ASSESSING INTEGRATION OF INFORMATION AND COMMUNICATION TECHNOLOGY IN CLASSROOM INSTRUCTION BY PHYSICISTEACHERS IN NAIROBI COUNTY, KENYA

BY:

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REG. NO. E55/23589/2011

A THESIS SUBMITTED IN PARTIAL FULFILLMENT FOR THE DEGREE OF MASTER OF EDUCATION (CURRICULUM DEVELOPMENT) IN THE SCHOOL EDUCATION OF KENYATTA UNIVERSITY

OCTOBER, 2014
DECLARATION

I confirm that this research thesis is my original work and has not been presented in any other university/institution for certification. The thesis has been complemented by referenced works duly acknowledged. Where text, data, graphics, pictures or tables have been borrowed from other works- including the internet, the sources are specifically accredited through referencing in accordance with anti-plagiarism regulations.

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DEDICATION

I dedicate this thesis to God Almighty who has given me the strength and provided me with all the resources that I required. Glory be to His name.
ACKNOWLEDGEMENTS

First, I thank God for giving me the desire, energy and resources to go through my course successfully. I sincerely thank my Supervisors Dr. Charles M. Magoma and Dr. Florence M. Itegi who gave me the guidance, skills and expertise that I needed in this research and other lecturers in the department who attended my defenses and helped sharpen my work. I appreciate the secretaries in the department Vanessa and Jane for their continual assistance and my classmates especially Kiruki for their encouragement and support. I also sincerely appreciate the support I received from my sponsors Rev. Solomon Bandiho and Sr. Frances Borgia. They selflessly struggled to get school fees for me and believed in me. I would also like to thank Dr. Nthamburi of KICD who assisted me in validating the instruments, Asoka of KIPPRA, Wambua of KICD, Mungai of CEMASTEA, Arunga, Melita, Nyaranga, Akili, Lang’at, Pacha and Ongeta for their constant advice, reviews and editing of my work. I appreciate the Sandoval family for their support. My colleagues who supported me, encouraged me and stood in for me to allow me time to study, specifically, Mr. Kimori for the permissions, Mr. Omondi, Mr. Gikonyo, and Mr. Kuloba who helped me go round to collect data, Stella for printing and binding my work. Lastly, I wish to thank my father (Dr. Mwanaongoro), my mother (Mrs. Mwanaongoro), my Uncles Nyangoro, Mukhwaku, Osore, Kalori, Gebu, and my aunts Oduya and Amonde for their continual moral support and providing my pocket money whenever necessary. My siblings - Machesi, Namatsi, Mulongo, Nekesa, Mukhwana, Abanji- and my niece Basu, nephews Jose and Salvadore for their constant encouragements. My late grandparents the late Joseph Oduor Atego and Hendrika Wanyangu who continually challenged me and inspired me to study hard, for their sake I worked hard not to let them down. Special thanks to my mum, for her constant moral support and encouragement.

God bless you all.
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ABBREVIATIONS AND ACRONYMS

CPD: Continuing Professional Development
DQASO: District Quality Assurance and Standards Officer
ESP: Economic Stimulus Programme
GOK: Government of Kenya
ICT: Information and Communication Technology
ITE: Initial Teacher Education
KICD: Kenya Institute of Curriculum Development
MDGs: Millennium Development Goals
M.E.T: Ministry of Education and Training
M.I.C Ministry of Information and Communications
MOEST: Ministry of Education, Science and Technology
NACOSTI: National Commission for Science, Technology and Innovation
N.U.C: National Universities Commission
SPSS: Statistical Package for Social Sciences
SMASSE: Strengthening of Mathematics and Science in Secondary Education
TAM: Technology Acceptance Model
TPD: Teacher Professional Development
TSC: Teachers Service Commission
UTAUT: Unified Theory of Acceptance and Use of Technology
UNESCO: United Nations Educational, Scientific, Cultural Organization
ABSTRACT

Acquiring physics knowledge is the assurance of having a technologically competent workforce in science, technology and engineering especially in this technological era and in line with fulfillment of Vision 2030. However, research shows that Physics is one of the subjects that have experienced poor performance and hence low enrolment at KCSE level in Kenya. This is because students perceive it as being difficult and uninteresting due to its abstract nature. Further, research shows that integration of ICT in physics instruction has the capability of improving quality of education, simplifying abstract content as well as creating interest in learners. Therefore, there is need for ICT to be introduced in classroom instruction of Physics to improve its quality, simplify the abstract content and create interest in learning. Thus, the purpose of this study was to assess integration of ICT in classroom instruction by physics teachers in Nairobi County, Kenya. The study sought: to examine the perceptions of Physics teachers as regards ICT integration in classroom instruction; their competence in integrating ICT in physics instruction; the availability and adequacy of ICT resources for ICT integration in classroom instruction; and to establish ICT support available to Physics teachers for effective ICT integration in classroom instruction. The study was guided by Unified Theory of Acceptance and Use of Technology (UTAUT) model. Descriptive survey research design was used. The study targeted 40 schools, 40 principals and 121 teachers of physics. Random sampling technique was used to get a sample of 18 schools and 52 Physics teachers whereas purposive sampling was used to get 18 principals. Questionnaires, interview schedules and an observation schedule were used to collect data. Validity and reliability of the study instruments were established through consultation, triangulation and piloting. The quantitative data was analyzed using descriptive statistics generated from SPSS version 21. On the other hand, qualitative data was analyzed thematically. The interpreted data was discussed, inferences were made and the report written. The study found out that the teachers have strong positive perception on usefulness and ease of use of ICT. Majority of Physics teachers were computer literate and had attended some form of training on how to use ICT in classroom instruction. However, implementation of ICT in classroom instruction by the teachers in their classrooms was very low. They attributed this to inadequate ICT resources in schools. There was also lack of strong administrative and technical support to secure ICT instructional materials and offer both moral and technical support. The teachers also felt that they had had inadequate training on ICT hence they were not competent enough to implement. The study recommends that teachers should attend more training and refresher courses, more ICT resources to be acquired by the schools and the schools to provide both technical and administrative support.
CHAPTER ONE

INTRODUCTION AND CONTEXTUALIZATION OF THE STUDY

1.1 Introduction

This chapter presents a description of the background to the study, the statement of the problem, objectives of the study, limitations and delimitations of the study, as well as the theoretical and conceptual frameworks that underpin this research.

1.2 Background to the Study

Physics education is an essential subject among the sciences (Wenham, Dorling’, Snell and Taylor, 1984). In the study of physics, learners think logically and are equipped with principles that help them understand the dynamics of how things that people depend on work (Webber, 2013). Physics generates knowledge that is essential for future advances in technology that will enable the economic engines of the world, Kenya inclusive to forge forward. For example, Physics emphasizes on interaction of matter and energy hence, all technology relies on it because this interaction is necessary for the technological needs of the changing society (Juceviciene and Kareanauskaite, 2004; Zhaoyao, 2002). Moreover, a majority of activities in our daily life involve Physics principles, which enables us to understand and relate better with our environment, hence making our lives more comfortable and enjoyable (Webber, 2013).
Physics knowledge is significant in the education of computer scientists, chemists, engineers as well as of other physical and biomedical scientists. Physics also broadens and improves our understanding of other areas such as the earth, agriculture, biological, chemical, and environmental sciences. In addition, physics also improves our understanding of cosmology and astrophysics - subjects of substantial importance to all peoples in the world, among other important aspects (IUPAP, 1999). Further, Physics contributes to technology related infrastructure and provides trained workforce necessary for scientific progress and inventions, hence it is vital in the fulfillment of Kenya’s Vision 2030 [which proposes intensified application of science, technology and innovation to raise productivity and efficiency levels across the economic, social and political pillars of Vision 2030].

On the other hand, the national goal number 2 part (c) of Kenya states that ‘education in Kenya should provide learners with necessary skills and attitudes for industrial development’. Whereas the general objective number 12 for secondary education in Kenya, states that, ‘secondary education should provide the learner with opportunities to build a foundation for technological and industrial development’. The general objective number 6 for Physics, states that, ‘at the end of the Physics course, the learner should be able to contribute to the technological and industrial development of the nation’ (KIE, 2002). Coupled with Millennium
Development Goals (MDGs) and the Vision 2030 in Kenya, Physics would play an important role in attaining all these aspects especially in this technological era.

As much as Physics knowledge is fundamental in this technological era, studies in pedagogy have shown that there is a general decline in popularity and interest in natural sciences and technologies, and especially Physics in the schools world over (Jarosievitz, 2012). Garwin and Ramsier, (2003) add that motivation for learning has also been on the decline, and the examination results have been deteriorating. This is because many students consider Physics difficult and theoretical (House of Lords, 2006), while some find it uninteresting (Hirschfeld, 2012) due to its abstract nature and opt for other subjects they perceive as being easier (Adeyemo, 2012). Enrolment in Physics has been low and the performance below average compared to other subjects in most schools (Amadalo, Ocholla and Memba, 2012) especially in African countries (Semela, 2010 and Musyoka, 2004).

The same case has been reported in Kenya whereby over the years, less than 50% of the students countrywide opt to proceed with Physics, yet the knowledge offered by Physics is very vital for all learners especially in this technological era. Muteti (2009) asserts that ‘when learners perform poorly in a subject, their expectations in the subject go down and their motivation in the subject decreases. This leads to low enrolment in the subjectp.5’ the low enrolment and poor performance of Physics in Kenya is shown in Figure 1.1 and Figure 1.2.
Figure 1.1 National KCSE candidatures in physics (2004-2010) Source: KNEC, 2004 – 2010 Reports

Figure 1.2 National average marks in KCSE physics (2004-2010) Source: KNEC, 2004 – 2010 Reports
Figure 1.1 and 1.2 shows the trend in the enrolment and performance of Physics over seven years, the percentage enrolment for both girls and boys is way below 50% and the same applies to performance. Despite this scenario, the 21st century challenges cannot be handled without basic knowledge of the sciences, Physics being the core of the sciences (Jarosievitz, 2012). Physics is one of the key subjects that all learners need to embrace to be able to fit well in the new technological age. Hence, the dire need to find a solution to the challenges that make Physics ‘unpopular’ among the learners. There is need for Physics lessons in secondary schools to be made interesting and the abstract content simplified and concretized to make the learners develop interest. This is not only to perform well in Physics, but also to enable them acquire high level of applicable skills enhanced through the subject, which will be necessary in the fulfillment of Vision 2030 (Jarosievitz, 2012).

This problem could be solved amicably by taking advantage of Information and Communication Technology (ICT) in education (whose operation in itself relies largely on Physics applications like the transistors in computers and mobile phones, photons and quantum in fiber optic, electromagnetism in generation of electricity, among others). Gulbahar and Guven (2008) explain that studies done in controlled conditions show that ICT use under the right circumstances improves outcomes in education and many educationalists advocate for a new pedagogy that would use ICT in preparing students for work in this information age.
Bingimlas (2009) and Means (1994) also hypothesize that ICT use improves higher order thinking skills and problem-solving abilities hence improving student achievement. It also motivates the learner and provides a collaborative learning environment to learners. Bangert, 2008, Sutton, 2006 and Dockstarder, 2004 add that ICT improves quality of education and creates interest and enjoyment in learning. Use of ICT would therefore be very instrumental even in fulfilling the general objective number 12 for secondary education in Kenya, which states that ‘secondary education should enhance enjoyment in learning’. Enjoyment currently lacks in the teaching and learning of Physics as a number of studies have shown and ICT is capable of bringing enjoyment in the Physics class through simulations, animations and real video shows. Adeyemo’s (2010) study in Nigeria on impact of ICT on Physics, found out that ICT has a great impact on teaching and learning of Physics, it creates interest in learners as well as improves their performance. A study by Nyaga (2011) on science in Embu district Kenya confirmed the same finding.

Kenya as a country fully supports ICT integration in education. According to the Ministry of Education Science and Technology, MOEST, (2005) in Kenya, students exposed to ICT mediated instruction in Physics, ‘benefit greatly with the analytical, creative, and collaborative power of computer technology to map out and analyze assumptions’. This is key in the fulfillment of vision 2030 and in this technological era considering that all aspects of our day-to-day activities are going
digital. Further, according to MOEST (2012 and 2005), research shows that ‘careful ICT use in education, facilitates the acquisition of relevant life skills. It also improves quality of teaching and learning leading to improvement in teaching skills, attention and interest of students and enhances collaboration and communication/ networking among the teachers, students and parents’.

