampled school were then studied and principals chosen randomly for interviews.

3.5 Research Instruments

The study employed interview schedule for principals, document sheets were used to collect data on student tests scores in physics and both open and closed ended questionnaires for physics teachers were administered. Open ended questionnaires gave room to the respondents to express themselves freely enabling the researcher to get individual views from the various participants. Closed ended questionnaires are easy to fill and required finite type of information like level of ICT training of the teacher. According to Kombo and Tromp (2006), a questionnaire is a research

instrument that gathers data over a large sample and offers no bias on the side of the researcher and respondents.

3.5.1 Principal's interview schedule

Section one on the interview schedule for principal's obtained information on demographic data, section two obtained data on ICT integration while section three obtained information on teacher's level of ICT training. Section four obtained data on teacher's level of operating ICT devices while section five obtained data on teacher's level of creating information and finally section six obtained data on teacher's level of accessing physics content on the internet.

3.5.2 Test score document

The researcher used test score documents to get data on students' K.C.S.E test scores in physics. This data was used to compare the achievement between students' taught by ICT competent teachers and those taught by teachers who were not ICT competent.

3.5.3 Teacher's questionnaire

The researcher used teacher's questionnaire to get information on teacher's demographic data in section one. Section two of the questionnaire obtained data on ICT integration in teaching while section three got information on teacher's level of ICT training and section four obtained information on teacher's ability to operate ICT devices. Section five of the questionnaire got information on teacher's ability to create information using ICT devices and lastly section six obtained data on teacher's ability to access information on the internet.

3.6 Validity and reliability of research instruments

3.6.1 Validity

The researcher employed Content validity which pertains to the degree to which the instrument fully assesses or measures the construct of interest (Oladimeji, 2015). The development of a content valid instrument is typically achieved by a rational analysis of the instrument by raters

(experts) familiar with the construct of interest or experts on the research subject (Beck 2006). Specifically, raters reviewed all of the questionnaire items for readability, clarity and comprehensiveness and came to some level of agreement as to which items should be included in the final questionnaire. The researcher requested some members of staff in the University of Nairobi to validate the questionnaire on a scale of 1 to 5 with one being the lowest score and five the highest score. The response from the staff members were between 3 and 5, thus the researcher proceeded with the instruments with consultations from the supervisor.

3.6.2 Reliability

The researcher used test – retest correlation to test reliability of the research instruments. According to Deniz and Alsaffar (2013), test – retest is an indication of stability over time when the same or similar scores are obtained with repeated testing with the same group of respondents. It is the most common form in surveys for reliability test of questionnaire which are administered to the same individuals under the same conditions after some period of time (Oladimeji, 2015). The researcher administered questionnaires to a group of individuals with similar characteristics as the actual sample and repeated the test at an interval of one week. The responses from the two sets of data were coded and Pearson correlation performed using MS Excel (2010) to determine the reliability. The formula used was:

=Pearson (Array1, Array2)

In which Array1 was the first set of responses obtained while Array2 was the second set of responses obtained. The coefficient (r) value obtained was 0.883. According to Singh et al. (2011), correlation coefficient (r) values are considered good if $r \geq 0.70$ and thus the instruments were considered reliable.

3.7 Procedure for Data collection

According to Kombo and Tromp (2006), data collection refers to gathering specific information aimed at proving or refuting some facts. The researcher sought a permit letter from the University of Nairobi to identify him as authorized to conduct the research from the institution. He then used the letter to obtain permission from NACOSTI and later proceeded to seek permission from the ministry of education, Makueni County, through the county director of education to collect data from the sampled schools within the county. The researcher then obtained contacts of physics teachers from a list of online SMASE training program conducted at Makueni County. The researcher further visited selected schools and made arrangements for interviews with the principals. The researcher then administered the questionnaires and document sheets electronically to those who were comfortable filling soft copy questions and physically to those in the schools visited and requested to fill the hardcopy questionnaires. Later, the researcher collected the questionnaires and document sheets on the dates agreed from the respondents.

3.8 Data analysis

Data analysis is examining what has been collected in a survey or experiment and making deductions (Kombo & Tromp, 2006). The researcher created codes and scales to the data after collection and analyzed it in various ways. Closed-ended questions were analyzed using nominal scales into mutually exclusive categories and frequencies by employing descriptive statistics using MS Excel (2010). Open-ended questions were analyzed using conceptual content analysis. The analysis involved production and interpretation of frequencies, counts, tables, bar charts and pies charts that described and summarized the data. The study also applied means, correlations and factor analysis to provide conclusions and comparisons on the variables.

The hypotheses were tested using ANOVA at 0.05 level of significance using MS Excel software. The F value calculated was compared against the critical F value and the P value obtained compared to the level of significance. If the F value obtained was greater than the critical F value the hypothesis was rejected. Similarly, if the P value obtained was less than the level of significance the hypothesis was rejected.

3.9 Ethical considerations

Identity of research respondents was treated confidentially and the findings of this research used only for academic purposes.

CHAPTER FOUR: DATA ANALYSIS AND INTERPRETATION

4.0 Introduction

This chapter contains analysis of data obtained from the research instruments administered. The data analyzed entails demographic data of the respondents, ICT integration in schools, the types of ICT devices used, the level of teachers' training on ICT and its relationship to students' academic achievement in physics, the level of teachers' confidence in operating the listed ICT devices, the level of teachers' confidence in creating information using ICT devices and the level of teachers confidence in accessing physics content on the internet. The availability of internet in schools is also analyzed in this chapter.

4.1 Demographic data

This gives the distribution of data responses within the county and shows how the instruments were returned at the various strata on the category of schools from the sample selected. After the research instruments were administered, 63% of the respondents returned fully filled instruments. These included all national schools, 9 extra county schools, 11 County schools and 16 sub county schools. Five female teachers returned the instruments whereas the rest where male teachers. The distribution of the respondents per Sub County is as shown in table 3 below.

Table3: Distribution of schools from the respondents per Sub County.

SUBCOUNTY	**CATEGORY**				**TOTAL**
	NATIONAL	**EXTRA COUNTY**	**COUNTY**	**SUB COUNTY**	
MBOONI WEST	1		2	3	6
MAKUENI	1	2	2	1	6
NZAUI		1	1	1	3
MBOONI EAST		2	1	4	7
KATHONZWENI		1		1	2
KILUNGU		1	1	1	3
MUKAA		1	1	2	4
MAKINDU			1	1	2
KIBWEZI		1	2	2	5
Total	**2**	**9**	**11**	**16**	**38**

From table three, it was observed that the schools which returned the instruments were distributed across all the sub counties and this gave a proper representation of the whole population of schools within Makueni County. All the teachers who responded to the questionnaires fully filled the document sheets collecting data on student K.C.S.E test scores. The researcher further interviewed 6 principals to get more information on the topic under investigation. The principals were 2 from national schools, 2 from extra county schools and 2 from sub county schools.

4.2 ICT integration in teaching physics

The integration of ICT in the classroom is a trending phenomenon in the contemporary society. Previous research has shown that use of ICT creates lively classrooms and improves learner participation (Egemen, 2018). From the literature review, it was observed that teachers use ICT in various ways within the teaching and learning setting (Mwalongo, 2011). From the responses received in this study, all the respondents admitted to have been using ICT in teaching physics thereby confirming to the previous researches done. It thus can be concluded that use of ICT in teaching physics is gaining moment in almost all secondary schools. All the teachers studied admitted that use of ICT has had positive impact on students' academic achievement in physics. To explain this change, one of the teachers said that, "the learners understand better and the scores change positively".

However, this study found out that the types of ICT used and frequency of use varied from school to school. The types of ICT devices studied where laptop, desktop, projector, digital camera, smart phone and Interactive White Board (IWB). The respondents were however given room to indicate any other type of ICT devices they used in teaching physics. This was factored in since provision of ICT devices in secondary schools depended on the individual school.

From the analysis, it was observed that the laptop is used by all physics teachers in the national schools, 80% of teachers in extra county schools, 73% of physics teachers in County schools and 47% in sub county schools. The percentage of respondents using the desktop in teaching across the schools are 50% in national, 60% in extra county, 45% in county and 27% in sub county secondary schools. The projector is used by 50% of the teachers in national schools, 40% in Extra County, 64% of teachers in county and 33% of teachers in sub county schools.

Digital camera, an ICT device used for recording videos and taking images is used by 50% of teachers in national schools, 40% in Extra County, 45% in county and 27% in sub county schools.

Smartphone being one of the most common ICT devices in the contemporary society is used by all teachers in national and extra county schools, 91% in county schools and 88% in sub county schools. The high percentage of teachers using the smartphone in teaching physics contradicts an earlier research by Motiwalla (2007) who observed that use of mobile technology in education was still at its infancy. The data on ICT integration in schools is summarized in table 4 below.

Table 4: percentage of teachers using ICT devices

School		INTERGRATION		TYPE OF ICT						
		Yes	No	Lap top	Desk top	Projector	Digital Camera	Smart Phone	IWB	Other
County	Total	11	0	8	5	7	5	10	0	0
	Percentage	100	0	72.7	45.45	64	45	91	0	0
National	Total	2	0	2	1	1	1	2	0	0
	Percentage	100	0	100	50	50	50	100	0	0
Sub county	Total	16	0	7	4	5	4	14	0	0
	Percentage	100	0	47	27	33	27	88	0	0
Extra county	Total	9	0	4	3	2	2	9	0	1
	Percentage	100	0	80	60	40	40	100	0	20
Combined	Total	38	0	21	13	15	12	30	0	1
	Percentage	100	0	64	39	45	36	92	0	3

From table 4, it is observed that 92% of the respondents use smartphone in teaching physics, making it the most used ICT device. The second most used ICT device is the Laptop by 64% of the teachers followed by projector with 45%, desktop with 36% and digital camera with 39%. The low percentage of teachers using desktop and projector can be linked to the fact that most secondary schools are not connected to electrical power supply as most of the teachers were recommending for electricity to be installed.