The MOEST (2006) emphasizes more on ICT use by noting that ‘ICT has the potential to play a powerful role in enhancing the tools and environment of learning, and preparing students to acquire skills and competencies fundamental for competitiveness in the global knowledge economy’. It is on these premises that the National ICT Policy and Vision 2030 of Kenya get their grounding, and Physics as a subject is instrumental in this achievement, hence the need to improve the quality, enrolment and achievement of Physics through ICT integration in the classroom, because without the knowledge in Physics, it is not possible to achieve Vision 2030.

In the Kenya National ICT Policy (2006), Kenya admits the fact that ‘nations that have exploited the use of ICT have gained significantly in terms of social and economic development and are quickly transforming into information and knowledge-based economies’. It also stipulates that ‘human resource development issues should be streamlined through the promotion of ICT curricula development
at all levels of education and ensuring that teachers/trainers possess the requisite skills’.

In addition, the policy also proposes that ‘e-learning should be promoted by developing content that not only addresses the country’s educational needs but also creates awareness of the opportunities offered by ICT as an integral tool in all spheres of life’. As a way of encouraging the uptake of ICT in education, the policy compels the Government of Kenya (GOK) to provide incentives to ICT service providers who are willing to deploy services in rural and under-served areas (Farrell, 2007; M.I.C, 2006; and MOEST, 2005). The thinking behind this strategy was that development in all aspects could be achieved by the education sector being on the forefront in using ICT in teaching and learning.

Vision 2030, the long-term development blueprint for Kenya, has the aim of ‘producing a globally competitive and prosperous country’ and transforming Kenya into ‘a newly industrialized, middle-income country that provides high quality life to all its citizens in a clean and secure environment by the year 2030’ (GOK, 2007)]. The GOK hopes to attain this through life-long training and education, which is a key sector in the social pillar of Vision 2030. Under education and training, the GOK aspires to provide a globally competitive and quality education that will make Kenya the regional center of research and development in new technologies (GOK, 2007). This can be achieved successfully
by embracing ICT and also understanding the principles of Physics, which can be
gained through quality instruction of Physics in schools and developing learners’
interests in Physics by use of ICT.

MOEST had introduced the Strengthening of Mathematics and Science in
Secondary Education (SMASSE) programme to help Mathematics and Science
teachers adapt to learner-centered methodology so that the performance of science
can improve, and enable learners apply what they learn in daily life. Apparently,
this had not offered a solution and the SMASSE programme is now adapting ICT
too. This confirms the importance of ICT in learning science. Further, the MOEST
had identified five schools in each of the former constituencies in Kenya (as
indicated in Appendix V for Nairobi County) and supplied them with ICT
resources to jump-start the ICT integration project in Kenyan public secondary
schools. This was with understanding that ICT is key in the improvement of
education.

The Kenya Institute of Curriculum Development (KICD) has digitized content as a
way to have relevant teaching content for schools. This content was designed in
such a way that it can be delivered using ordinary computer systems, web-based
for online access both locally and globally, mobile phones and other mobile
technology devices, therefore significantly transforming the way teaching and
learning should be conducted (Omuya, 2012). Therefore, to succeed in improving
the status of Physics, teachers need to change modes of teaching Physics from the traditional teacher-centered to learner-centered by adapting new learning cultures of using ICT in classroom teaching, which is proven to improve quality of education (Nallaya, 2010). However, they can only do that with necessary skills and resources. Moreover, learners entering schools are growing up in a digital world, and schools must therefore build on this foundation to meet the challenges of the digital world in order to realize students’ full potential (UNESCO, 2010).

Integrating ICT in classroom instruction of Physics is instrumental in responding to the dire need of Physics knowledge and skills as well as opportunities and challenges of the ‘global village’ (Bingimlas 2009 and Means, 1994). However, it would be wasteful to put in place policies and equip schools with ICT resources without taking into consideration whether teachers are using ICT in classroom instruction or not. This is because teachers play a key role in the success of any innovation, and therefore, teachers’ acceptance and use of ICT is essential if integration of ICT in classroom instruction of Physics is to succeed in Kenya and eventually lead to the achievement of Vision 2030 (Kumar, Rose and D’Silva2008). However, the decision regarding whether to use ICT rests with the teachers (Hennessy, Harrison & Wamukote, 2010; Wabuyele, 2003).

1.3 Statement of the Problem
The government of Kenya has formulated policies to industrialize the country by 2030 as well as implement use of ICT in all sectors. Knowledge in Physics is key
in achieving this industrialization. However, low enrolment and performance index in physics can be a setback to this goal. This deficit can have serious implications for the career options since the world is becoming technological and hence knowledge of Physics is mandatory. Use of ICT in instruction is capable of improving performance and hence enrolment in Physics by simplifying abstract content and creating interest in learners, however, use of ICT in classroom instruction is pegged on the willingness of teachers to use ICT in classroom instruction.

Thus, the success of ICT use in classroom instruction depends strongly upon the support and attitudes of teachers involved and their willingness to embrace ICT. Positive teacher attitudes towards ICT use are critical if ICT is to be integrated effectively into the teaching of physics to improve performance and hence enrolment. However, it was not clear whether the Physics teachers had the necessary elements to integrate ICT in classroom instruction and whether they had embraced ICT in classroom instruction with an aim of improving the state of Physics in terms of performance and enrolment. It was therefore the intention of this study to find out the state of ICT integration in classroom instruction of physics by Physics teachers in Nairobi County, Kenya.
1.4 **Purpose of the Study**

The purpose of this study was to assess integration of information and communication technology (ICT) in classroom instruction by Physics teachers in Nairobi County, Kenya.

1.5 **Objectives of the Study**

The study sought to:

i. Determine Physics teachers’ perceptions as regards ICT integration in classroom instruction.

ii. Examine the Physics teachers’ ICT competence to integrate ICT in classroom instruction.

iii. Assess the adequacy of ICT resources available to Physics teachers for ICT integration in classroom instruction.

iv. Establish ICT support available to Physics teachers for effective ICT integration in classroom instruction.

1.6 **Research Questions**

The following are the research questions of the study:

i. What are the Physics teachers’ perceptions towards ICT integration in classroom instruction?

ii. To what extent are Physics teachers competent to integrate ICT in their classroom instruction?
iii. To what extent are the ICT resources available to Physics teachers adequate for ICT integration in classroom instruction?

iv. What support is available to Physics teachers for effective ICT integration in classroom instruction?

1.7 **Significance of the Study**

The findings of this study may be of value to policy makers in the MOEST. The findings may assist them to know the extent to which Physics teachers in Nairobi County are using ICT in classroom instruction. Consequently, the policy makers may be able to strategize on better ways of providing professional development in relation to the integration of ICT in classroom instruction, and hence encourage greater use of ICT by Physics teachers.

The findings of this study may also be useful to Physics teachers by enabling them to make certain choices that might improve their teaching and hence enable them offer quality education to the learners of Physics who will be the vision bearers of Vision 2030. Physics teachers might acquire new knowledge; develop new attitudes, skills, valuations, teaching and learning experiences. They might reorganize and present these learning experiences in a manner to raise the interest learners in learning physics.
Suggestions that emanated from this study could be used to improve the ICT integration process in schools. Further, the study findings have added to the already available body of knowledge in regard to integration of ICT in classroom teaching and learning, and possibly may prompt other researchers to carry out further research in the subject area from different perspectives in Nairobi County and/or elsewhere in the country. It is also hoped that this study could be useful for other training institutions worldwide in their endeavor of ICT integration.

1.8 Assumptions of the Study

This study made the following assumptions: That:

i. Perceptions of teachers translate to actual use of ICT.

ii. Competence levels of teachers is as a result of adequate training and can be measured from their literacy certifications, uniformity of the training, their confidence in the training and their frequency of ICT use

iii. There is a correlation between competence in ICT and confidence in ICT hence competence leads to confidence.

iv. Presence of ICT technician offers confidence to the teachers to use ICT in classroom instruction and hence integration.

v. Presence of adequate ICT resources leads to ICT use

vi. The independent variables in this study directly influences the dependent variable
vii. Gender of the teachers and the type of school have no effect on the findings of the study

1.9 Limitations of the Study

The findings of this study are time bound because technology changes very fast due to constant improvement.

Due to the size of the sample size and location of the study, the findings may not be generalized to other counties other than Nairobi. Internal validity of the instruments may also be compromised incase the teachers give false information especially where the researcher would rely solely on what they say for example in objective i and ii. Hence, the researcher used an observation schedule and an interview schedule for the principals to help minimize threats to internal validity.

1.10 Delimitations of the Study

The study was confined to Nairobi County public secondary schools that had been supplied with ICT resources by MOEST under the economic stimulus programme (ESP) because they would give the specific information required by the fact that they already had ICT resources, therefore, are findings were not generalized to private schools in Nairobi County.

The study focused on Physics teachers only because Physics contributes to technology related infrastructure and provides trained workforce necessary for
scientific progress and inventions, hence it is vital in the fulfillment of Kenya’s Vision 2030, hence, the results may not be generalized to teachers of other subjects.

There are many uses of ICT in a school setting; this study was confined to use of ICT by Physics teachers in classroom instruction only. ICT resources are diverse. This study focused on the ICT resources commonly used in Kenya and those supplied by the MOEST to schools.

There could be other factors that may be used to assess teachers’ integration of ICT in classroom instruction. However, this study confined itself to the factors adapted by the researcher from the Unified Theory of Acceptance and Use of Technology (UTAUT) model. These factors are Physics teachers’ perceptions, Physics teachers’ ICT competence, adequacy of ICT resources available to Physics teachers, and ICT support available to Physics teachers.

### 1.11 Theoretical Framework

This study was underpinned on the Unified Theory of Acceptance and Use of Technology (UTAUT) model, formulated by Venkatesh, Morris, Davis, and Davis (2003). The model is based on the conceptual and empirical similarities across different technology acceptance models namely the Theory of Reasoned Action
The formulation of UTAUT was based on the best bits of the existing theories. After being empirically tested, the results reflected positively with UTAUT being able to explain approximately 70% of the variance in user intentions to use the new technology in favour to other models. The UTAUT explains user acceptance (behavioural intention) i.e. an attitude leading to the teacher wanting to use technology. It also explains usage of technology (usage behaviour) i.e. actual usage. The two are dependent on four factors, namely: performance expectancy, effort expectancy, social influence, and facilitating conditions (Khan and Iyer, 2009; Wade and Schneberger, 2005; Anderson and Schwager, 2004; Igor, 2005). It was these four independent variables that the researcher modified and came up with the variables for this study. The variables are Physics teachers’ perceptions, Physics teachers’ ICT competence, adequacy of ICT resources available to Physics teachers, and ICT support available to Physics teachers.

According to the UTAUT model, performance expectancy (referred to as perceived usefulness in the TAM model) is the degree to which a teacher believes that using ICT will help him or her to attain gains in class performance. The teachers accept and use ICT in classroom instruction if they believe that ICT will make learners get good grades and lead to quality classroom instruction. The
researcher hoped to establish whether the Nairobi County Physics teachers perceive ICT to be useful/important in their classroom instruction hence improving performance.

The second aspect of the UTAUT model, Effort expectancy (referred to as perceived ease of use in TAM model) is defined as the degree of ease associated with the use of ICT. Venkatesh, et, al. (2003) state that teachers will be willing to use ICT if they perceive it as being easy and effortless to use i.e. if it will not require their extra time, effort and resources. This concept further shows that the teacher’s level of competence and confidence determines the ease with which that particular teacher uses ICT in the classroom. This construct helped the researcher find out whether Physics teachers in Nairobi County perceive ICT to be easy to use and whether that influences their use of ICT in classroom instruction. From this construct, the researcher also determined the teachers’ levels of ICT competence through training.

The third factor of the UTAUT model is the social influence. This is defined as the degree to which a teacher perceives that ‘important others’ like the school principal, fellow teachers, the students, the parents and the professional bodies like the Ministry of Education and the policy makers who make up the school environment, believe he or she should use ICT. This assisted the researcher establish ICT support available to the Physics teachers, in terms of administrative
and technical support and how the availability or lack of the support would influence the teachers to use or not to use ICT in classroom instruction.

The fourth factor of the model is facilitating conditions, which UTAUT defines as the degree to which a teacher believes that organizational and technical infrastructure exists to support his/ her use of ICT. In this case, for Physics teachers to integrate ICT in classroom instruction, the necessary infrastructure should be in place as well as the necessary resources [like computers, projectors, Local Area Networks (LANs), internet, and digital curriculum].

Physics teachers accept and use ICT in their classroom instruction if they believe that they have adequate infrastructure and resources (which are in good working condition) in place. This construct consequently helped the researcher find out the state, availability, and adequacy of ICT resources in schools and its influence on Physics teachers’ integration of ICT in classroom instruction.

**1.12 Conceptual Framework**

The independent variables in this study are Physics teachers’ perceptions, Physics teachers’ ICT competence, adequacy of ICT resources available to the Physics teachers, and ICT support available to Physics teachers. On the other hand, the dependent variable in the study is actual integration of ICT in classroom
instruction, which eventually leads to developed interest in Physics, improved performance and good quality of teaching and learning of Physics.

The ‘Physics teachers’ perceptions’ variable is concerned with how Physics teachers perceive usefulness and ease of use of ICT. Literature indicates that teachers usually accept and use ICT when they perceive it as important in improving the quality of education and student achievement and when they perceive it as easy to use. It was measured using perception statements modified from Davis (1989). The ‘Physics teacher ICT competence’ variable was measured using computer literacy, how well trained, competent and confident Physics teachers in Nairobi County were in the use of ICT in classroom instruction.

‘Adequacy of ICT resources’ variable explains the availability and adequacy of the ICT equipment, digital content, internet and time available for the Nairobi County Physics teachers to use ICT in classroom instruction and how often the resources are utilized. The construct was measured by finding out the availability of the ICT resources and whether they were adequate or not and the frequency of use. Lastly, there is the ‘ICT support available to Physics teachers’ variable, which covers administrative and technical support available to Physics teachers to assist them to use ICT in classroom instruction. This construct was measured using statements that enabled the researcher to determine whether the teachers have support or not. Concisely, the researcher assessed how the independent variables influenced
Nairobi County secondary school Physics teachers’ integration of ICT in classroom instruction. The intervening variables will not be used in this study.

### Independent Variables

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<tr>
<th>Physics Teacher ICT Perceptions</th>
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<td>- Perceived usefulness</td>
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<td>- Perceived ease of use</td>
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<th>Physics Teacher ICT Competence</th>
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<td>- Literacy</td>
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<td>- Training</td>
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<td>- Confidence/ Competence</td>
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<th>Adequacy of ICT Resources to Physics Teacher</th>
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<td>- Availability</td>
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<td>- Utilization / Use</td>
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<th>ICT Support available to Physics Teacher</th>
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<tr>
<td>- Administrative support</td>
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<td>- Technical support</td>
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### Dependent Variable

**ICT Integration in Classroom Instruction of Physics**

### Intervening Variables

- Gender
- Age
- Experience
- Voluntariness of use

### Outcome

Improved interest in Physics & simplified content hence improved performance & enrolment

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**Figure 1.1 Relationship between the Independent variables: Physics Teacher ICT perceptions, Physics teacher ICT Competence, ICT Resources and ICT Support and the dependent Variable ICT Integration in Classroom Instruction of Physics**

1.13 Definition of Operational Terms

This section defines terms as used in this study as follows:

**Administrative Support:** Refers to the support offered by the school administration to the teachers in terms of incentives, providing money for ICT, allowing teachers to attend ICT related courses and encouraging them to use ICT in class among others, to facilitate use of ICT in classroom instruction.

**Classroom instruction:** Refers to the teaching methodology employed by Physics teachers in the execution of a lesson.

**ICT integration:** Refers to the acceptance and use of any ICT tool / resources by Physics teachers in their classroom instruction.

**ICT resources:** Refers to ICT tools/ equipment [(computers, projectors, laptops, CD ROMs etc.], digital content, internet and time available) necessary for Physics teachers to integrate ICT in their classroom instruction.

**Teacher Perceptions:** Refers to teachers’ attitudes, beliefs and convictions in relation to ICT use in classroom instruction.

**Teacher ICT Competence:** Refers to Physics teachers having necessary ICT skills and knowledge through training, resulting to confidence in using a wide range of varying ICT applications competently for various classroom instructions.

**Technical support:** Refers to the availability of competent technical work force to assist Physics teachers deal with any technical issues that they may face in the course of ICT integration in their classroom instruction as well as repair and maintain the ICT resources.
CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

This chapter reviews literature on the importance of ICT in education, and on factors [teacher competence, teacher perceptions, ICT resources, and support for Physics teachers] likely to influence teachers’ acceptance and use of ICT in classroom instruction.

2.2 Importance of ICT Integration in Education

Ofodu (2007) refers to Information and Communication Technology (ICT) as ‘electronic or computerized devices, assisted by human and interactive materials that can be used for a wide range of teaching and learning as well as for personal use’. Oye, Iahad and Rahim (2011) define ICT as

‘Processing and sharing of information using all kinds of electronic devices, an umbrella that includes all technologies for the manipulation and communication of information (p.2)’.

This study utilized both definitions.

Information and Communication Technology (ICT) has increasingly become important in almost all sectors of modern life. Education being a powerful agent of change is at the forefront of embracing ICT. According to UNESCO (2007), ICT
has the capability of widening education access and subsequently improving learning outcomes especially those of Physics that has been consistently low. Information and Communication Technology (ICT) is especially important to the Kenyan education system and it is hoped that ICT can be the launch pad of the country to achieve the MDGs and Vision 2030 that largely depends on Physics knowledge in terms of infrastructure and ICT.

Researches by Sutton (2006) and Bangert (2008) show that ICT can advance the learners’ academic qualities through promoting higher order thinking, improved communication skills, problem-solving and deep understanding of the learning tool and taught concepts and retention. Another common reason for using ICTs in the classroom has been to prepare the current learners for the work environment where ICTs, in particular computers, the internet and related technologies are becoming very necessary (Tinio, 2002). However, it is not known yet whether ICT is being used in Nairobi County and thus improving the learners’ academic qualities, hence the need for this study.

The learners will later on compete in the global market for jobs and for general survival and they will be at a loss if at the end of their education, they are not able to understand and use ICT as well as be able to fit in the technological age. Therefore, for Kenya to be able to fit in the global market, and for her to produce quality graduates, it is mandatory that the education system embraces ICT and
especially in Physics, whose principles are key in attainment of Vision 2030. The mandate of this study is to find assess the extent to which ICT is being integrated in learning and teaching of Physics.

Generally, students enjoy learning through ICT. The current generation of learners are more technology-oriented and would enjoy an ICT supported learner-centered method of learning more than the traditional teacher-centered method, which they find boring (Nallaya 2010). Therefore, ICT can be the main solution since it leads to active student participation and independent learning (UNESCO, 2010 and Nallaya, 2010). The hands-on experience of ICT excites learners and makes them enjoy collaborating with their peers.

Many teachers have reported that ICT has increased students’ need to work co-operatively and to engage in peer tutoring (Capper, 2003). Collaboration is also encouraged when students are given work in pairs or in small groups to a limited number of computers. Apparently, according to Valtonen (2011), research shows that even when each student has a computer to him/ herself, they still resort to helping each other. This should be encouraged as it promotes learning. However, it is not clear if the same could be said of the leaners of Physics in Nairobi County hence the need for this study.
Dockstader (2004) argues that since the presence of ICT motivates learners in the classroom, they tend to show increased academic engagement time. This is because they do not get tired and bored very fast and hence are able to explore deeper into the content area curriculum. In such instances, students are able to move beyond knowledge and comprehension to application and analysis of information, which is favorable in Physics subject where learners are required to solve problems. All learners are the same and would most likely respond the same to ICT, however, this can only be possible if they are exposed to ICT by their teachers, hence the need for this study.

According to the Kenya Education Options Paper, ICT is capable of enhancing learning in a number of ways if well utilized in classroom instruction (MOEST, 2005). In the same paper, it is noted that:

ICTs have the potential of playing a powerful role in enhancing the tools and environment of learning and preparing students to acquire skills, competencies, and social skills fundamental for competing in the emerging global knowledge economy (MOEST, 2005 p. 20).

This is very vital in the Physics subject whose knowledge and skills are key in fulfillment of Vision 2030. This study focused on the importance of ICT in improving the performance hence enrolment in Physics by simplifying abstract content and creating interest in learners. This study sought to find out the extent of ICT use in classroom instruction by the Physics teachers in Nairobi County.
2.3 Teachers’ Perceptions on Integration of ICT in Classroom Instruction

Teacher perceptions refer to innate issues that affect the teacher as an individual person. Realizing attitudes and their effect on teachers is important in recognizing that perceptions contribute to teachers’ attitudes, and that attitudes influence action (Awan, 2011). Scholars agree that apt identification of teachers’ perceptions is critical for successful ICT integration in the classroom. The perceptions of the Physics teachers in Nairobi County have not been established yet, hence the need for this study.

Teachers’ beliefs can make or break implementation of an innovation, and therefore, must be focused towards the innovation. Thus, in order to implement ICT in teaching and learning of Physics in Kenya, policy makers and teacher trainers need a better understanding of the beliefs that influence teachers’ decisions either to use ICT or not (Kriek and Stols, 2010). Cuban (2001) argues that beliefs influence what and how teachers choose to teach and what innovations they support or reject. There is, therefore, need for a deeper understanding of the nature of beliefs that influence teachers’ behaviour and how these beliefs manifest themselves. These researches were not done in Nairobi; therefore, it’s with this understanding that this research was necessary to find out the beliefs of the Physics teachers in Nairobi County.
Gulbahar and Guven (2008) further explains that a new technology will be favourably accepted and diffused if the adopters, in this case the teachers of Physics, perceive it to be beneficial. This means that it is compatible with their existing practices, is easy to understand and use, it can show observable results and can be experimented on a small scale before use. A teacher will adopt any innovation as long as he/she finds it useful to him/her as well as the learners and easy to use. This study was designed to find out whether Physics teachers in Nairobi County perceive ICT being beneficial and easy to integrate in their classroom instruction or not and whether their perceptions translate to actual use.

According to Davis, Bagozzi and Warshaw (1989), ‘perceived usefulness’ is defined as the ‘degree to which a person believes that using a particular technology will enhance his or her job performance’. Teachers will tend to use or not to use ICT according to the extent that they believe it will improve their performance. According to a study by Kumar, *et al.* (2008), and those of Hu, Clark, and Ma (2003) and Venkatesh and Morris (2000), there has been identified a significant positive relationship between perceived usefulness and actual use of ICT by the teachers. Gulbahar and Guven (2008) findings also showed a strong positive relationship between teachers’ perceptions on ICT usefulness, and their attitudes towards use in classroom. It was not clear, if this was the perception amongst the Nairobi County Physics teachers, hence the need for this study.
The study by Oyedeko and Tella (2010) in Nigeria concluded that teachers have a high perception that ICT contributes a lot to the performance of learners and that there is a difference in performance when ICT is used to teach. Further, the findings of a research by Tella, Tella, Toyobo, Adika and Adeyinka, (2007) and that by EdQual [a Research Consortium of educational institutions in the UK and Africa (Ghana, Rwanda, South Africa, Tanzania) on educational quality], indicated that, the teachers who use ICT feel that their use of ICT benefits their students. ICT benefits learners by helping them gain confidence, develop self-esteem and motivation. It also stirs interest and learning of the subject, boosts recall, triggers learners’ response and giving steady feedback (Hennessey, Harisson and Wamukote 2010). No study has yet been done to find out the case of Nairobi Physics teachers, hence the need for this study.

The positive relationship shows that as the perceived usefulness of ICT increases, the teachers experience better actual use of ICT in the classroom. Their foregoing studies however, were not carried out in Kenya nor were they about Physics teachers hence the need for this study. Equally, this study was interested in finding out what the perceptions of Nairobi County Physics teachers were concerning usefulness of ICT in classroom instruction. There was no known research, which had looked at the perceptions of Physics teachers in Nairobi County on usefulness of ICT use in the classroom instruction. The study aimed at finding out if Physics teachers in Nairobi County believed that ICT would improve their lessons and
improve the performance of the learners. The study also sought to find out whether the belief led to actual usage of ICT in classroom instruction.