One teacher in the extra county schools indicated to have been using flat screen in teaching although it was not chosen for study. It is however observed that no respondent uses the Interactive White board in teaching physics. The observation that teachers use ICT in teaching

makes it realistic to study the influence of the teacher competence in using ICT devices in the performance of students in physics. The data was further analyzed into bar graph and pie chart as shown below.

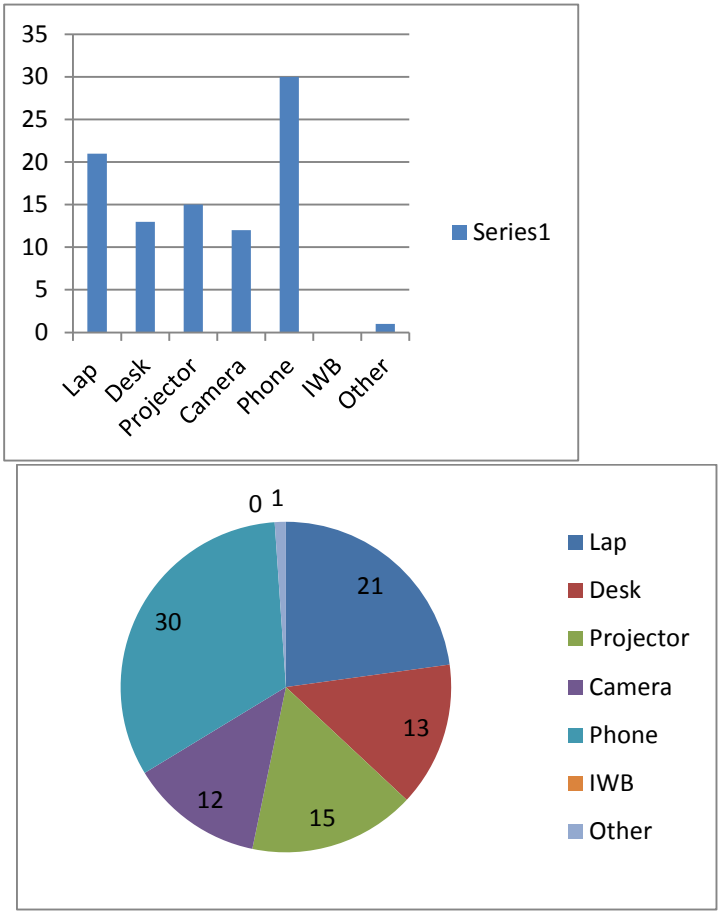

Fig 2: bar graph and pie chart for frequency of teachers using various ICT gadgets.

4.3 Relationship between teacher's level of ICT training and students' academic achievement in physics

Training is essential to acquaint one with competency skills in ICT. According to Munanu (2014), ICT training enables the teacher to acquire more confidence on ICT use. From the teachers studied, 82% admitted to have had a formal training in ICT. 30% of them took computer studies at KCSE level, 48% took ICT as a unit in teacher training colleges, and 42% have a certificate in ICT from an ICT college while 3% have a diploma in ICT training. These results were similar

with results from an earlier research done by Goko (2012) who observed that 85.4% of the teachers had certificate in computer but only 4.2% had a diploma in ICT. This shows that the majority of teachers lack advanced training in ICT. This study also found out that there is no respondent who has an undergraduate or post graduate training in ICT. The breakdown is shown in table five below.

Table 5: Teacher training in ICT

School		TRAINING		LEVEL					INSET		Application software		Sufficient ICT skills		Other means of attaining ICT skills			
		Trained	Not trained	KCSE	Unit in college	Certificate	Diploma	Degree	Trained	Not trained	Trained	Not trained	Yes	No	peer interaction	internet	private tutor	other means
	T	8	3	0	6	2	1	0	11	0	1	10	5	6	4	10	1	0
County	P	73	27	0	55	19	9	0	100	0	9	91	45	55	36	91	9	0
	T	2	0	0	1	2	0	0	2	0	0	2	1	1	0	2	0	0
National	P	100	0	0	50	100	0	0	100	0	0	100	50	50	0	100	0	0
	T	16	2	0	6	8	0	0	16	0	4	11	7	8	5	13	0	0
Sub county	P	87	13	0	40	53	0	0	100	0	27	73	47	53	33	87	0	0
	T	9	1	1	3	2	0	0	9	0	2	3	1	8	1	4	0	0
Extra county	P	80	20	20	60	40	0	0	100	0	40	60	20	80	20	80	0	0
	T	27	6	1	16	14	1	0	33	0	7	26	14	19	10	29	1	0
TOTALS	P	82	18	3	48	42	3	0	100	0	21	79	42	58	30	88	3	0

From table 5, only one teacher in Extra County schools took ICT at KCSE. 50% of respondents in national schools, 60% in Extra County, 55% in County and 40% in sub county schools took

ICT as a unit in teacher training colleges. In addition, all teachers in national schools, 60% in extra county schools, 19% in County schools and 53 % in Sub county schools have a certificate in ICT training from an ICT college while only 1 teacher in county Schools has had a diploma in ICT training. This shows that majority of the teachers (48%) have their ICT training at teacher training colleges where they took ICT as a unit.

The respondents were also asked if they have attended any in-service training (INSET) which emphasized on ICT use in teaching physics. The INSETS studied were CEMASTEA and SMASSE and all respondents admitted to have attended such trainings. The duration of attendance varied with the least being one week and the most being 6months. From the literature review, it was found out that regular refresher courses are important since they enable teachers acquire more knowledge which in turn makes them more confident and improves their competency. It thus becomes important to have more in-service trainings as one principal interviewed said; "When teachers got trained through SMASSE, they are able to deliver their content in multiple ways and involve the learners more making learning more real and interactive".

To get more information on ICT training, the respondents were asked if they have been trained on any application software used for teaching physics and only 27% in sub county schools, 40% in extra county schools and 9% in county schools admitted to have been trained. This transforms to only 21% of the respondents having training on any application software for teaching physics. However, 12% of the respondents cited Google classroom as the software they had been trained on. This software does not just specialize in teaching physics and this leaves only 9% to have been trained on using physics software. The software's which they cited were circuit maker, Encarta and phet Colorado.

The other avenues studied as a source of acquiring ICT knowledge and skills include interaction with peers, internet and private tutors in whom 88% of the respondents admitted to have acquired ICT skills from the internet making it the largest channel through which teachers studied acquired ICT skills. 30% of respondents admitted to have acquired ICT skills through interaction with peers with only 3% citing to have used a private tutor to acquire ICT skills. The findings confirm with earlier findings in the literature review in which more teachers prefer peer tutoring programs where a more skilled teacher in ICT assists another teacher who is less experienced (Ghavifekr and Rosdy, 2015).

The researcher asked the opinions of the respondents on the sufficiency of ICT skills they feel they have acquired from their various trainings and exposure on ICT learning. Only 42% of them said they have acquired sufficient skills to integrate ICT in teaching physics where 50% came from national school, 20% in Extra County, 45% in the county and 47% in the sub county schools. However, the largest percentage, 58% of the respondents said they have not acquired sufficient skills to integrate ICT in teaching physics. These findings concur to earlier observations made by Munanu (2014) where he stated that most teachers have the ability and training to use computers but their ICT skills are not well advanced. It thus can be observed that in order to boost teacher's ICT skills, there is need to increase the frequency of in-service trainings.

The researcher wanted to find out from the respondents if there was any institution offering ICT training to physics teachers. Majority of the respondents said they don't know of any institution while the few who admitted to knowing one cited SMASSE and CEMASTEA. These bodies specialize on strengthening science subjects and thus it's clear there is need for an institution which offers ICT training to teachers.

From the study, there are some challenges and weaknesses which were highlighted by teachers regarding ICT training. These include lack of enough ICT equipment in schools, frequency of in-service trainings being scanty and lack of attitude/interest in some teachers. These findings corresponded with other findings by Abuhmaid (2010) who highlighted challenges to ICT training to teachers which include teacher believe, timing, mode of training and workload.

Objective 1: To investigate the relationship between teacher's level of ICT training and students' academic achievement in physics.

To investigate the relationship between teacher's level of ICT training and students' academic achievement in physics, document sheets were issued to the respondents and were required to fill the KCSE physics test results for the past 4 years. The KCSE exam results were chosen since the exam is tested and done uniformly throughout the country thus providing a common ground for analyzing the student results. The mean mark for the four years was then calculated and tabulated.

Table 6: Mean mark for schools at the various levels of ICT training

	ICT Trained		**Level of ICT training**		**Trained on application soft ware**		**Acquired sufficient ICT skills**	
	Trained	Not trained	KCSE/unit in college	Certificate /diploma	Trained	Not trained	Yes	No
National	8.41		7.5	7.96		8.41	7.5	8.41
Extra County	7.1	5.5	7.1	7.05	7.0	6.6	7.3	6.65
County	5.36	4.67	5.17	5.7	4.87	5.2	5.88	4.58
Sub county	3.79	2.25	3.34	4.04	3.85	3.3	3.68	3.73
Average mean mark	**6.165**	**4.14**	**5.7775**	**6.1875**	**5.24**	**5.8775**	**6.09**	**5.842**

From table 6, the mean mark of test scores for students taught by ICT trained teachers was higher than that of students taught by teachers with no ICT training. This shows that ICT training improves students' performance in physics. Similarly, the students taught by teachers with Certificate and diploma in ICT training performed better than students taught by teachers who took ICT as a unit in teacher training college and had KCSE certificate in ICT signifying that the level of training of teachers has an influence on students' performance. However, the mean mark for students taught by teachers who are trained in using physics software in teaching was a bit lower than those taught by teachers not trained on using physics software. It thus can be concluded that a high level of teacher training on ICT leads to a better performance of students in physics.