The other teacher perception is the perceived ease of use, which, Davis et al. (1989) defines as the ‘degree to which a person believes using a particular technology will be free of effort’. While teachers may believe that ICT use is beneficial, on the other hand, they may find it hard to use and hence the performance benefits of usage may be outweighed by the effort needed to use ICT in the classroom. According to Teo, Lee and Chai (2007), studies show that it is possible that ICT with a high level of perceived ease of use is more likely to induce positive attitudes among teachers, hence making them adopt it in their classrooms. It is fitting to say that teachers use ICT if they perceive it effortless to use in the classroom. Therefore, this study was interested to find out whether the Nairobi County Physics teachers perceived ICT as easy to use, and further determines its influence on actual use.

Kumar, et al., (2008) concluded that perceived ease of use has a strong influence on teachers’ actual use of ICT. The findings also show that teachers perceive ease of use to be slightly more important compared to the usefulness of ICT in their pursuit of use. Many governments are emphasizing teacher development as a key element to using ICT to improve teaching and learning and quality of education. This is because teacher development enhances the teachers’ skills hence, making
them find it easy to use [National Universities Commission (N.U.C, 2005)]. These studies were not on Physics teachers and therefore, on this note, it is not clear if Physics teachers in Nairobi County can attest to the importance and need of teacher development hence ease to use, thus, the need for this study.

Zhao and Cziko (2001) give three conditions necessary for teachers to accept and use ICT in their classrooms, which are: the teachers’ believe in the effectiveness of ICT, the teachers' believe that its use will not cause disorders, and that they have control over ICT. Demetriadis, et al. (2003) had similar conclusions. They concluded that, “training efforts are generally welcomed by teachers but consistent support and extensive training is necessary in order for them to consider themselves able to integrate ICT in their teaching methodologies” (p. 35). In other words, constant training will enable teachers find ICT easy to use. This finding has had not been established in Nairobi County Physics teachers.

A study in Vietnam by Dang (2011) on language teachers (lecturers) shows that teachers who use ICT in classroom instruction only focused on the software programs they perceive to be easy like downloading information from the internet, using Microsoft word and PowerPoint presentations. However, the other programs like mind mapping, education blogs, and voice threads are rarely used because the teachers perceive them to be difficult. This shows that ease of use has a great influence on teachers’ use of ICT in classroom instruction. It is needful to assist
teachers find all aspects of ICT easy to use for effective integration especially through training. The teachers in Dang’s study were teachers of language and working in a university in Vietnam, the study used Technology Acceptance Model (TAM) and mixed method research design.

Therefore, it was necessary to find out the case of Physics teachers teaching in secondary schools, in Nairobi County, using UTAUT model and descriptive design method of research. It was not clear if Physics teachers in Nairobi County were also just concentrating on easy programs as those of Vietnam. This study aimed at finding out if Physics teachers perceived ICT easy to use and whether they were using it for classroom instruction.

2.4 Teachers’ Competence in Integration of ICT in Classroom Instruction

Modes of teaching Physics need to change from the old teacher-centered method to learner-centered method of instruction, which ICT would facilitate very well hence improving performance and enrolment. Therefore, apart from the teacher having the right perceptions on ICT, the teachers need to be competent in ICT to be able to integrate it in classroom instruction. Various studies show that a lot of focus on ICT integration in education is on the tool rather than the key users - the teachers. Much emphasis is on providing the resources and infrastructure for ICT rather than the teacher who is key in the implementation process (Sang, et al., 2009). The resources may be available and the infrastructure in place, but the
teacher must be competent and willing to make use of them. In this study, the study population had some resources supplied to them, however, it was not clear whether the teachers were involved in terms of competence through training, hence the need for this study.

Aruna (2011) and Acker, Buuren, Kreijns, and Vermeulen, (2011) argued that computer literacy is key to a teacher for any ICT integration to take place in any given subject, in this case Physics. Smaldino, Heinich, Russel, Molenda, and Cavanaugh (2005) also asserted that no integration can take place without literacy. This is because most time will be spent ‘learning the technology rather than using the technology’. Computer literacy is a prerequisite to ICT competence, therefore, it will determine competence and hence use of ICT in classroom instruction. It was not clear if Physics teachers especially those in Nairobi County were computer literate hence able to master other ICT skills that would enable them go ahead and use other ICT resources available for their classroom instruction of Physics, hence the need of this study.

A study by the Ministry of Education and Training [MET] (2005) in Western Australia found out that 82% of teachers were not regularly using ICT in the classroom. This is supported by the findings of Polly et.al. (2010) and Afshari, Bakar, Su, Samah and Foi, (2009). The studies established that the teachers’ level of ICT competence and their attendance of training on how to integrate ICT were
the most influential factors on a teachers’ integration of ICT in the classroom. This is a valid reason for a teacher not to use ICT or any innovation for that matter because unless a teacher is aware of how to use a tool, it is not possible for them to use the tool. Therefore, this study sought to establish the competence levels of Physics teachers in Nairobi County and thereafter find out whether competence was influencing their use of ICT in classroom instruction.

A study in Cyprus by Chrysostomou and Mousoulides (2009) found that confidence influences teachers’ use of ICT in classroom instruction. According to Arunga (2011), literature suggests that teachers’ attitudes towards using ICT in their teaching are highly influenced by their confidence in use of ICT. The teachers’ attitudes will be positive towards use of ICT if they feel competent with the training they have attained and hence confident in delivering subject content through use of ICT in the classroom in the presence of their students, who, in many cases, are well acquainted with technology outside school. Awan (2011) supports this finding. Confidence comes as a result of competence, when a teacher is competent through training, then they feel confident to use the tool before their learners. In this case, ICT which may be a challenge to teachers as opposed to the learners as a result of the generation gap, the learners are more techno-savvy than their teachers, for that reason, a teacher needs to be very confident to attempt using ICT in the classroom.
These studies however did not look specifically at Physics teachers, hence the need of this study. With the abstract nature of a number of content areas in Physics, a Physics teachers has to be competent in ICT to attempt using ICT in his/her classroom instruction. This is very important considering the current technological age in which we are. This study was interested in finding out how competent the Physics teachers, in the capital city of Kenya (Nairobi County) are in terms of ICT use in classroom instruction.

Awan’s (2011) study cautioned that the training needs of teachers could not be over-looked when developing programs aimed at modifying teaching and learning practices in classrooms. This is because, the teacher is the user of the programs and therefore cannot be left out and be expected to implement the same.

On the other hand, a study in Cambodia by Richardson (2009) found that teachers were ready to use the acquired skills in training. However, integrating ICT in classroom instruction was still difficult for a number of them who required more training to get there. This is because general ICT skills is not enough to make teachers competent and confident enough to use ICT in class, which requires more specific training on how to integrate ICT in the curriculum, in this case, Physics curriculum. Mumtaz (2000) adds that teachers need to know the content and how it is supposed to be taught using ICT. This means that, even with basic skills, the teachers need to be trained further on how to use ICT with the content. This would
not be any different for a teacher of Physics since computer literacy is common to all. Therefore, it is necessary for teachers to undergo intense training to ensure their competence and confidence in ICT use. Even if Physics teachers in Nairobi County were computer literate, they would still require specific training to use ICT in classroom instruction. Therefore, it was in the interest of this study to find out the training levels of the teachers of Physics in Nairobi County and further confirm if the training was adequate to translate into use in their classroom instruction.

Thus, lack of professional development hinders teachers from integrating ICT in their classrooms although they may want to learn how to integrate it. Further, Tinio (2002) argues that even the teachers that are already competent in ICT, need to continuously upgrade their skills and keep abreast with the latest developments in ICT, this can be achieved through frequent refresher courses. This is very important because technology keeps evolving and the Physics teacher should not rely on old knowledge and skills. Glazer and Hannafin (2006) andMuijs and Lindsay (2008) add that the traditional one-off trainings, are not effective since they do not allow time for the teacher to master the skill well, and hence lacks confidence to use ICT on his/her own in the classroom.

This is especially true in this age where the learners are more technology-friendly than their teachers are (Nallaya, 2010), hence the teacher would want to be competent before attempting to use ICT in classroom instruction. This study was
interested in finding out whether Physics teachers were attending refresher courses to keep them abreast with the ever-evolving ICT so that they can competently use ICT in their classroom instruction.

Refresher courses are important because research shows that Initial Teacher Education (ITE) and Continuing Professional Development (CPD) improve teachers' confidence and competence in using ICT to meet the needs of students (Swarts, 2008 and Waema, 2011). According to Tinio (2011), for many under-paid and over-worked teachers in developing countries, effective adoption of ICTs would be successful by giving them continuous opportunities to learn ICTs based on their circumstances and experience, and at their own convenience. This would apply to Physics teachers in Nairobi County considering that Kenya is a developing country, however, it has not been found out yet, hence the need for this study.

In Kenya, a study carried out by Kirimi (2012) in Kangema, Murang’a County found that a majority of the teachers 87% just had a certificate in computer application packages. A certificate may not be adequate for a teacher to use ICT in classroom instruction confidently and frequently. A study by Mwingirwa (2012) in Tigania found that 67% of mathematics teachers had some form of ICT training; and that majority (52%) of those with some training were just certificate holders. Mwingirwa (2012) further asserts that 90% of those teachers with some training
used computers for general use and not for classroom instruction because they felt incompetent. However, none of these studies focused on Physics teachers, therefore, this study was interested in finding out the situation of ICT integration in classroom instruction by Physics teachers in Nairobi County.

Consequently, the quality of education is dependent on ICT and the development of high quality teachers among other factors. Teachers have to be thoroughly prepared to embrace ICT as one of the pillars of education (UNESCO, 2007). It is therefore important that teacher preparation programmes prepare teachers effectively in ICT integration. Regrettably, Mungai (2012) asserts that results from various empirical studies indicate that there are inadequate preparation opportunities for teachers on ICT integration globally. This study therefore had an interest in finding out to what extent these findings were true to Physics teachers in Nairobi County.

2.5 Adequacy of ICT Resources for ICT Integration in Classroom Instruction

The ICT resources in this study refer to ICT tools in the school necessary for Physics teachers to integrate ICT in their classroom instruction (Teo, et al., 2007). These resources include ICT equipment/ facilities, digital content, internet and time available. According to Bandele (2006), Bryers (2004), and Ofodu (2007), ICT facilities/ equipment include desktop computers, LANs, laptops, printers,
radio, television, overhead projectors, CD-ROM, internet, smart boards, video/VCD machines, among others. According to Inveneo (2011), computers are the most commonly used form of ICT in many developing countries and they are still very expensive. This study sought to find out adequacy of such ICT resources accessible to Physics teachers in Nairobi County, this is because the sampled schools had been supplied with ICT resources.

Hennessy, et al., (2010), Groves and Zemel (2000) express the fact that the teachers’ acceptance and use of ICT is highly dependent on availability of resources. If the resources are not available, the teachers will not be motivated to use ICT in classroom instruction, simply because there are no resources to use or the resources are not adequate for use in relation to student populations. However, the study by Teo, et al., (2007) found that the resources were not very important in influencing the teachers’ attitudes towards adopting and using ICT.

This could be true because there could be resources but inadequate in relation to the number of students, or in bad condition or the teachers may not know how to use them. Therefore, in such a case, availability of resources would not influence teachers’ use of ICT. This study therefore, sought to find out whether ICT resources that were supplied by the MOEST were adequate and whether or not they had influence on the Physics teachers in Nairobi County to use ICT. Kumar, et al., (2008) add that the teachers avoid allocating time to ICT-assisted
instruction if the quantities of resources are inadequate to meet the needs of their students or are not functioning well. The MOEST supplied ICT resources to five schools in each constituency in Nairobi County in 2010. However, it was not yet fully established if the resources supplied were adequate and whether they were in use by the Physics teachers, hence this research was timely.

According to the World Bank (2011), despite efforts by governments, NGOs, corporate organizations and individuals to donate computers to as many schools as possible, they are still not adequate. Therefore, there are a big number of schools unable to purchase computers for use by their teachers and students. In addition, teachers must have adequate access to functioning computers (and other ICT facilities like laptops, projectors, digital content, internet) and sufficient technical support. Redesigning curriculum and assessment tools to lean on ICT, lead to optimal use of ICTs in education. The schools that were involved in this study already had resources from the MOEST. However, it was not clear whether the resources were adequate in relation to the number of students (since different schools have different student capacities) and whether Physics teachers were using them, hence the need for this study.

Further, a study by Kiptalam and Rodrigues (2010) observed that access to ICT facilities is a major challenge facing most African countries, with a ratio of one computer to 150 students per school against the ratio of 1:15 students per school in
the developed countries. This ratio in the developed world has now improved with time to 1:5 per school. An ideal student computer ratio would be 1:1, but due to the advantage of collaboration, 1:2 would be best whereby learners can share a computer and assist each other in the learning process.

According to Kumar, et.al (2008), to ensure teachers use ICT in the classrooms, the Malaysian Education Ministry gave support and assistance to the Mathematics, Science, and English language (MSE) teachers in the form of providing ICT facilities and financial incentives. Incentives motivate teachers to adopt innovations. The above studies did not look at Physics teachers specifically, yet Physics is key in this technological age, hence the need of this study. This study aimed at finding out if Physics teachers in Nairobi County had adequate resources and if they were given incentives as a motivation to integrate ICT in classroom teaching and whether they were utilizing the resources supplied by MOEST.

A study by Wanjala, Khaemba and Mukwa (2011) in Bungoma County, Kenya found that computer hardware and software were the main barriers affecting implementation of ICT. Teachers reported that the computers were not enough and had no access to software. However, a study by Kiptalam and Rodrigues (2010) across Kenya found that a large number of teachers from the sampled schools had access to ICT resources and especially computers and internet both at school and at home. However, just a few had accessed relevant content on the web. They also
found out that most teachers were using the internet more on getting information for teaching than for collaboration with other teachers through emailing. These studies were not conducted in Nairobi County nor were they on Physics teachers, and hence this study aimed at finding out the situation of ICT resources availability, adequacy and utilization by Physics teachers in Nairobi County.

A study by Kirimi (2012) in Kangema Murang’a County found that 88% of schools had some ICT resources like computers. However, the majority, 56% had less than five computers, most of which were used for other purposes like clerical work other than classroom teaching. From the study, 48% were in the offices, 44% in the laboratory, 2% in the staffroom, and 6% in other places. Only 35% of the teachers were able to access the ICT resources on a daily basis. This shows that the majority of the ICT resources were used for managerial purposes other than the required purpose of classroom instruction to improve quality and student performance. Forty-two percent strongly agreed while 45% agreed that inadequate number of computers hindered them from using ICT in classroom teaching. In Mwingirwa’s (2012) study in Tigania East, 67% of the schools had computers, 26% used them for general use; 56% had radios and TVs, which were used entirely for entertainment. The teachers had no idea how the radio and TV could be used for teaching. This study aimed at finding out the situation in Nairobi County and on Physics teachers.
Time is also a resource in ICT integration, in the Philippines, some teachers felt burdened with their current planning and teaching responsibilities and felt that adding technology would be an added demand to their time and energy (Blomeryer and Martin, 1991). Teachers complain that they are involved in many other school improvement programmes that are equally important, and therefore feel that not all teachers are required to use ICT in their classrooms. However, in this study it was necessary for the Physics teachers to use ICT themselves with an aim of improving interest in Physics as well as performance and enrolment.

A teacher needs time to prepare a lesson, and time to deliver the lesson as well as evaluate. School programs and curriculum content are organized in a timetable and therefore the teacher must be able to work in the stipulated time frames to achieve his/ her lesson objectives. Depending on the time available on the timetable, this may determine whether a teacher will use ICT or not. The aspect of how Physics teachers in Nairobi County viewed the time factor was not known, hence the need for this study.

A study by Dang (2011), in Vietnam that was assessing world links schools programme, and that of Malaysia by Sim and Theng (2008), identified lack of time for using ICT in classes and for planning as a factor hindering use of ICT in the classroom. The teachers complained that class time was too limited to use ICT and that ICT use takes a lot of time to prepare. On average, an hour ICT enhanced
lesson will require around 3 - 4 hours to prepare. It is important to recognize that mastering ICT requires time, and that teachers’ preparation involves both the training and experimenting with ICT before using it in the classroom. It had not been established yet whether Physics teachers in Nairobi County were having a challenge with time after the introduction of ICT, hence the need for this study to find out this aspect.

A study by Kirimi (2012) in Kangema Murang’a County and that of Mwingirwa (2012) in Tigania East agree that a number of teachers complained of having many lessons per day hence could not get time to prepare for an ICT integrated lesson, considering that they also had co-curricular activities to take care of like games and clubs. Makau (1989) asserts that pressure to complete syllabus is put on teachers and therefore they put all their energy on the strategies to help them complete the syllabus and avoid any technology, however good, which may disrupt syllabus completion in any way. This study was interested in finding out how Physics teachers in Nairobi County utilized their time in relation to ICT.

2.6 Support for Integrating ICT in Classroom Instruction

Teachers require technical support and administrative support to enable them adopt ICT in their classroom instruction. This support motivates and gives them confidence to integrate ICT in their lessons. Groves and Zemel (2000) rated administrative support as one of the key factors that influence teachers’ use of
ICT. Many teacher or student-initiated ICT projects have been undermined by lack of support from the administration, which plays a key role in ICT integration in education. For ICT integration programs to be successful and maintainable, administrators themselves must be competent in the use of the ICT, and they must have an extensive understanding of the technical, curricular, administrative, financial, and social dimensions of ICT use in education (Tinio, 2002). It was not clear whether the administrators in Nairobi County are competent in the use of ICT and offer support to the Physics teachers, hence the need for this study.

According to Wanjala, et al., (2011), school administrators control policy-making, financial allocation, and program implementation within schools. Hence, administrators must be educated on the use of ICT in schools and worth of using ICT in their schools. A principal who supports ICT will be approachable in issues related to ICT and will ensure smooth running of the process by making sure the teachers are well trained, have the right equipment and are using ICT. According to UTAUT model, teachers would be motivated to use ICT if the ‘important others’ in this case the administrator and other teachers, support them. Nairobi County Physics teachers would benefit from such support, though it was not clear whether they had it or not, hence the need of this study.

In addition, as key leaders of change in the teaching-learning processes, school principals can make possible ICT integration in teaching and learning process.
This is because ICT integration involves making decisions, influencing others, supporting teachers and being role models in ICT use. To achieve that, school principals need to understand that ICT integration is about a change in the teaching and learning processes (Afshari et al., 2009) and thus give maximum support to the teachers. It was the need of this study to find out the support available to Physics teachers from the principals.

Drawing from several research sources, Leng (2008) reiterates that effective leadership is a key element of success in any innovation in education. He asserts that leadership is vital for successful integration of ICT in the classrooms. Therefore, the Nairobi County school principals need to support ICT use in the classrooms to encourage the teachers of Physics. This study aimed at finding out whether they were doing so or not. According to Wanjala et al. (2011), the principals should also encourage the teachers to continue developing technology-based skills and allow them to attend ICT integration related courses. If a teacher feels not competent enough, he/she should be allowed to attend courses more often until he/she feels competent. The principal should also ensure that the teachers are putting into practice what they have learnt. The teacher can be allocated some practice time on the timetable with a technician until he/she perfects the skill.

According to Hennessy, et al., (2010), lack of incentives and lack of administrative support may influence teachers not to use ICT in classrooms. Wanjala et al.,(2011)
add that a variety of incentives can be used, including: certification, professional advancement, pay increases, paid time off to participate in professional development, formal and informal recognition at the school and community levels and among peers, reduced isolation, and enhanced productivity.

On the other hand, Tinio (2011) adds that institutionalized incentives and support for teachers to pursue ICT Teacher Professional Development (TPD) are also critical. This may take the form of promotions for teachers who innovate with, as opposed to merely using ICTs in the classroom, or simply making sure that teachers have adequate access to ICT after training. This would motivate them to put into practice what they have learnt and be able to train others. It was not clear whether the teachers were motivated with incentives to use ICT in classroom instruction or not, considering that, ICT use is key in this time and age of technology, and therefore all avenues should be employed to ensure ICT use is implemented.

Other than administrative support, teachers often need on-site technical support as well as pedagogical support such as advice on choosing relevant software and integrating it into instruction. A study in Nigeria by Tella et al. (2007); in Malaysia by Keong, Horani, and Daniel (2005); and Sim, and Theng (2008) found that lack of technical support in the schools was a factor hindering teachers’ willingness and self-belief of using ICTs during the lessons. This was consistent
with the findings of a study by Cox et al. (1999) which reported lack of technical support at the school-level as a barrier in the uptake of ICT in teaching. According to Cuban (2001), lack of available technical support is likely to lead to teachers avoiding ICT, for fear that, a technical fault may lead to lessons being unsuccessful. The same was not known for Physics teachers in Nairobi County, hence the need for this study.

In Kenya, Wanjala et al. (2011) report that ICT support personnel for assisting teachers are limited in most schools in Bungoma. The schools that have an on-site ICT technician do not provide teachers with adequate computer assistance, as they would require. This is likely to discourage teachers from using ICT in the classroom, with the fear of being stuck in case of a technical problem or not being sure of which relevant software to use for various teaching areas. This study aimed at finding out whether Physics teachers in Nairobi County had technical support to assist them whenever they required assistance.

Wanjala et al. (2011), add that whether the technical support staff are part of the school staff or are out-sourced, or both, they are essential for successful ICT use in any school. Though the technical support requirements of a school would depend on what and how ICT is used, general skills that are required would be in installation, operation, and maintenance of technical equipment including
software, network administration and security. Without on-site technical support, much time and money may be lost due to technical breakdowns.

2.7 Summary of Reviewed Literature

From the above literature, it is evident that the issues that may influence Physics teachers’ attitudes towards use of ICT in classroom are the teacher competence, their perceptions, availability of adequate operational resources and both the administrative and technical support. If these factors are put in place, then it would be easy for the teachers to integrate ICT in their classroom instruction.

There was a controversy in literature on whether availability of adequate operational resources influences use of ICT or not. Some studies reiterated that availability influences ICT use while others reiterated the availability of resources has no effect on ICT use, hence, the need for this study to find out.

Many researches that have been done have generally looked at all teachers and a few on Mathematics teachers, science and languages in general. Again, most of the studies were carried outside Kenya a majority of which were focusing on university lecturers in different universities. The studies that were conducted in Kenya were not carried out in other counties, other than Nairobi County. It has not yet also been established how the above factors influence Physics teachers in Nairobi County to use or not to use ICT in their classroom instruction.
Accordingly, this study seeks to assess integration of ICT by Nairobi County Physics teachers in classroom instruction, in reference to the Physics teachers’ perceptions, their ICT competence, adequacy of ICT resources and ICT support available to the Physics teachers.
CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter contains the research design, study locale, target population, sampling techniques and sample size, research instruments, pilot study, data collection procedures, data analysis, and logistical and ethical considerations.

3.2 Research Design

Descriptive survey design was used for this study because the study required original data from Physics teachers and principals as regards the Physics teachers’ perceptions, competence, and adequacy of ICT resources, administrative support and technical support given to them. The information gathered from Physics teachers and principals, was used to describe, analyze and interpret perceptions, competence, adequacy of ICT resources, administrative support and technical support hence descriptive survey design was appropriate.

According to Creswell,(2009) descriptive survey design provides quantitative description of the state of the parameters of study, in this case, it provided quantitative description of the state of ICT integration in classroom instruction by Physics teachers in Nairobi County as it is, by studying a sample of Physics teachers. This design was also affordable to the researcher since it enabled the
researcher to collect data within a short period of two weeks as per the researchers’ schedule. A schematic representation of the research design is shown in Figure 3.1.

![Diagram of research design]

**Figure 3.1 Steps of the process of the study**  
Source: Developed by Researcher, (2012)
3.3 Study Locale

The study took place in Nairobi County. The county neighbours Kiambu, Machakos and Kajiado Counties (Appendix VI). Nairobi County is a multi-ethnic region with an ethno-linguistic population. The county has two categories of secondary schools, that is, private and public. The study was carried out in public secondary schools to which the government supplied ICT resources through the ESP Programme to integrate ICT in classroom instruction.