For a proper analysis and comparison, the training level in ICT was divided into low level and high level. Those who took ICT at KCSE and as a unit in teacher training colleges were combined with those who did not have any training in application software and formed the low level of ICT training while those who had a certificate and diploma were combined with those who were trained in usage of application software to form the high level of ICT training. The mean sores for the low level were compared with those for the high level in the various categories of schools.

Table 7: Combined K.C.S.E physics mean mark for students taught by teachers with high level and low level of ICT training

	National	Extra county	County	Sub county	Average
High level	7.5	7.025	5.29	3.94	5.94
Low level	7.95	6.85	5.19	3.34	5.83

From table 7, the combined mean mark of students taught by teachers with high level of ICT training was higher than that of students taught by teachers with low level of ICT training. To further analyze the mean scores, descriptive statistics was carried out and results tabulated.

Table 8: Descriptive statistics for mean scores of students taught by teachers with high level and low level of ICT training.

High level of training		*Low level of training*	
Mean	5.93875	Mean	5.8325
Standard Error	0.818195	Standard Error	1.006002
Median	6.1575	Median	6.02
Mode	#N/A	Mode	#N/A
Standard Deviation	1.63639	Standard Deviation	2.012004
Sample Variance	2.677773	Sample Variance	4.048158
Kurtosis	-2.58912	Kurtosis	-1.30731
Skewness	-0.48241	Skewness	-0.4258
Range	3.56	Range	4.61
Minimum	3.94	Minimum	3.34
Maximum	7.5	Maximum	7.95
Sum	23.755	Sum	23.33
Count	4	Count	4
Confidence Level(95.0%)	2.603862	Confidence Level(95.0%)	3.201547

From table 8, the standard deviation for mean score of students taught by teachers with high level of ICT training was 1.636, variance was2.6778 and skewness was -0.4824 while the standard deviation for scores of students taught by teachers with low level of ICT training was 2.012, variance was 4.0481 and standard deviation is -0.4258. In order to check if there is any statistical significant difference in the results, analysis of variance (ANOVA) was conducted to test the null hypothesis.

HO1: There is no statistical significant difference between the teacher's level of ICT training and students' academic achievement in physics.

Analysis of variance was conducted on the mean mark of students taught by teachers of both levels of ICT training. The results of the analysis are in table 9 below.

Table 9: ANOVA analysis for high level and low level ICT training mean marks.

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	19.89881	3	6.632936	87.98092	0.000416	6.591382
Within Groups	0.301563	4	0.075391			
Total	20.20037	7				

From table 9, the p-value obtained was 0.000416 and is less than the alpha value, 0.05. Similarly, the F-value, 87.98 is greater than the critical F value, 6.59 thus the null hypothesis that there is no statistical significant difference between the teacher's level of ICT training and students' academic achievement in physics is rejected. This means there is a statistical significant difference between the teacher's level of ICT training and students' academic achievement in physics. It's also taken to imply that students taught by teachers with high level of ICT training perform better in physics than students taught by teachers with low level training in ICT.

When asked of their own opinion on the influence teacher's level of ICT training has on students' academic achievement in physics, all the principals and teachers strongly agreed that a high level of ICT training of teachers makes students perform better. To explain this opinion, one principal stated that ICT training makes a teacher pass physics content in an enjoyable simple method thereby demystifying the belief that physics is difficult. This makes the subject fun hence improving the performance of the students.

4.4 Relationship between teacher's level of operating ICT devices and students' academic achievement in physics

The level of confidence in operating ICT devices strongly determines whether a teacher will use the devices in teaching physics or not. Henessy et al. (2005) observed that teachers who did not develop sufficient confidence in operating ICT devices avoided using them in teaching. Thus, if a teacher avoided using ICT then the students will be derived of the advantages which come with ICT learning and in return their academic achievement will vary from students taught using ICT. There are various skills which show that one is competent in operating an ICT device and the skills investigated in this study include booting a computer, connecting PC to projector and using the projector, using smartphone, mounting SD to smartphone, operating digital camera, printing, mounting MODEM to PC, managing files, using physics software and using IWB

In the data collection tools administered, respondents were requested to rate their level of confidence in performing the various operations on ICT devices. The confidence levels investigated were very confident (VC), confident (C), not sure (NS), not confident (NC) and very unconfident (VU). The respondent was required to choose only one level of confidence per ICT device listed. The sum of responses per level of confidence was calculated and summary results tabulated in table 10 below.

Table 10: percentage of responses per confidence level of operating ICT devices

Level of confidence	Booting	Basic operations	Connecting pc to projector	Using projector	Operating smart phone	Mounting SD to phone	Operating digital camera	Printing	Mounting MODEM to PC	Managing files	Copying from Phone to PC	Using physics software	Using IWB
VC	67	57	52	52	86	49	32	61	38	43	61	26	0
C	31	30	36	32	12	42	50	26	46	39	30	6	0
NS	0	7	5	14	2	9	16	11	14	7	9	44	40
NC	2	6	7	2	0	0	2	2	2	6	0	18	42
VU	0	0	0	0	0	0	0	0	0	0	0	6	17
S	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

From table 10, it is observed that 86% of the respondents formed the majority in the category of Very confident in operating smartphone, 50% formed the majority in category of being confident in operating digital camera, 44% formed the majority in the category of being not sure in using physics software in teaching, 42% were the majority in the category of being Not confident in using IWB in teaching while 17% were very unconfident in using interactive white board. The high percentage in the confidence of operating smartphone can be attributed to the fact that all teachers admitted to using the gadget in teaching while the high percentage of respondents indicating they are unconfident in using IWB can be attributed to the fact that they don't use it in teaching physics as observed in the previous findings.

For proper analysis, the level of confidence was grouped into two categories. Very confident and confident were combined to form the category of being Confident(C) in operating ICT devices while not sure, unconfident and very unconfident were combined to form the category of not Confident (NC). The percentage of respondents in the categories were then calculated and listed in table 11 below.

Table 11: Combined percentage of competency levels of operating ICT devices.

Level of confidence	Booting	Basic operations	Connecting pc to projector	Using projector	Operating smart phone	Mounting SD to phone	Operating digital camera	Printing	Mounting MODEM to PC	Managing files	Copying from Phone to PC	Using physics software	Using IWB
C	98	87	88	84	98	91	82	87	84	87	91	32	0
NC	2	13	12	16	2	9	18	13	16	13	9	68	100

From table 10, it is observed that the majority of respondents were confident in almost all computer operations except using physics software and using IWB. Generally, 77% of the respondents were competent in performing various operations on ICT devices while 23% were not confident in operating ICT devices. The data was summarized in the bar graph below.

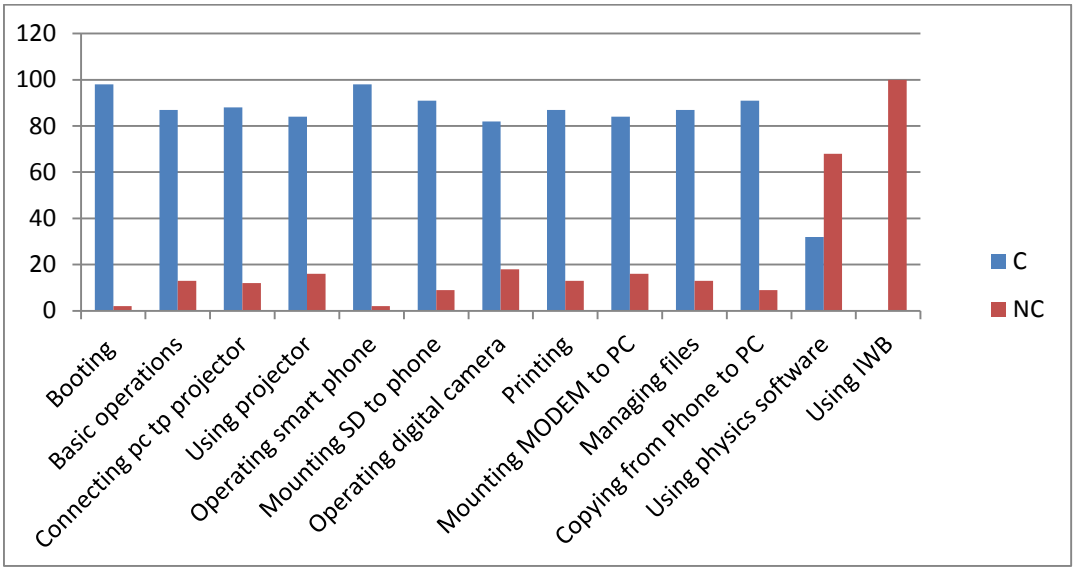

Fig 3: Bar graph for combined percentage of teachers who are confident (C) and teachers who are not confident (NC) in operating stated ICT devices.

Objective 2: To investigate the relationship between teacher's level of operating ICT devices and students' academic achievement in physics.

The documentary sheets were analyzed to investigate the relationship between teacher's level of operating ICT devices and students' academic achievement in physics. The mean for the test scores in KCSE was compiled for various levels of confidence and tabulated in table 12.

Table 12: Combined K.C.S.E physics mean scores for students across various levels of confidence

Level of confidence	Booting	Basic operations	Connecting pc to projector	Using projector	Operating smart phone	Mounting SD to phone	Operating digital camera	Printing	Mounting MODEM to PC	Managing files	Copying from Phone to PC	Using physics software	Using IWB	Average
C	5.89	5.95	6.01	6.02	5.88	5.89	5.93	5.99	5.95	5.87	5.94	5.88		**5.93**
NC	4.28	4.56	3.6	3.47	4.78	3.91	4.05	3.7	4.79	4.65	4.51	5.87	5.84	**4.35**

From table 12, the mean core of learners taught by teachers who were confident in using ICT devices is higher than that of students taught by teachers who were not confident in using ICT devices. One of the respondents stated that students concentrate most when the teacher is confident with handling the ICT devices used in teaching leading to improvement in their performance. To further give an analysis of the test scores, descriptive statistics was carried out and the results tabulated.