The County harbors the capital city of Kenya. Most of the developments in a country begin in the capital city (Blomeryer and Martin, 1991), considering that ICT resources would be more familiar to the city than other areas, it was necessary to know the state of ICT integration in Nairobi County. In addition, this being the information age, and with the vision 2030 at hand, the researcher had an intention of finding out whether the Physics teachers in the capital city are integrating ICT in classroom instruction because such information was not available.

3.4 Target Population

The study focused on 40 public secondary schools in Nairobi County that were supplied with the ICT resources by the MOEST (Appendix V). The schools had the required information to meet objectives of the study since they already had ICT resources supplied by the MOEST, hence were aware of ICT integration in classroom instruction. Therefore, the researcher was able to find out whether they
were using ICT or not. In the schools, 40 principals and 121 public secondary school Physics teachers [Teacher Service Commission (TSC), 2012] formed the study population.

The study focused on Physics teachers because ‘Physics contributes to technology related infrastructure and provides trained workforce necessary for scientific progress and inventions’, hence it is vital in the fulfillment of Kenya’s Vision 2030. However, Physics has been recording low enrolment and performance, ICT is believed to simplify abstract content in Physics, create interest in the learners and improve performance and hence enrolment. It was therefore necessary for Physics teachers to give feedback on whether they were using ICT in classroom instruction or not with an aim of improving delivery of Physics content. The Principals, as the teachers’ supervisors, gave data that was used to triangulate data given by the teachers of Physics. An observation was also conducted for the same purpose of triangulation.

3.5 Sampling Techniques and Sample Size

3.5.1 Sampling Techniques

Simple random sampling was used to determine a sample of 18 schools from 40 public secondary schools. The names of all the schools that have ICT resources according to MOEST data were written each on a separate piece of paper and put in a container (tin). To avoid bias, the tin was shaken, and then the schools were
picked at random to come up with 18 schools according to the sampling matrix Table 3.1. Random sampling is free from systematic bias, it also enables the analyst to estimate the probability of any finding actually occurring solely by chance (Govard, 2001). According to Boudah (2011), random sampling is used when the purpose of the survey is to describe a population as accurately as possible and an individual in the population has an equal right of being selected.

The principals in the sampled schools were sampled purposively, where the principal was not present on the day of data collection, his/ her deputy offered the information.

Purposive sampling was used to identify the Physics teachers in each school, this was because the number of Physics teachers in the sampled schools was much lesser than expected from the TSC records, hence, in the majority of schools, there was only one Physics teacher, and hence the teacher was purposively sampled.

3.5.2 Sample Size
Since the target population was less than 10,000, the researcher got the desired sample size using the formula given by Fisher, Laing, Stoeckel and Tomsend, (1998):

\[ nf = \frac{n}{1 + (n/N)} \]
According to Fosgate, (2009) sample size calculations are often based on large sample approximation methods. If the sample size is relatively large compared with the total population, then a correction factor should be considered. A typical recommendation is to employ the correction factor when the sample includes 10% or more of the population. The formula for the correction used was

$$n' = n \times \frac{N}{n + N}$$

Using the corrected factor formula above, the researcher corrected the sample size of 36 schools of the population of 40, which was 90% of the population, to 18 schools, which was 45% of the population, which was appropriate considering high homogeneity of the study area and population. This was because Physics teachers targeted were all TSC employees teaching in Nairobi County public schools, their schools were supplied with ICT resources, therefore they had similar characteristics and hence the results can be generalized to the rest.

**Table 3.1 Sampling Matrix for Sample Size**

<table>
<thead>
<tr>
<th>Target Population</th>
<th>Sample Size</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schools</td>
<td>40</td>
<td>18</td>
</tr>
<tr>
<td>Principals</td>
<td>40</td>
<td>18</td>
</tr>
<tr>
<td>Physics Teachers</td>
<td>121</td>
<td>52</td>
</tr>
<tr>
<td>Total</td>
<td>201</td>
<td>88</td>
</tr>
</tbody>
</table>
3.6 Research Instruments

This study used questionnaires for Physics teachers to collect primary data from the teachers, interview schedules to collect primary data from the school principals and an observation schedule. The three instruments from different sources assisted in triangulation, which is perceived to be a strategy for improving the validity of research findings as supported by [Joint United Nations Programme on HIV/AIDS (UNAIDS (2010))]. Triangulation has proved to be an effective tool for reviewing and corroborating findings in surveys. It can balance the different perspectives, lead to a valid conclusion, and create opportunities to compare a wide range of data on a particular situation or phenomenon side-by-side, providing new insights. It can also compensate for poor quality or insufficient data.

3.6.1 Physics Teachers’ Questionnaire on ICT integration in classroom instruction

Questionnaire was appropriate for this study because it was cost effective, familiar, easy to administer since each item was followed by alternative answers giving uniform data and therefore objective and easy to analyze since they are in immediate usable form (Mugenda and Mugenda 1999). The questionnaire for Physics teachers had both open and closed-ended questions. The researcher used closed-ended questions to help reduce ambiguity by allowing greater precision in question asking (Greener, 2011). They also allow respondents to be asked similar questions several times and hence fortify the study’s validity and consistency; Are
easy to fill in and hence, not consume the teachers’ time. Besides the close-ended questions, the researcher used open-ended questions to solicit the teachers’ recommendations or general comments. This was because it is not possible to give all possible options in a questionnaire, and therefore, by using the open-ended question, it allowed the respondents to express themselves freely.

Section A of the Teacher Questionnaire contained items designed to solicit general background information. Section B had items on Physics teachers’ perceptions on ICT, in this section, the perceptions of the teachers on perceived usefulness and ease of use were determined. Section C had items on Physics teachers’ ICT competence, in this section, the teachers’ literacy, training on ICT use and extend of competence and hence confidence were examined. Section D dealt with ICT resources; the availability and adequacy of the resources supplied by MOEST were determined, and thereafter their frequency of use established. Section E dealt with ICT Support, in this section, availability of both administrative and technical support was established. Apart from a 4-point Likert scale ranging from “Strongly Disagree” to “Strongly Agree”, as suggested by Kriek and Stols (2010) used for perception questions, the questionnaire had questions requiring ‘YES’ or ‘NO’ responses, and those that required respondents to choose from the options given by ticking.
3.6.2 Principals’ Closed Fixed Response Interview Schedule on ICT integration in classroom instruction

Interview provides broad and deeper information about a subject phenomenon under study, this presents a high validity of data collected since the researcher and respondents are able to talk in detail and depth (Letts, 2003).

The principals’ interview was a closed fixed response interview because it is efficient and standard across all the respondents (Boudah, 2011). This assisted the researcher in triangulating the data provided by the Physics teachers. However, like the teachers, the Principals were also asked an open ended general question to give any view not captured by the researcher. The Principals were also able to give more details on responses given. Section A of the Principals’ Interview Schedule contained items designed to solicit their general background information. Section B had items on perceptions on ICT whereas section C had items on Physics teachers’ ICT competence. On the other hand, section D dealt with ICT resources while section E had items on ICT support.

3.6.3 Observation Schedule on ICT integration in classroom instruction

The observation schedule had a list of resources which the researcher confirmed their availability and adequacy, their use in a teaching session, and availability of technical support. The observation schedules therefore triangulated data from both
Physics teachers and the principals especially on objectives 3 and 4. It also helped confirm integration of ICT in classroom instruction.

3.7  Pilot Study

The pilot study helped confirm whether the questions in the instruments were well interpreted and understood by the teachers and principals and whether they elicited the required responses. From the pilot study, ambiguous items were changed. The pilot study involved two schools in Nairobi County that had already been supplied with ICT resources by the MOEST. The research instruments were administered to four Physics teachers and two Principals in the two schools. The identity of the schools is anonymous in this study since confidentiality of information given was assured to the teachers and the principals. The piloted schools were not included in the main study.

3.7.1  Validity

Borg and Gall (1989) explain that validity is the degree to which a test measures what it is supposed to measure. The validity of the instruments was established through assistance from ICT experts at KICD and MOEST, ICT teacher educators, as well as from the supervisors. Validity was also determined during the pilot study to ensure content validity when the instruments were tested.
3.7.2 Reliability

Mugenda and Mugenda (1999) define reliability as the measure of the degree to which a research instrument yields consistent results after repeated trial. In this study, the split half technique was used to establish reliability. The researcher administered the questionnaires once and split them into half during piloting. The correlation coefficient between the two halves was calculated using the Spearman Brown Prophesy formulae \( Re = \frac{2r}{1 + r} \). A correlation of 0.85 was obtained, according to Orodho (2009), a correlation coefficient of about 0.8 is high enough to suggest instruments are reliable for the study. Triangulation using data from teacher questionnaires, interview for principals and observation schedule were used to ensure reliability of the data collected.

3.8 Data Collection Procedures

According to Kombo and Tromp (2001), data collection is the process of gathering specific information aimed at proving or refuting certain phenomena. The researcher got an authorization letter from the School of Post-Graduate Studies, Kenyatta University which was taken to the National Commission for Science, Technology and Innovation (NACOSTI) to provide a permit to carry out the research.

The researcher informed the sampled schools about the intended visit through a letter to the Principal at least two weeks before the visit. Thereafter, the researcher
visited the selected schools to distribute the questionnaires to the participating teachers and interview the Principals. Careful instructions on how the questionnaires were to be filled by the concerned teachers were given to them. The principals were interviewed and lastly an observation schedule was conducted.

3.9 Data Analysis and Presentation of Results

Data analysis is the process of examining collected data with a view to making deductions and inferences. Raw data was organized, cleaned, coded and entered into the Statistical Package for Social Sciences (SPSS) programme version 21.0 for analysis. Quantitative data from the questionnaires, closed response interview schedule and the observation schedule were analyzed using descriptive statistics such as frequencies and percentages generated by SPSS version 21. Qualitative data from the open questions on both the questionnaire and the closed response interview schedule, and some from the observation schedule, was analyzed qualitatively using themes.

The quantitative data was presented in form of frequency tables, pie charts, bar graphs and photographs. The data obtained from the two open questions on both the questionnaires and interview schedules was presented through narrations. The interpreted data was discussed and inferences made.
3.10 Logistical and Ethical Considerations

The respondents were informed about the whole procedure of the study after which they gave their informed consent to participate in the study. They were assured of confidentiality of the information they gave. They were not required to write their names on the questionnaires nor the name of their schools to avoid the fear of being implicated or their schools being implicated because of the research results (Mugenda and Mugenda, 1999). The researcher used code numbers to identify the different schools (Appendix V), especially during the report write-up. The respondents were notified of their importance in taking part in the research and how the findings of the research could improve or contribute to their professional well-being.
CHAPTER FOUR

PRESENTATION OF FINDINGS, INTERPRETATION AND DISCUSSION

4.1 Introduction

The purpose of the study was to assess integration of information and communication technology in classroom instruction by Physics teachers in Nairobi County, Kenya. This chapter comprises presentation of results, analysis and discussions of the findings arising from the responses from Physics teachers and the principals; and from an observation schedule. The study was guided by four objectives: i) To determine Physics teachers’ perceptions as regards ICT integration in classroom instruction. ii) To examine the Physics teachers’ ICT competence to integrate ICT in classroom instruction iii) To assess availability and adequacy of ICT resources for classroom instruction and lastly, iv) To establish ICT support available to Physics teachers for effective ICT integration in their classroom instruction.

4.2 General and Demographic Information

The schools were randomly selected since the focus was on the Physics teachers in the schools and not the schools. As a result, 50% of the schools sampled were boys’ schools, 33% mixed schools while 17% were girls’ schools as shown in Figure 4.1.
Figure 4.1 Types of Schools

The schools had common characteristics such that they all had benefited from the ESP programme. The majority of Physics teachers (83%) that participated in this study were male while 17% were female as shown in Figure 4.2. The majority of the Principals (60%) were male while 40% were female.

Figure 4.2 The Genders of Physics teachers
The teachers’ ages ranged between 21 and 50 years, with the majority (44%) falling between 31 and 40 years, 28% others between 21 and 30 years. Another 28% of the teachers were between 41 and 50 years. Figure 4.3 illustrates the teachers’ ages.