Table 13: Descriptive statistics for mean scores of students taught by confident and unconfident teachers in operating ICT devices

confident		*Not confident*	
Mean	5.933333	Mean	4.462308
Standard Error	0.015242	Standard Error	0.211112
Median	5.935	Median	4.51
Mode	5.89	Mode	#N/A
Standard Deviation	0.0528	Standard Deviation	0.761174
Sample Variance	0.002788	Sample Variance	0.579386
Kurtosis	-1.17964	Kurtosis	-0.01069
Skewness	0.424569	Skewness	0.708665
Range	0.15	Range	2.4
Minimum	5.87	Minimum	3.47
Maximum	6.02	Maximum	5.87
Sum	71.2	Sum	58.01
Count	12	Count	13
Confidence Level(95.0%)	0.033548	Confidence Level(95.0%)	0.459973

From table 13, the standard deviation for mean score of students taught by confident teachers was 0.0528, variance was 0.002788 and skewness 0.424 while the standard deviation for students

taught by teachers not confident in operating ICT devices was 0.7611, variance was 0.5794 and skewness 0.7087. In order to check if there is any statistical significant difference is the results, analysis of variance (ANOVA) was conducted to test the null hypothesis:

HO2: There is no statistical significant difference between the teacher's level of operating ICT devices and students' academic achievement in physics.

Analysis of variance (ANOVA) was conducted on the mean mark of students taught by confident teachers in operating ICT devices and teachers who were not confident to test if there is any statistical significant difference between the mean marks. The results of the analysis are in table 14 below.

Table 14: ANOVA analysis for mean marks of students taught by teachers who are confident and teachers who are not confident in operating ICT devices.

Source of Variation	*SS*	*Df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	40.5	1	40.5	13.88571	0.009779	5.987378
Within Groups	17.5	6	2.916667			
Total	58	7				

From table 14, the F value obtained of 13.88 is larger than the critical F value of 5.99 thus the hypothesis that there is no statistical significant difference between the teacher's level of operating ICT devices and students' academic achievement in physics is rejected and the alternative adopted. Similarly, the p value 0.0098 is smaller than the alpha value of 0.05 implying there is a statistical significant difference between the teacher's level of operating ICT devices and students' academic achievement in physics since students taught by confident teachers in operating ICT

devices produced higher mean score than the students taught by teachers who were not confident in operating ICT devices.

When asked of their opinion on the influence of teacher's level of operating ICT devices on students' academic achievement in physics, both the teachers and principals agreed that a high level of confidence makes students perform better. To support their opinion, most teachers said a high level of confidence in operating ICT devices facilitates better presentation of content making students understand better. Another teacher said that, "it helps students perceive physics as not being abstract", and leading to better performance. One of the principals said that, "teacher's confidence in operating ICT devices translates to students' confidence in themselves hence good performance". It thus can be concluded that a confident teacher in operating ICT devices leads students to have positive academic achievement in physics.

4.5 Relationship between teacher's level of creating information using ICT devices and students' academic achievement in physics

Content is the core of any learning processes. In most cases the teacher is regarded as the source of knowledge in reference to the teacher being the one to pass content to the learner. If the content is poorly structured or not passed on properly to the learner, the understanding of the learner will be low and this will affect the learner's academic achievement. In regard to using ICT devices in teaching, the teacher should be able to create physics content using ICT devices and pass the same to learners.

In this study, the skills of creating information using ICT devices studied were typing, using Microsoft (MS) Word, MS Excel, MS Access, MS Publisher, Paint, MS PowerPoint, creating animations, creating simulations, Recording Audio, Recording video using Digital camera, laptop

and smart phone, taking images using camera, laptop and smart phone, creating virtual digital content and lastly editing and formatting existing information

In the questionnaires administered, respondents were requested to rate their level of confidence in creating physics information using the application software's and ICT devices listed. The levels of confidence studied were Very confident (VC), Confident (C), Not sure (NS), Not confident (NC) and very unconfident (VU). The respondents were required to choose only one level of confidence per Application software or ICT gadget. The responses per level of confidence were summed up and percentages tabulated.

Table15. Percentage of responses per level of confidence on creating physics information.

	Typing	**MS word**	**MS excel**	**MS Access**	**MS publisher**	**Paint**	**MS PowerPoint**	**Photoshop**	**Creating Animations**	**Creating Simulations**	**Recording Audio**	**Video with camera**	**Video with laptop**	**Video with smart phone**	**Image with camera**	**Image with laptop**	**Image with phone**	**Virtual Digital content**	**Editing & formatting**
VC	46	33	33	22	21	9	33	9	3	24	39	33	30	51	39	33	58	3	18
C	42	46	34	30	21	21	46	28	21	36	49	39	27	46	52	27	39	25	55
NS	12	18	30	42	55	58	18	39	37	37	12	19	37	3	6	37	3	36	18
NC	0	3	3	6	3	12	3	24	39	3	0	9	6	0	3	3	0	30	9
VU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0
TOTAL	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

From table 15, it is observed that 58% of the respondents were very confident in taking images using smart phone while only 9% were very confident in Using paint software to create information. 55% were the highest respondents who cited they were confident in editing and formatting existing content while 21% formed the least percentage of being confident in using MS publisher and paint software's. The highest percentage of respondents in the category of not being sure of their confidence level in creating information was 58% in using paint software while the least percentage, 3% in that category said they were not sure of taking images using smart phone and recording video using the same gadget.

In the category of not confident, 39% formed the majority by choosing creating animations while 3% were not confident in creating information using various channels. Lastly, only 6% of the respondents were very unconfident in creating virtual digital content. These findings concurred with previous research in which teachers where observed to be competent in basic ICT skills such as using word processors, spreadsheets and slide presentation (Irfan &Mohamad, 2014, Lau & Sim, 2008)

For proper analysis and comparison, the confidence levels were divided in to two levels of confidence, Confident (C) and Not Confident (NC) level. The respondents in the category of Very confident (VC) and confident (C) were combined together to form the level of confident(C) while those who said they were not sure (NS), were not confident (NC) or were very unconfident (VU) in creating information formed the category of Not confident (NC). The resulting percentages in the two levels were recorded in table 16.

Table 16. Percentages of responses either confident or not confident in creating information.

	Typing	MS word	MS excel	MS Access	MS publisher	Paint	MS PowerPoint	Photoshop	Creating Animations	Creating Simulations	Recording Audio	Video with camera	Video with laptop	Video with smart phone	Image with camera	Image with laptop	Image with phone	Virtual Digital content	editing
C	86	79	67	52	43	30	79	37	24	60	89	72	57	97	91	60	97	28	73
NC	14	21	33	48	57	70	21	63	76	40	11	28	43	3	9	40	3	72	27
TOTAL	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

It is observed from table 16 that the majority of respondents, 97% were confident in recording video and taking images using the smartphone. This high number points out that the smartphone is the most commonly used ICT gadget in creating physics information, a fact that can be attributed to it being very available in the contemporary society. Only a small percentage of the respondents, 28% were confident in creating animations. This can be linked to the earlier observations in which very few of the respondents, only 26% were trained to use any application software. The results were summarized in the combined bar graph below.

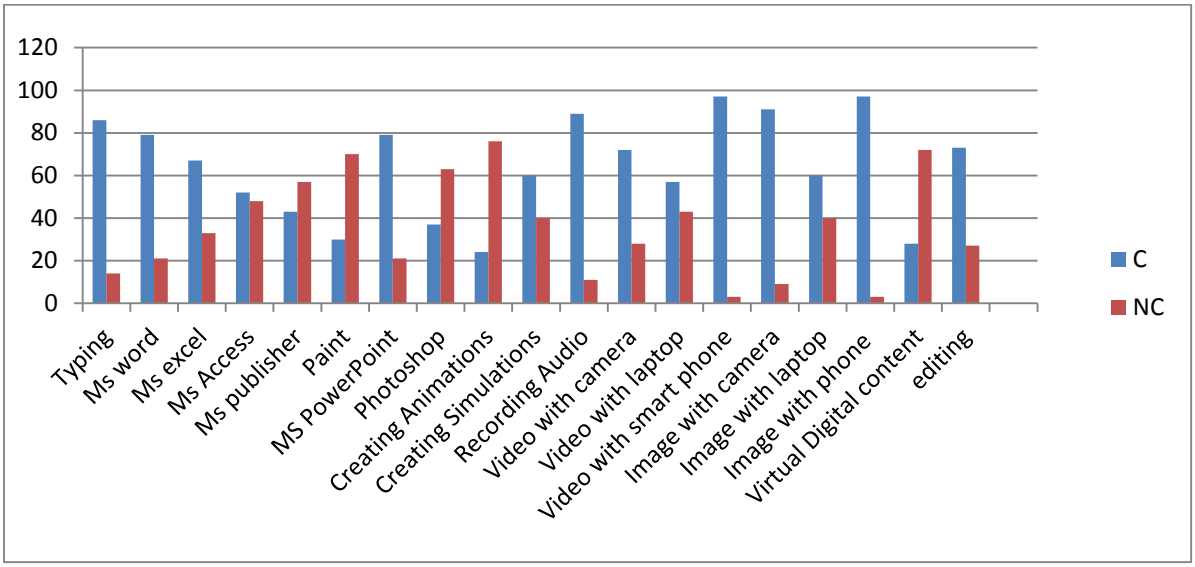

Fig 4: Bar graph for combined percentage of teachers who are confident (C) and not confident (NC) in creating information using ICT devices.

Objective 3. To investigate the relationship between teacher's level of creating information using ICT devices and students' academic achievement in physics.

To investigate the relationship between teacher's level of creating information using ICT devices and students' academic achievement in physics, documentary sheets with the KCSE test scores were analyzed. The mean scores for students taught by teachers at the respective levels of confidence were combined and tabulate.

Table 17: Combined mean score for students taught by teachers at the two levels of confidence in creating information using ICT devices.

	Typing	MS word	MS excel	MS Access	MS publisher	Paint	MS PowerPoint	Photoshop	Animations	Simulations	Audio	Video with camera	Video with laptop	Video with smart phone	Image with camera	Image with laptop	Image with phone	Digital content	editing	Average
C	6.83	5.94	5.93	5.90	5.80	5.51	5.90	5.50	5.83	5.55	6.08	6.08	6.30	5.95	6.00	6.10	6.01	6.02	5.98	**5.96**
NC	5.07	4.82	4.99	5.09	5.96	6.05	4.92	6.29	6.01	5.89	4.77	5.38	4.69	2.80	2.43	4.91	2.02	5.04	5.38	**4.87**

From table 17, it is observed that the means score of students taught by teachers confident in creating information using ICT devices was higher in almost all channels of creating information save for using Paint, creating animations, using Photoshop and using MS publisher. The general men score for students taught by confident teachers in creating information using ICT devices was higher than that of teachers who were not confident in creating information using ICT devices. Descriptive statistics was conducted on the two sets of score and their result outlined in table 18 as obtained from MS Excel.

Table 18: Descriptive statistics for mean score of students taught by confident and not confident teachers in creating information using ICT devices.

Confident		*Not confident*	
Mean	5.958421	Mean	4.868947
Standard Error	0.067587	Standard Error	0.275717
Median	5.95	Median	5.04
Mode	5.9	Mode	5.38
Standard Deviation	0.294605	Standard Deviation	1.201822
Sample Variance	0.086792	Sample Variance	1.444377
Kurtosis	3.689325	Kurtosis	1.261049
Skewness	1.087124	Skewness	-1.35336
Range	1.33	Range	4.27
Minimum	5.5	Minimum	2.02
Maximum	6.83	Maximum	6.29
Sum	113.21	Sum	92.51
Count	19	Count	19
Confidence Level(95.0%)	0.141995	Confidence Level(95.0%)	0.57926

From table 18, the mean score of learners taught by confident teachers in creating information using ICT devices was 5.9584(d.p) and 4.8689(d.p) for learners taught by not confident teachers. The standard deviation from the mean is 0.2946 and 1.2018 while variance for the two sets of scores is 0.0868 and 1.4444. The skewness for the scores of students taught by teachers who are confident and those not confident in creating information using ICT devices was obtained to be

1.087 and -1.3533 respectively. To test if there in any statistical significant difference between the scores, ANOVA was conducted to test the null hypothesis:

HO3: There is no statistical significant difference between the teacher's level of creating information using ICT devices and students' achievement in Physics.

Analysis of variance was conducted on the two sets of scores of students taught by confident and not confident teachers in creating information using ICT devices and the results as obtained from MS Excel tabulated.

Table 19: ANOVA analysis of scores of students taught by confident and unconfident teachers in creating information using ICT devices.

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	11.29785	1	11.29785	14.76063	0.000477	4.113165
Within Groups	27.55457	36	0.765405			
Total	38.85242	37				

From table 19, the F value obtained, 14.76 is greater than the critical F value of 4.113 and thus, the null hypothesis is rejected. This means there is a statistical significant difference between teacher's level of creating information using ICT devices and students' academic achievement in physics. Likewise, the P value obtained, 0.000477 is smaller than the level of significance, 0.005 signifying that there is a statistical significant difference between scores of students taught by confident teachers in creating information using ICT devices and scores of students taught by unconfident teachers in creating information using ICT devices with the former performing better.

Respondents were asked their opinion on the influence teacher's level of creating information using ICT devices has on students' academic achievement and they all strongly agreed that confident teachers in creating information lead to students performing better in physics. One of the teachers responded by saying that lack of teacher confidence in creating information using ICT devices makes it hard to integrate ICT and hence performance of students drops. A principal stated that, 'a teacher who is confident in creating content using ICT devices makes learning real, active and interactive thereby leading to students performing better'. It thus can be concluded that teachers who are confident in creating information using ICT devices lead to students having a higher academic achievement in physics.

4.5 Relationship between teacher's level of accessing physics information on the internet and students' academic achievement in physics

The researcher was interested in finding out if schools were connected to Wi-Fi network, the speed of internet access, if teachers could access the internet while away from school and if they could access the internet through their mobile phones. He thereby requested respondents to fill such information in section six of the questionnaires and the results obtained were tabulated.

Table 20: Internet access by teachers.

	School with internet	**Internet access away from school**	**Phone access internet**	**Speed of internet access**			
				Fast	**Slow**	**Moderate**	**Not sure**
National	1	2	2	1	0	1	0
Extra county	4	9	9	2	0	2	2
County	0	11	11	9	0	7	0
Sub county	**0**	15	15	6	2	7	0
Total	**5**	**38**	**38**	**18**	**2**	**16**	**2**
Percentage	13	100	100	47	6	49	6

From table 20, it is observed that only 5 schools were connected to Wi-Fi internet, 1 national and 4 extra county schools. However, all the respondents said they could access the internet while away from school, a fact that can be attributed to the finding that their mobile phones can access the internet. 6% of the respondents were not sure of their speed of internet access, 6% said their speed was slow, 49% had a moderate speed of internet access while 47% had a fast speed of accessing the internet. Access to the internet is beneficial to the physics teacher since it is rich in vast physics content. According to Lima (2006), internet is a valuable channel to transmission of information.

Level of confidence in accessing physics content on the internet

Respondents were requested to rate their level of confidence in browsing, downloading, saving downloaded content and using various social media platforms to access physics content. The levels of confidence studied were very confident (VC), Confident (C), not sure (NS), Not confident (NC) and very unconfident (VU). The responses were analyzed and percentages per level of confidence recorded in table 21.

Table 21: Level of confidence of teachers in accessing the internet.

	Browsing using				Fast speed		Downloading video		Downloading text		Downloading images		Saving downloaded		Using social media platforms							
	Phone		PC												WhatsApp		Facebook		Twitter		emails	
VC	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P
	22	67	15	46	14	42	13	39	13	39	14	42	12	36	13	39	9	27	4	13	6	18
C	11	33	14	42	16	49	17	52	18	54	16	49	19	58	17	52	13	39	10	30	16	49
NS	0	0	2	6	3	9	3	9	2	6	3	9	2	6	3	9	10	30	12	36	7	21
NC	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	1	3	7	21	4	12
VU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	**38**	**100**	**38**	**100**	**38**	**100**	**38**	**100**	**38**	**100**	**38**	**100**	**38**	**100**	**38**	**100**	**38**	**100**	**38**	**100**	**38**	**100**

From table 21, it is observed that 67% of respondents were very confident in browsing using the smartphone, a fact that can be attributed to the gadget being locally available and affordable. However, only 13% of the respondents were very confident in using Twitter platform to access physics content. 58% were confident in saving downloaded content while 30% were not sure of their confidence in using twitter platform to access physics content. Only 3% of the respondents were very unconfident in browsing using the PC and using Facebook as a platform to access and share physics content for teaching.

The various confidence categories were further grouped to form two levels of confidence in which a respondent could be grouped to being confident (C) or not confident (NC) in accessing the internet. Those who responded to being very confident (VC) and confident (C) were combined to

form the confident level while those who responded to be not being sure (NS) of their confidence, not confident (NC) and very unconfident formed the level of not confident. The percentages were calculated and tabulated in table 22.

Table 22: Combined percentage of respondents for confident and not confident levels of accessing the internet.

	Browsing using		**Fast speed**	**Downloading video**	**Downloading text**	**Downloading images**	**Saving downloaded content**	**Using social media platforms**			
	Phone	**PC**						**WhatsAp**	**Facebook**	**Twitter**	**emails**
C	100	88	91	91	94	91	94	91	67	43	67
NC	0	12	9	9	6	9	6	9	33	57	33
TOTAL	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

From table 22, it can be observed that all the respondents were confident in browsing using the mobile phone, 94% were confident in downloading text and saving downloaded content while only 43% were confident in using twitter platform to access physics content and use the platform for teaching physics. The social media platform which had the majority of respondents say they were confident in was WhatsApp with 91%. This results are in line with previous studies in which teachers and learners recognized WhatApp as being the most preferred channel of conveying information (Asterham, 2018 , Egemen, 2018). The results are summarized in the bar graph below.

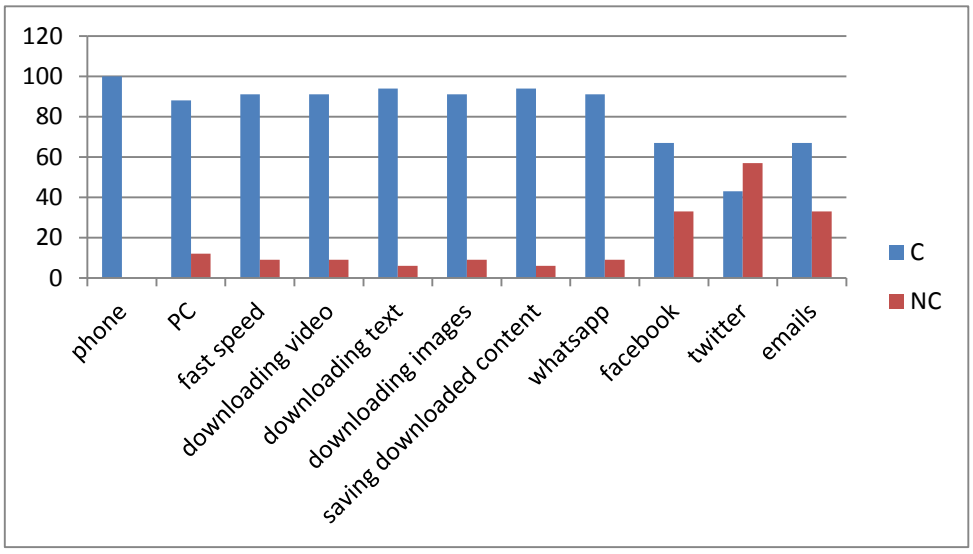

Fig 5: Bar graph for combined percentage of confident and unconfident teachers in accessing physics information on the internet.