![Figure 4.3 Age Bracket of Physics teachers](image)

None of the teachers was above 50 years of age. This shows that the sample comprised of the teachers in the productive age, who are likely to be in the field for a while, and hence the teachers were the best respondents for the study.

Majority of the schools sampled, had only one teacher teaching Physics. In the schools that had more than one Physics teacher (which were rare), only one concentrated in teaching Physics. The Principals explained that Physics was an
optional subject at form 3; few students enrolled for Physics such that, even if a school was two streamed or more, the Physics class became one at form 3. According to TSC regulations, the maximum number of lessons per teacher should be 28, total Physics lessons in a one-streamed school are 18 while in and in a two-streamed school, are 26. If the school is not two streamed, the Physics teacher has fewer lessons; hence, he/she is required to teach his/her other subject, which were either chemistry or Mathematics, both of which were compulsory subjects in all the sampled schools, hence requiring more teachers.

The return rate of the questionnaires was 64%, which was sufficient, however the researcher experienced problems in observation whereby some teachers were unwilling to be observed in class while some did not allow the researcher to take photos for their ICT resources siting that it would be a security threat.

4.3 Teachers’ Perceptions on ICT Integration in Classroom Instruction

The first objective was to determine the perceptions of Physics teachers as regards ICT integration in classroom instruction. The perceptions of Physics teachers were measured using a Likert scale, ranging from strongly agree to strongly disagree on various perception statements on usefulness and ease of use of ICT as shown in Figure 4.4.
On usefulness of ICT, majority of the Physics teachers strongly agreed and agreed that ICT improves lesson preparation and teaching of Physics whereas only 11% of those teachers disagreed. All Physics teachers either agreed (65%) or strongly agreed (35%) that use of ICT in their classroom teaching motivates their learners. Equally, all Physics teachers either strongly agreed (72%) or agreed (28%) that ICT makes Physics as a subject interesting and thus helps the learners to understand abstract concepts. On the same note, Physics teachers either agreed (56%) or strongly agreed (39%) (With only 6% disagreeing) that ICT encourages
collaboration among learners and teachers - collaboration among learners enhances learners’ interactions.

It is noteworthy that Physics teachers in Nairobi County had strong positive perceptions on the usefulness of ICT in classroom instruction. A strong positive perception on the usefulness of ICT is a good foundation for teachers to accept and integrate ICT in classroom instruction. Figure 4.5 shows responses of the Principals’ perceptions in regard to the teachers’ use of ICT in classroom instruction.

![Chart showing Principals' perceptions on the use of ICT in classroom instruction]

**Figure 4.5 Principals’ Perceptions on the Use of ICT in classroom instruction**

All the interviewed principals were positive that ICT use in classroom teaching was important and that it improved students’ achievement. Eighty percent (80%) of the principals believed that ICT stimulates interest in learners. Therefore,
majority of the principals, just like the Physics teachers, confirmed that they had strong positive perceptions on usefulness of ICT in classroom instruction. This is a good indication because perceived usefulness has a strong influence on the use of ICT. If the principals have strong perceptions on ICT, then it is easier for them to support ICT use in instruction.

The findings were in tandem with those of a number of studies, for example, Dang (2011) reports in his research in Vietnam on university academicians that 91% believed that ICT enhances lesson preparation while 98% believed that ICT improves teaching performance. Oyedeko and Tella (2010) also found out that ICT greatly influences learner participation and teaching performance. The findings of a research by Tella et, al. (2007) in Nigerian secondary schools indicated that the teachers who use ICT felt that their use of ICT benefited the learners by stimulating their interest in learning, enhancing retention and hence triggering learner response in giving feedback.

In Kenya, studies by Kirimi (2012) in Kangema and Mwingirwa (2012) in Tigania East and Wabuyele, (2006) found that over 90% of the teachers believed that increased use of ICT improved students’ achievement, made the lessons more interesting, led to a deeper understanding of the content and also increased interaction among the learners. Collaboration among the teachers affords them an opportunity to share different classroom strategies and resources. Collaboration
also helps to focus, affirm and propagate for better practice, which can result from discussions during collaboration. According to Wabuye (2006), teachers and principals perceptions are significant for ICT integration in classroom instruction to take place effectively.

The key reason for use of ICT in classroom instruction of Physics has been to create interest in learners as well as simplify abstract concepts hence improving performance and consequently enrolment. Research has shown that learners shy away from Physics because they find it uninteresting due to its abstract nature. So for teachers to believe that ICT would make Physics interesting is a good motivator for them to use it in classroom instruction. Their use of ICT in teaching creates interest in the learners and this eventually results in good performance. Good performance by the learners will translate into high enrolment hence more manpower on the job market and therefore facilitate the fulfilment of Vision 2030 in Kenya.

According to Kumar, et al., (2008), Gulbahar, and Guven (2008), there is a strong positive correlation between teachers’ perceptions on ICT usefulness, and their actual use of ICT in the classroom. However, this correlation between teachers’ perceptions and use of ICT was lacking in the case of Nairobi County teachers of Physics. This is because although Physics teachers had positive perceived usefulness of ICT, they were not using it as expected in their classroom
instruction. This could be because the teachers felt the training they had received was not adequate. Hence, they did not obtain required skills that would enable them use ICT in classroom instruction comfortably as much as they believed that use of ICT was important. Another reason for the low use could have been lack of adequate resources in the schools.

On the other hand, the teachers responded to a statement on their perception on ease of use of ICT as shown in Figure 4.4. Majority (72%) of Physics teachers had a positive perception on ICT being easy to use in classroom teaching while 28% disagreed. It is interesting to note that although Physics teachers felt ICT was easy to use in their classroom instruction, they had challenges in using it in their instruction. Again this could be linked to the fact that they felt the training they had received had not been adequate to enable them use ICT comfortably. Eighty one per cent (81%) of the principals also reported that the teachers were comfortable using ICT and were finding it easy to use as shown in Figure 4.5.

The teachers were still not using ICT in classroom instruction despite the fact that they perceived ICT as being important as well as being easy to use. Unlike the findings of Nairobi County, Kumar, et al.’s (2008) findings show that teachers’ perceived ease of use has more influence on their use of ICT than usefulness of ICT was. These disconnect between ease of use of ICT and actual use could also be attributed to inadequate resources in the schools. This is because, even if a teacher
found ICT important and easy to use yet did not have the resources, it would be impossible to use ICT in classroom instruction.

4.4 Teachers’ Competence in ICT Integration in Classroom Instruction

The second objective of this study sought to examine the Physics teachers’ ICT competence to integrate ICT in classroom instruction. Computer literacy is a prerequisite to ICT competence. In relation to whether they were computer literate or not, majority of the Physics teachers were computer literate only 6% were not computer literate as shown in Figure 4.6.

![Figure 4.6 Computer Literacy for Physics Teachers](chart)

On the other hand, 86% of the principals confirmed that the teachers were computer literate while 14% of them indicated that their Physics teachers were not computer literate. The percentage of Physics teachers who were computer literate in this study was higher compared to that in a study by Mwingirwa (2012) in
Tigania East, whereby only 67% of the mathematics teachers had some form of training to use ICT while 33% had no training related to ICT. This could be because Tigania is in the rural setting while Nairobi harbours the capital city and hence the implementation of policies could be faster and the teachers in Nairobi County are most likely able to access more computer colleges than those in Tigania. This could also be due to elapsed time since the Tigania study was done one year earlier than the Nairobi study, this may imply that with time, there is improvement in the number of computer literacy amongst teachers.

The big number of computer literate teachers in the schools was a good starting point since computer literacy is a prerequisite to ICT competence, which eventually leads to ICT integration for classroom instruction. This is because it is not possible to integrate ICT in classroom instruction without being computer literate. Arunga (2011), Acker et al. (2011) and Smaldino et al. (2005) affirm that computer literacy is obligatory to enable any teacher to accomplish ICT integration in any given subject. Inadequate computer literacy may lead to most of the time being spent in ‘learning the technology rather than using the technology’.

Further, Physics teachers indicated their computer literacy level certifications as shown in Figure 4.7.
Majority of Physics teachers (56%) had just a certificate, 33% had no certification but indicated that they were computer literate through ‘learning by using’ or ‘hands on’, 11% had a diploma and none had a degree in ICT. The findings of this study regarding literacy certification were in agreement with other studies whereby majority of the teachers just have a certificate. For example, in a study by Kirimi (2012), 85% of the teachers had a certificate in computer literacy, in Mwingirwa’s (2012) study 52% had a certificate in computer literacy while in Migwi’s (2009) study, 57% had a certificate in computer literacy, while 38% had no form of certification. Certificate level of certification is much basic meaning that as much as majority of the Physics teachers were computer literate, their literacy levels were very basic, and hence more training was required to increase their competence levels.
Apart from the computer literacy and certification, Physics teachers responded to whether they had undergone any specific formal training on how to use ICT in classroom instruction or not. As much as computer literacy is a prerequisite to ICT integration, it is not adequate since a teacher requires more training to integrate ICT effectively in classroom instruction. The majority (72%) of the teachers had some form of formal training while 28% had received no form of formal training. Sixty nine percent (69%) of the principals pointed out that Physics teachers in their schools had received some form of formal training on how to use ICT in classroom instruction, while 31% of the same teachers did not have any formal training.

The findings in this study on formal training on how to use ICT were in contrast to Migwi’s (2009) study, whereby only 9% of the teachers had received specific formal training on how to use ICT in instruction, while the rest 91% had not received any training at all. In comparison to Migwi’s findings, there is improvement in terms of the number of teachers with specific formal training in ICT in Nairobi County. This is attributed to the elapsed time between the time the study by Migwi and the current study. On the other hand, this improvement can also be attributed to the locality of the study considering that Nairobi harbours the capital city of Kenya where ICT resources and colleges would be more easily accessed.
To confirm the Physics teachers’ training, both the teachers and the principals listed the institutions that trained the teachers as shown in Figure 4.8.

Figure 4.8 Trainers of Physics teachers on how to use ICT

Kenya Institute of Curriculum Development (KICD) ICT Champion programme trained the highest number of the Physics teachers (55%). Strengthening of Mathematics and Science in Secondary Education (SMASSE) seminars/workshops trained 27% while the District Quality Assurance Officers (DQASO) trained 6%. The remaining 12% had not received any form of training from any specific institution. Majority of the principals (41%) confirmed that the teachers had received training from KICD ICT Champion programme, 25% from DQASO, 17% from SMASSE, while 17% by their own initiative.
The training for Physics teachers was not uniform since different teachers received training from different institutions and hence the standard and quality of each of the trainings could not be established.

As regards the adequacy of the different trainings the teachers’ and the principals’ responses were as shown in Figure 4.9.

![Graph showing responses of teachers and principals regarding training adequacy.]

**Figure 4.9 Adequacy of the Training of Physics teachers on how to use ICT**

Half of the Physics teachers (50%) felt the training was not adequate while 28% of them agreed that the training was adequate. The rest of Physics teachers (22%) had not been trained and so they would not judge the quality of the training. The number of teachers who felt that the training was not adequate (50%) and those who could not comment due to lack of training (22%) was relatively high (72%). Forty eight percent (48%) of the principals indicated that the Physics teachers’
training was not adequate. Another 26% of the principals reported that the teachers had not been trained at all.

Classroom observation showed that very few teachers were confident with the use of ICT in classroom instruction, and were using ICT on a very limited basis. The teachers who attempted to use ICT felt that it was their hard work, and not the training that made them use ICT in classroom instruction. However, they used the simpler application software like Microsoft Word, Powerpoint and use of a projector and avoided the a little more difficult software (like mind mapping, video editing, e-lecture making, photo editing, Hot Potatoes, screen casting, and voice threads etc.) due to lack of competence.

In support of inadequate training of teachers, Arunga (2011) contends that few teachers in East Africa have the knowledge to teach their subject content using ICT because they have not been adequately trained to do so. Mungai (2012) asserts that there exists inadequate preparation opportunities for teachers on ICT integration globally.