Objective 4: To investigate the relationship between teacher's level of accessing information on the internet and students' academic achievement in physics.

To investigate the relationship between teacher's level of accessing information on the internet and students' academic achievement in physics, the KCSE mean scores for students taught by teachers at both confident and non-confident levels of accessing information were computed and tabulated. The mean scores were then analyzed.

Table 23: Combined mean score for students taught by teachers at the two levels of accessing information on the internet.

	Browsing using		**Fast speed**	**Downloading video**	**Downloading text**	**Downloading images**	**Saving downloaded content**	**Using social media platforms**				**Average**
	Phone	**PC**						**WhatsApp**	**Facebook**	**Twitter**	**emails**	
C	5.86	5.85	5.74	5.86	5.87	5.86	5.87	5.91	5.99	6.01	6.07	5.899
N		5.29	5.94	5.29	5.77	5.21	4.89	4.53	4.87	5.78	6.90	5.447

From table 23, students taught by teachers who were not confident in accessing physics information and using Titter platform for teaching performed better than students taught by teachers who were confident in using the same platform. Across the other channels under study for accessing physics content on the internet, students taught by confident teachers performed better than students taught by unconfident teacher. However, the margin between the scores is small since the students who performed better had a mean score of 5.899 and those taught by non-

confident teachers had a mean score of 5.447. Descriptive statistics was done on the mean scores for more analysis.

Table 24: Descriptive statistics for mean scores of students taught by confident and unconfident teachers in accessing physics information on the internet.

Confident		*Not confident*	
Mean	5.899091	Mean	5.447
Standard Error	0.027616	Standard Error	0.214968
Median	5.87	Median	5.29
Mode	5.86	Mode	5.29
Standard Deviation	0.091592	Standard Deviation	0.679788
Sample Variance	0.008389	Sample Variance	0.462112
Kurtosis	0.333986	Kurtosis	1.239018
Skewness	0.435173	Skewness	0.928898
Range	0.33	Range	2.37
Minimum	5.74	Minimum	4.53
Maximum	6.07	Maximum	6.9
Sum	64.89	Sum	54.47
Count	11	Count	10
Confidence Level(95.0%)	0.061532	Confidence Level(95.0%)	0.486291

From table 24, the mean score for the first set of data is 5.899, with a standard deviation of 0.0916, variance of 0.00839 and skewness of 0.4352 while the mean for the second set of data is 5.447, standard deviation of 0.6798, variance of 0.4621 and skewness of 0.9289. All the observations

were as calculated using MS Excel. To test if there is any statistical significant difference between the teacher's level of accessing information on the internet and students' academic achievement, analysis of variance was conducted on the results to test the null hypothesis.

HO4: There is no statistical significant difference between the teacher's level of accessing information on the internet and students' academic achievement in Physics.

Analysis of variance (ANOVA) was conducted on the two sets of mean scores for students taught by confident teachers in accessing physics content in the internet and students taught by teachers not confident in accessing physics content in the internet to test the null hypothesis that there is no statistical significant difference between the teacher's level of accessing information on the internet and students' academic achievement in physics. The results were listed in table 25.

Table 25: ANOVA analysis for scores of students taught by confident and unconfident teachers in accessing physics content on the internet.

Source of Variation	*SS*	*Df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	1.070594	1	1.070594	4.794195	0.041239	4.38075
Within Groups	4.242901	19	0.223311			
Total	5.313495	20				

From table 25, the F value obtained, 4.794 was larger than the critical value for F, 4.38 and thus the null hypothesis was rejected and the alternative adopted that there is a statistical significant difference between teacher's level of accessing information on the internet and students' academic achievement in physics. Similarly, the p value obtained, 0.0412 is smaller than the alpha value of

0.05 and this signifies that students taught by confident teachers in accessing information on the internet performed better than students taught by teachers who were not confident in accessing physics content on the internet.

On the research instruments, respondents were asked of their opinion on the influence of teacher's level of accessing internet on students' academic achievement in physics and they all agreed that a teacher confident in accessing physics content on the intent produced students with a better performance in physics. Most of the teachers said the internet provides a variety of information which simplifies abstract content. From the observations, it thus can be concluded that a teacher who is confident in accessing physics content on the internet leads students to have a high academic achievement on the subject.

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

This chapter deals with summary of the research and gives the research methodology, data collection, analysis and the findings obtained from the data collected as analyzed. The conclusions made from the findings and the recommendations made are also given in this chapter.

5.1 Summary

The study aimed at investigating the influence of teacher competency in using ICT devices on student academic achievement in physics in Makueni County. Descriptive survey design was used in which out of 375 schools in the county, a sample of 60 schools which formed 16% of the population was chosen through stratified random sampling. The researcher collected data through administration of questionnaires and document sheets to physics teachers and interview schedule for principals. From the sample, 63% of the respondents returned fully filled research instruments and were 2 national schools, 9 extra county schools, 11 County schools and 16 Sub county schools. To get more information, interview schedules for principals were employed in which 6 principals were interviewed.

The ICT competencies studied were four which included teacher training on ICT, operating ICT devices, creating information using ICT devices and accessing the internet. From the competences, the researcher formed four objectives which were investigated. The objectives were, to investigate the relationship between teacher's level of ICT training and students' academic achievement in physics, to investigate the relationship between the teacher's level of operating ICT devices and students' academic achievement in physics, to investigate the relationship between teacher's level of creating information using ICT devices and students' academic achievement in physics to investigate the relationship between teacher's level of accessing physics

information on the internet and students' academic achievement in physics. These objectives were analyzed through descriptive statistics and conceptual content analysis.

The researcher formulated the objectives into null hypotheses and the following hypotheses were investigated. There is no statistical significant difference between the teacher's level of ICT training and students' academic achievement in physics, there is no statistical significant difference between the teacher's level of operating ICT devices and students' academic achievement in physics there is no statistical significant difference between the teacher's level of creating information using ICT devices and students' academic achievement in Physics there is no statistical significant difference between the teacher's level of accessing physics information on the internet and students' academic achievement in Physics. These hypotheses were analyzed through ANOVA which was done using MS Excel version 10.

The researcher made the assumption that all schools have ICT devices used in teaching physics. From the responses in the questionnaires and interview schedule, all respondents confirmed that ICT was used in teaching physics. It was observed that the smartphone was used by all the respondents making it the most commonly used ICT device in teaching physics. It was followed by laptop which was used by 80% of the respondents, desktop by 60% and projector and digital camera by 40% of the respondents. From the study, the researcher found out that the flat screen was also used in teaching physics by 20% of the respondents. However, no respondent admitted to using interactive white board in teaching physics.

ICT training

From the study, it was observed that 82% of the teachers had ICT training at various levels; it's only 18% of the respondents who had no training on ICT. All the respondents were observed to have attended either SMASSE or CEMASTEA in-service trainings which emphasized on using

ICT in teaching physics. A further 21% of the respondents had been trained in using software which is used in teaching physics, however, 12% of the respondents cited Google classroom as the software they had been trained on. This software does not just specialize in teaching physics and this leaves only 9% to have been trained on using physics software. The software's which they cited were circuit maker, Encarta and phet Colorado.

There are other avenues of gaining ICT skills away from the formal training and 88% of the respondents cited to have acquired ICT skills from the internet while 30% have acquired ICT skills through interaction with peers. It was also observed that 58% of the respondents have not acquired enough skills to integrate ICT in teaching physics. The researcher wanted to find out if there was any institution which specialized on teaching ICT to physics teachers and 94% of the respondents said they never knew of any. The 6% who affirmed to knowing of such an institution cited SMASSE and CEMASTEA. This leaves a gap on ICT training to teachers in which there is need for an institution to train them on using ICT in teaching physics. The weaknesses in ICT training which arose from the study were fear or lack of interest from the teacher's and lack of enough equipment's.

The researcher investigated the relationship between the teacher's level of training and students' academic achievement in physics using combined KCSE mean scores for students taught by teachers with high level of ICT training and students taught by teacher's with low level of ICT training, it was observed that students taught by teachers with high level of ICT training had a higher score than students taught by teachers with low level of ICT training. To test if there is any statistical significant difference in the scores, ANOVA analysis was conducted at 0.05 level of significance and the p value obtained was 0.000416. This p value obtained is less than the level of significance and it means there was a statistical significant difference between the scores. It

thus was concluded that teachers with high level of ICT training led to a higher academic achievement of students in physics.

Level of operating ICT devices and student academic performance in physics

To investigate the relationship between teacher's level of operating ICT device and students' academic achievement in physics, the researcher looked at two major levels of operating ICT devices. These levels were confident level and not confident level. From the study, it was observed that 77% of the respondents were confident in operating various ICT devices while 23% were not confident. 86% of the respondents were very confident in operating smartphone while 17% were very unconfident in operating the Interactive white board.

When the relationship between teacher's level of operating ICT devices and students' academic performance was investigated, it was observed that students taught by teachers with confident level of operating ICT devices obtained a mean score of 5.93 which was higher than that of students taught by teachers with low level of operating ICT devices who obtained a mean of 4.35. When ANOVA was conducted at 0.05 level of significance, the p value obtained was 0.009779. This p value obtained is less than the level of significance and it shows there is a statistical significant difference between teacher's level of operating ICT devices and students' academic achievement with teachers who are confident producing students with higher mean score than teachers who are not confident in operating ICT devices.

Creating information using ICT devices

For one to be creative in using ICT devices in teaching, information has to be created and the existing content edited. In this study, the skills of creating information using ICT devices investigated were typing, using MS office application software's, using Paint software, creating animations and simulations, recording audio, using Photoshop, recording video and taking images

using laptop, digital camera and smartphone, creating virtual digital content and editing existing information. It was observed that 97% of the respondents were confident in recording video and taking images using smart phone while only 28% were confident in creating animations.

When the relationship between teacher's level of confidence in creating information using ICT devices and students' academic performance in physics was investigated, it was observed that students taught by confident teachers obtained a mean score of 5.96 which was higher than 4.87, the score obtained by students taught by teachers who were not confident in creating information using ICT devices. ANOVA conducted on the two sets of scores at 0.05 level of significance produced a p value of 0.000477 which was less than the level of significance. This confirmed that there was a statistical significant difference between the teachers level of creating information using ICT devices and students' academic achievement in physics with teachers who were confident producing students with higher scores than teachers who were not confident in creating information using ICT devices.

Accessing physics content on the internet

From the study, it was observed that only 13% of the schools studied were connected to Wi-Fi network while the rest 87% were not. However, all the respondents indicated that they could access internet while away from school and that they all had mobile phones which could access the internet. The speed of internet access was however not the same to all respondents as 39% said they had a fast speed of internet access, 6% had it slow, 49% had moderate speed while 9% were not sure of their speed of internet access.

The skills tested in accessing and obtaining physics content from the internet were ability to browse using either mobile phone or PC, speed of browsing, downloading video, text and images, saving downloaded content and using various social media platforms in accessing physics content

and disseminate the same to students. It was observed that all the respondents were confident in browsing using the smartphone and 88% using PC. Above 90% of the respondents were confident in downloading and saving content while on using social media platforms, 91% were confident in using WhatsApp, 67%, 43% and 67% were confident in using Facebook, Twitter and emails respectively. That high percentage in WhatsApp was attributed to the fact that it is the most common and convenient media in passing video, audio and images.

Relationship between teachers' level of accessing the internet and students' academic achievement in physics was investigated and it was observed that students taught by confident teachers obtained a mean score of 5.899 which was higher than 5.447, the mean score obtained by students taught by teachers who were not confident in accessing the internet. ANOVA conducted on the two sets of scores at 0.05 level of significance produced a p value of 0.041which was less than the level of significance. This showed there is a statistical significant difference between the results and thus it can be concluded that teachers who were confident in accessing physics content in the internet produced students with higher scores than teachers who were not confident in accessing physics information on the internet.

5.2 Conclusion

From the study, it thus can be concluded that teachers who are confident in the use of ICT in teaching physics produced students with higher academic achievement than teachers who are not confident in using ICT. The study was based on the Diffusion of Innovations (DOI) theory which explains how an idea or event gains momentum over time and diffuses through a specific population making a person or the populations do something differently than how they used to do it. This study investigated on the ICT competences of physics teachers and how the applications of these competences diffuse through students' population to influence on their academic

achievement in the subject. It was observed that these ICT competencies improved the academic performance of students and thus the study supported the theory.

Recommendations

From the observations and conclusions, the following recommendations are made

1. The government to connect all secondary schools with electrical power and provide ICT facilities.

2. The ministry of education to set up an ICT training institution or training centers to train physics teachers and increase the frequency of in-service trainings so as to enable teachers acquires sufficient ICT competencies to integrate the same in teaching.

3. The government to install Wi-Fi network connection to all secondary schools to enable teachers to access physics content effectively.

4. More research to be done on the frequency of ICT use in teaching and its influence on student academic achievement in physics.

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APPENDICIES

Appendix 1: Physics teacher's Questionnaire

Dear Respondent,

This questionnaire is designed to gather information on the influence of teacher competency on use of ICT in teaching physics in students' academic achievement in Makueni County. The study will be carried out for a partial fulfillment of the master of education degree from The University of Nairobi. Kindly respond to the questionnaire by typing letter A (for agree) in the appropriate box or by filling the spaces provided. The information in this questionnaire will only be used for study purposes, be treated with confidentiality and in no instance will your name or name of your school be mentioned in this research. Your assistance is highly appreciated.

Thank you for your cooperation

SECTION 1: (Demographic data)

1. What is the name of your school? _____

2. What is your gender? Male ☐ Female ☐

3. State the type of your school

National school ☐ Extra County school ☐ County school ☐ Sub County school ☐

4. Which sub-county is your school in?

Mbooni East ☐ Mbooni West ☐ Makueni ☐ Kathonzweni ☐

Kilome ☐ Kibwezi ☐ Kilungu ☐ Mukaa ☐ Nzaui ☐

SECTION 2: ICT INTEGRATION IN TEACHING

1. Do you use ICT in teaching physics? Yes ☐ No ☐

2. If yes in 1 above kindly indicate letter "**A**" for a single cell per row to show the kind of ICT used and frequency of use.

Type of ICT	**Frequency**				
	Every lesson	Once per week	Once per term	At least once per topic	Not frequently
Laptop					
Desktop					
Projector					
Digital camera					
Smart phone					
Interactive white board					
Others (specify)					

3. How do you integrate ICT in physics class?

To show a video ☐ Showing animations ☐ To project notes ☐ Showing a picture ☐

Simulate a practical/ demonstration ☐ Solving calculation ☐ Play audio ☐

Any other ways ☐ describe

……
……
……

4. Any change in the students' performance when taught using ICT and when taught without ICT integrated lessons?

Yes ☐ No ☐

Explain your observations on the change

_____

_____

SECTION 3: ICT TRAINING

1. Do you have any training on ICT?

Yes ☐ No ☐

2. If Yes in 1 above,

What level of training in ICT did you attain? Tick all which apply.

A) K.C.S.E certificate ☐

B) Took ICT as a unit/subject in teacher training college ☐

C) ICT College: i) certificate ☐ ii) Diploma ☐ iii) Degree ☐ iv) Post graduate ☐

3. Have you ever attended any kind of inset training which emphasized on use of ICT

Yes ☐ No ☐

If yes, kindly indicate the duration for the inset on the table below.

INSET	**DURATION**
(i) SMASE	
(ii) CEMASTEA	
(iii) OTHERS (kindly name them)	

4. i) Are you trained on any application software used for teaching physics?

Yes ☐ No ☐

ii) If your answer in 4 i) above is yes, kindly name the application software(s).

_____

_____

5. i) Are there institutions which offer ICT training to physics teachers?

Yes ☐ No ☐ Don't know ☐

ii) If your answer in 5 i) Is Yes, kindly name the institution(s).

_____

_____

_____

6. Briefly describe the weaknesses on ICT training to physics teachers.

_____

_____

_____

_____

7. In your opinion;
i) Have you acquired sufficient skills from your ICT training to comfortably integrate ICT in teaching physics? Yes ☐ No ☐

ii) How does your level of ICT training influence student achievement in physics? Kindly indicate "A" per one cell in each row.

Opinion	**scale**				
	Strongly agree	Agree	Not sure	disagree	Strongly disagree
Has no influence in students' performance					
Makes students perform better					
Makes students' performance to drop					

8. Apart from formal training on ICT, through which other ways have you acquired ICT skills?

Interaction with peers ☐ Internet ☐ Private tutor ☐ Other means ☐ please clarify them

_____

_____

_____

SECTION4: TEACHER'S LEVEL OF OPERATING ICT DEVICES

1. How would you rate your level of confidence in operating the following ICT devices? Please indicate letter "A" in only one cell per each row.

Skill		**Level of confidence**				
		Very confident	Confident	Not sure	Not confident	Very unconfident
Booting a computer	i) Desktop					
	ii) Laptop					
Basic computer operations (Using keying and pointing devices)						
Connecting PC to a projector						
Using a projector						
Operating a smart phone						
Mounting SD card to:	Smart phone					
	PC					
	Digital camera					
operating a digital camera						
Printing						
Mounting a MODEM to PC						
Managing files and folders	Creating					
	Editing					
	Deleting					
	Importing					
	Copying/pasting					
	Combining files					
	Searching					
Copying data from phone to PC						
Using any physics software						
Using Interactive White Board						
Others (specify						

2. In your opinion, how does your level of confidence in operating ICT devices influence student achievement in physics? Kindly indicate letter "A" in one box in each row.

Opinion	**Scale**				
	Strongly agree	Agree	Not sure	disagree	Strongly disagree
Has no influence in students' performance					
Makes students perform better					
Makes students' performance to drop					

3. In your own words, briefly describe the opinion you indicated in number 2 above of the influence the teacher's level of confidence in operating ICT devices has on student academic achievement in physics.

_____

_____

_____

_____

SECTION 5: TEACHER'S LEVEL OF CREATING INFORMATION USING ICT DEVICES

1. How would you rate your level of confidence in creating various forms of information using ICT devices?

Please indicate letter "A" in only one box per each row.

Skill		Level of confidence				
		Very confident	Confident	Not sure	Not confident	Very unconfident
Typing						
Creating files using operating systems	Word processors					
	Spreadsheets					
	MS access					
	MS publisher					
	Paint					
	MS Power point					
	Photoshop					
Creating animations using any software(s)						
Crating simulations using any software(s)						
Recording audio						
Recording a video using	Digital camera					
	Laptop					
	Smart phone					
Taking images using	Digital camera					
	Laptop					
	Smartphone					
Creating virtual digital content						
Editing and Formatting existing information to fit your desired content level						

2. In your opinion, how does your level of confidence in creating information using ICT devices influence student achievement in physics? Kindly indicate letter "A" in one box per each row.

Opinion	**Scale**				
	Strongly agree	Agree	Not sure	disagree	Strongly disagree
Has no influence in students' performance					
Makes students perform better					
Makes students' performance to drop					

3. In your own words, briefly describe the opinion you indicated in number 2 above of the influence the teacher's' level of creating information using ICT devices has on student academic achievement in physics.

SECTION 6: TEACHER'S LEVEL OF ACCESSING THE INTERNET

1. i) Is your school connected to the internet?

   Yes ☐ No ☐

   ii) Can you access internet while away from school

   Yes ☐ No ☐

iii) Can your phone access the internet?

   Yes ☐ No ☐

2. How would you rate your speed of accessing the internet?

   Fast ☐ Slow ☐ Moderate ☐ Not sure ☐

3. How would you rate your level of confidence in accessing the internet?

Please indicate letter "A" in only one box per each row.

Skill		**Level of confidence**				
		Very confident	Confident	Not sure	Not confident	Very unconfident
Browsing physics content	Using smart phone					
	Using PC					
Fast in browsing						
Downloading video						
Downloading text						
Downloading images						
Saving downloaded content						
Using various social media platforms to access and use physics content in teaching						
I	WhatsApp					
Ii	Facebook					
Iii	Twitter					
iv	Emails					

4. In your opinion, how does your level of confidence in accessing information in the internet influence student achievement in physics? Kindly indicate letter "A" in one box per each row.

Opinion	**Scale**				
	Strongly agree	Agree	Not sure	disagree	Strongly disagree
Has no influence in students' performance					
Makes students perform better					
Makes students' performance to drop					

5. In your own words, briefly describe the opinion you indicated in number 4 above of the influence the teacher's level of confidence in accessing information on the internet has on student academic achievement in physics.

_____

_____

5. What adjustments if any would you like to be made by the ministry of education and other stakeholders in education sector so as to improve on your competency in the use of ICT in teaching physics?

Appendix II: Interview schedule for principals'

Dear Respondent,

This interview schedule is designed to gather information of teacher competency on use of ICT in teaching physics in Makueni County. The study will be carried out for a partial fulfillment of the master of education degree from The University of Nairobi. The information in this interview will only be used for study purposes, be treated with confidentiality and in no instance will your name or name of your school be mentioned in this research. Your assistance is highly appreciated.

Thank you for your cooperation

SECTION 1: (Demographic data)

1. What is the name of your school? _____

3. State the type of your school

National school ☐ Extra County school ☐ County school ☐ Sub County school ☐

4. Which sub-county is your school in?

Mbooni East ☐ Mbooni West ☐ Makueni ☐ Kathonzweni ☐

Kilome ☐ Kibwezi ☐ Kilungu ☐ Mukaa ☐ Nzaui ☐

SECTION 2: ICT INTEGRATION IN TEACHING

1. Does your physics teacher use ICT in teaching physics?

Yes	**No**	**Don't know**

2. If yes in 1 above, what kind of ICT used is used?

Laptop	
Desktop	
Projector	
Digital camera	
Smart phone	
Interactive white board	
Others (specify)	

SECTION 3: ICT TRAINING

1. Does your physics teacher have any training on ICT?

Yes	No	Don't know

3. In your opinion, how does the teacher's training in ICT influence student achievement in physics?

Opinion	scale				
	Strongly agree	Agree	Not sure	disagree	Strongly disagree
Has no influence in students' performance					
Makes students perform better					
Makes students' performance to drop					

3. In your own words, briefly describe the opinion you indicated in number 2 above of the influence the teacher's training in ICT has on student academic achievement in physics.

_____
_____
_____
_____

SECTION4: TEACHER'S LEVEL OF OPERATING ICT DEVICES

2. How would you rate your physics teacher's level of confidence in operating the following ICT devices?

Skill	Level of confidence				
	Very confident	Confident	Not sure	Not confident	Very unconfident
Basic computer operations (Using keying and pointing devices)					
Using a projector					
Operating a smart phone					
Using any physics software					
Using Interactive White Board					

2. In your opinion, how does the teacher's level of confidence in operating ICT devices influence student achievement in physics?

Opinion	Scale				
	Strongly agree	Agree	Not sure	disagree	Strongly disagree
Has no influence in students' performance					
Makes students perform better					
Makes students' performance to drop					

3. In your own words, briefly describe the opinion you indicated in number 2 above of the influence the teacher's level of confidence in operating ICT devices has on student academic achievement in physics.

_____

_____

_____

_____

SECTION 5: TEACHER'S LEVEL OF CREATING INFORMATION USING ICT DEVICES

2. How would you rate your physics teacher's level of confidence in creating various forms of information using ICT devices?

Some of the Skills	Level of confidence				
	Very confident	confident	Not sure	Not confident	Very unconfident
Typing, Creating files using operating systems, Creating animations using any software,					
Recording audio and video using digital camera, laptop or smart phone					
Taking images using digital camera, laptop and smart phone					

2. In your opinion, how does the physics teacher's level of confidence in creating information using ICT devices influence student achievement in physics?

Opinion	**Scale**				
	Strongly agree	Agree	Not sure	disagree	Strongly disagree
Has no influence in students' performance					
Makes students perform better					
Makes students' performance to drop					

3. In your own words, briefly describe the opinion you indicated in number 2 above of the influence the teacher's' level of creating information using ICT devices has on student academic achievement in physics.

_____

_____

SECTION 6: TEACHER'S LEVEL OF ACCESSING THE INTERNET

1. Is your school connected to the internet?

Yes	**No**

2. Can your physics teacher access physics content on the internet while at school?

Yes	**No**	**Don't know**

3. In your opinion, how does the teacher's level of confidence in accessing information in the internet influence student achievement in physics?

Opinion	**Scale**				
	Strongly agree	Agree	Not sure	disagree	Strongly disagree
Has no influence in students' performance					
Makes students perform better					
Makes students' performance to drop					

5. In your own words, briefly describe the opinion you indicated in number 4 above of the influence the teacher's level of confidence in accessing information on the internet has on student academic achievement in physics.

_____

_____

6. What adjustments if any would you like to be made by the ministry of education and other stakeholders in education sector so as to improve on your teacher's competency in the use of ICT in teaching physics?

Appendix II: Test score document

Dear Respondent,

This document sheet is designed to gather information on the influence of teacher competency on use of ICT in teaching on students' academic achievement in physics in Makueni County. The study will be carried out for a partial fulfillment of the master of education degree from The University of Nairobi. The information in this document sheet will only be used for study purposes, be treated with confidentiality and in no instance will your name or name of your school be mentioned in this research. Your assistance is highly appreciated.

Thank you for your cooperation

SECTION 1: (Demographic data)

1. What is the name of your school _____

2. State the type of your school

National school ☐ Extra County school ☐ County school ☐ Sub County school ☐

3. Which sub-county is your school in?

Mbooni East ☐ Mbooni West ☐ Makueni ☐ Kathonzweni ☐

Kilome ☐ Kibwezi ☐ Kilungu ☐ Mukaa ☐ Nzaui ☐

SECTION 2: K.C.S.E TEST SCORES

YEAR	**K.C.S.E PHYSICS MEAN SCORE**
2019	
2018	
2017	
2016	

Appendix III: Permit letters

REPUBLIC OF KENYA

MINISTRY OF EDUCATION

STATE DEPARTMENT OF EARLY LEARNING AND BASIC EDUCATION

Email:cdemakueni@gmail.com
When replying please quote

County Education Office
P.O. Box 41
MAKUENI.

MKN/C/ED/5/33/ VOL II/46

19th October, 2020

Paul Mutinda Muendo
University of Nairobi
P.O BOX 30197-00100
NAIROBI

RESEARCH AUTHORISATION FOR PAUL MUTINDA MUENDO

Reference is hereby made to letter from National Commission for Science Technology and Innovation dated **9th October, 2020 Ref. NACOSTI/P/20/7061 on "Teacher Competency on the use of Information Communication Technology on student Academic performance in Physics in Secondary Schools in Makueni County".**

The bearer of this letter has been authorized to undertake a research in Makueni County for the period **ending 9th October, 2021.** You are therefore requested to assist where possible.

COUNTY DIRECTOR OF EDUCATION
DATE: 19/10/2020
P.O. BOX 41-90100
MAKUENI COUNTY

Robinson K. Kiarii
For County Director of Education
MAKUENI.

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **764696**

Date of Issue: **09/October/2020**

RESEARCH LICENSE

This is to Certify that Mr.. paul mutinda muendo of University of Nairobi, has been licensed to conduct research in Makueni on the topic: Teacher Competency on the use of Information Communication Technology on Student Academic performance in Physics in Secondary schools in Makueni County, Kenya. for the period ending : 09/October/2021.

License No: **NACOSTI/P/20/7061**

764696

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.

UNIVERSITY OF NAIROBI
COLLEGE OF EDUCATION & EXTERNAL STUDIES
SCHOOL OF EDUCATION

Telephone: 0724692079

P.O. BOX 30197, 00100 NAIROBI

P.O. BOX 92, 00902 KIKUYU

30th Sept. 2020

National Commission for Science, Technology and Innovation (NACOSTI)
P. O. Box 30623, 00100
Nairobi, KENYA

Dear Sir/Madam

RE: APPLICATION FOR AUTHORITY TO CONDUCT RESEACH IN KENYA: MUENDO PAUL MUTINDA

This is to certify that **Muendo Paul Mutinda Reg. Number E60/89943/2016** is a student at the University of Nairobi, Department of Educational Communication and Technology pursuing Masters in Educational Technology. He is seeking authorization to conduct research titled **"Teacher Competency on the use of ICT in teaching and student academic performance in Physics in Makueni County, Kenya."**

Kindly assist him to acquire research permit to enable him continue towards completion of his work.

Yours faithfully,

PROF. JANE C. GATUMU
CHAIRMAN,
DEPARTMENT OF EDUCATIONAL COMMUNICATION AND TECHNOLOGY

FINANCIAL BUDGET

Item	**Amount**
Preparation of questionnaires	10,000
Internet for literature review	5,000
Stationery	2,000
Transport	10,000
Miscellaneous	5,000
Editing and proof reading	5,000
Printing	10,000
Binding	3,000
Total	**50,000**

TIME FRAME

Time	**No. of months**
Preparation of proposal	January – September
Literature review	All through
Administration of instruments	October
Data analysis	October
Report writing	October – November
Submission	November