In Table 4.1, Physics teachers indicated the reasons why they felt the training was not adequate.
Forty four percent (44%) of the teachers cited lack of refresher courses while 38% cited the time for training being short. Further, Physics teachers responded to whether they had ever attended any ICT related refresher course or not, only 33% of the teachers indicated having ever attended a refresher course. The rest of the teachers (77%) had never attended any refresher course, hence confirming the finding that lack of refresher courses was a major reason for the feeling that the training was inadequate. Even those who felt competent suggested continuous refresher courses to be conducted so as to upgrade teachers’ skills. The teachers in Sim and Theng’s (2008) study also suggested that school-based professional development and ICT seminars/conferences are important avenues for improving teachers’ ICT skills.

Glazer and Hannafin (2006) and Muijs and Lindsay (2008) argue that one-off trainings are ineffective because they leave the teacher having not mastered the skill well, and therefore lacks confidence to use ICT on his/her own in the
classroom. Tinio (2002) adds that even the most comfortable teachers in ICT, need to upgrade their skills continuously and be well informed of new developments and best practices.

Attendance of refresher courses is very important because technology keeps evolving and Physics teachers cannot rely on old knowledge and skills, when for example a new software or hardware comes to the market. Swarts (2008) also supports this assertion by saying that ICT Teacher Professional Development (TPD) should be on-going and should be as flexible as possible because it imparts the teacher with the necessary skills and confidence to enable him/her to use ICT.

The teachers also specified their level of competence in using various ICT applications after the training as shown in Figure 4.10.
Apart from internet use in which only 44% of teachers were highly competent, most teachers were just fairly competent in various competencies/skills like use of Microsoft office, email, other digital softwares, digital content, solving minor ICT problems and use of ICT in classroom instruction of Physics. There were also some teachers not competent at all in the skills as shown in Figure 4.10. This means that as much as majority of the teachers (94%) had indicated that they were computer literate and 72% had received some formal training on how to use ICT in classroom instruction, the teachers’ competence levels in the various skills they were required to have was still low, confirming their feeling that the training was not adequate.

Figure 4.10 Physics Teachers’ Extent of ICT Competence

Apart from internet use in which only 44% of teachers were highly competent, most teachers were just fairly competent in various competencies/skills like use of Microsoft office, email, other digital softwares, digital content, solving minor ICT problems and use of ICT in classroom instruction of Physics. There were also some teachers not competent at all in the skills as shown in Figure 4.10. This means that as much as majority of the teachers (94%) had indicated that they were computer literate and 72% had received some formal training on how to use ICT in classroom instruction, the teachers’ competence levels in the various skills they were required to have was still low, confirming their feeling that the training was not adequate.
On the Confidence to use ICT in classroom instruction, the responses by Physics teachers were as shown in Figure 4.11.

![Pie chart showing confidence levels of Physics teachers](image)

**Figure 4.11 Extent of Physics Teachers’ Confidence in Use of ICT**

Majority (83%) of the teachers were just fairly confident, 11% were not confident at all to use ICT in classroom instruction and only 6% of Physics teachers were highly confident with the use of ICT in their classroom instruction. It can be noted from Figure 4.11 that as much as the teachers had been trained, they still felt that the training was insufficient and this led to their low level of competence and hence confidence in the use of ICT in their classroom teaching. Fifty percent (50%) cited that the training was not adequate whereas 22% of them had not been trained at all. Therefore, this calls for more training and refresher courses.
A study in Cyprus by Chrysostomou and Mousoulides (2009) and that by the Ministry of Education and Training [M.E.T] (2005) in Western Australia established that the teachers’ level of ICT competence and their attendance of training on how to integrate ICT were the most influential factors on the teachers’ integration of ICT in the classroom. The teachers’ attitudes will be positive towards the use of ICT if they feel confident with the training that they have attained and hence they will have confidence in delivering the subject content through use of ICT in the classroom.

Further, Physics teachers were asked to respond to how frequently they used some common ICT applications like Microsoft Word for either typing their records or notes, Microsoft excel for calculating students’ marks, PowerPoint for class presentations, emails for collaborating with other teachers from other schools and internet for searching for relevant digital teaching content. It emerged from their responses that majority of them rarely used the applications and those that used them, used them only when it was necessary as shown in Figure 4.12.
Figure 4.12 Frequency of use of some ICT applications by the Physics teachers

Majority of the Physics teachers used different ICT applications either rarely or when necessary, this could be due to lack of competence on the part of the teachers. This finding that teachers rarely used the ICT applications is supported by a study that was conducted in Vietnam by Dang (2011) which showed that teachers who use ICT in instruction only concentrated on the software programs they perceived to be easy and shy away from those they perceived to be difficult.

The frequency of those Physics teachers using ICT to teach Physics is as shown in Figure 4.13.
Figure 4.13 Frequency of using ICT in classroom instruction by Physics teachers

Figure 4.13 shows that majority of the teachers (50%) rarely used ICT in classroom instruction, 22% used ICT often, 17% when necessary, 11% never used at all, while none of the teachers ‘always’ use ICT in classroom instruction. Therefore, as much as a large number of Physics teachers (94%) in Nairobi County are computer literate, and 72% have had at least some form of formal training in the use ICT for classroom instruction, the findings show that integration of ICT in classroom teaching is still very low.

This could be due to lack of confidence and competence that result from inadequate training and lack of refresher courses as was indicated by the teachers. On the other hand, there was also lack of adequate resources for example most
schools had just one laptop, one projector and around 11 desktop computers against an average of 220 learners for a one streamed school and 440 learners for a double streamed school. For an average class of 55 learners, it means each computer will have 5 learners per session. This makes the ratio of a computer to learners so high hence making the teachers avoid using ICT. This finding is in line with a study by Mwingirwa (2012) in Tigania, whereby the teachers who had no form of ICT training shied off from using ICT at all. However, in both Mwingirwa’s study and the current study, the teachers had a desire to be more trained on ICT use for classroom instruction.

There should be emphasis on training of teachers in Nairobi County on ICT integration and be encouraged to attend continuous teacher development courses as well as comprehensive in-service seminars for refresher courses to enable them fully implement ICT in classroom instruction. The Koech Report of 1999 on Total Quality Education Training (TQET) supports this thinking. The Report further explains that teacher education needs to be revised especially on emerging issues such as information and technology. On the other hand, Awan’s (2011) study demonstrated that the training needs of teachers in ICT cannot be over-looked when developing initiatives aimed at changing teaching and learning practices in schools and classrooms. Therefore, training programmes should be able to assist teachers on how to achieve specific educational objectives through ICT in teaching of Physics in Nairobi County.
4.5 Adequacy of ICT Resources for ICT Integration in Classroom Instruction

The third objective of this study was to assess the availability and adequacy of ICT resources for Physics teachers for effective classroom instruction. Responses by Physics teachers as regards availability and adequacy of resources for ICT classroom integration are as shown in Figure 4.14.

![Figure 4.14 Availability and adequacy of ICT resources for ICT integration](image)

**Figure 4.14 Availability and adequacy of ICT resources for ICT integration**

From Figure 4.14, it is notable that ICT resources were available but were not enough in ratio to the number of teachers and students in the schools. Regarding desktop computers, 67% of Physics teachers indicated that they were available but not enough, 11% were available but in bad condition, 11% others indicated that they did not have any desktop computers. Only 11% of Physics teachers indicated
that they had enough desktops for their use. When resources are inadequate, the likelihood of teachers using ICT in instruction is minimal. On average, most schools had 10 desktop computers, in an average class of 55 learners, it means 5 learners per computer which is a crowd hence, there may not be effective learning. The space per desktop computer was also small such that it could not accommodate 5 chairs for the 5 learners at ago, hence making it difficult for teachers to use the desktop computers. This scenario means that for a one streamed school 220 learners and 440 learners for a double-streamed school will be scrambling for the same resources at a ratio of 1:22 and 1:44 respectively as a result the rate of wear and tear becomes high.

Observation confirmed that scenario as shown in photograph 4.1.

Photograph 4.1 A Photograph showing a computer lab

Since the computer labs could not handle large groups of learners, due to limited number of computers, only the students who were taking Computer Studies as an
optional subject were allowed into the computer labs to do their projects. These results are in tandem with those of a study by Kirimi (2012) in Kangema who found that 88% of schools had computers but they were inadequate for efficient teaching by the teachers and in Migwi’s (2009) study, there was also a limited number of computers for teachers and students in the schools. The desktop computers would be instrumental in simulations, which are activity based, where the learners do activities and see the results but if the learners cannot access the desktops, then it is difficult to use such simulations, which are key in student-centered approach, simplifying abstract content and at the same time creating interest in the learners of Physics.

On the other hand, on observation, some computer labs in some schools had been vandalized as shown in Photograph 4.2.

Photograph 4.2 A photograph showing a vandalized computer lab
All the other ICT resources (desktop computers, internet connection, projectors, laptops and digital content) had been stolen. In such schools (11%), there was totally no use of ICT. Vandalism had adversely affected the concerned schools since they would be required to start the programme afresh meaning extra cost. This is because they would be required to replace the resources. With such a trend, it becomes unlikely for the teachers to use ICT in instruction because the number of desktops is not enough for the big class sizes in public secondary schools as a result of free day secondary education.

The desktop computers may be irrelevant without digital content, as indicated in Figure 4.14, majority (67%) of Physics teachers did not have enough digital content, 17% others did not have digital content at all, and another 6% of the teachers indicated that they had enough of the digital content. This shows that even if the schools had enough desktop computers, they would still face the challenge of digital content. The digital content can be obtained from KICD, private suppliers or by downloading from the internet, which will require a teacher to be competent to know how to get the right content as well as have extra time to search for the content on the internet. However, 50% of the teachers indicated that they did not have enough internet access (bundles), 22% indicated that they had good access to internet, 17% did not have internet access at all while 6% had access though in bad condition, meaning unusable. This makes it more difficult for the teachers to
source for the digital content on the internet as well as collaborate with other teachers through emails.

As indicated on Figure 4.14, 72% of the teachers indicated that they did not have enough overhead projectors, 17% of them indicated that they did not have any projector at all. However, 6% of Physics teachers indicated that they had enough of the overhead projectors. On the other hand, 50% indicated that they did not have enough laptops, 22% did not have laptops at all, 11% had enough laptops while 6% had laptops but in bad condition. When a school has just one projector and one laptop as was the case of many schools (67%), or has but broken down as reported by 11% or worse vandalized as reported by another 11% , then it means no teacher can use ICT consistently. This is because all the teachers in the school have equal rights to that limited resource. In the case of Physics where the teacher requires to use animations, videos and simulations frequently to explain the abstract content, to make it simpler as well as create interest in the learners, it becomes impossible.

This is because the Physics teacher will be required to book the laptop and/or projector because another teacher of another subject may also require it at the same time, this inconsistency of accessing the resources when required, may discourage the teacher from using ICT often. This trend of inadequate resources was prevalent despite the fact that the sampled schools were among the schools that
were supplied with resources by MOEST under the ESP programme. This shows that the resources supplied by MOEST were not adequate.

Figure 4.15 shows the responses of the principals on the adequacy of ICT resources.

![Figure 4.15 Principals' responses on adequacy of ICT resources](image)

Sixty nine percent (69%) of the principals interviewed indicated that their schools were well equipped with ICT resources. This was despite the fact that on observation, the resources were few compared to number of the learners at an average computer to student ratio of 1:5, per class, 1:22 in a one-streamed school and 1:44 in a double-streamed school. However, 31% of the principals agreed that the resources were not enough for classroom instruction. The schools were
beneficiaries of the ESP programme, yet it was so evident that the resources were not adequate for effective integration for just one subject (Physics) meaning the other subjects were equally affected. It shows that the programme was not yet successful and hence more needs to be done for effective integration of ICT in classroom instruction.

The 11% of the teachers, who indicated that they had enough resources, were from schools whereby the principals indicated having received some resources from other sources like support from BOM, NGOs and other well-wishers. However, it still seemed not sufficient since out of 56% principals that had received resources from elsewhere, only 11% of their teachers were satisfied with the available resources and still the average computer to student ratio was 1:4 per class session, 1:15 in a single streamed school and 1:29 in a double-streamed school. This was so because the highest number of computers in the computer lab was 15 computers, some of the computers were being used for other purposes in the offices.

This is a clear indication that there still exists a deficiency in ICT resources and that there was disparity in terms of management of ICT resources because all the schools were funded equally, yet disparity was noted in terms of the resources available. However, this finding was an improvement of a study by Kiptalam and Rodrigues(2010) who observed that access to ICT facilities was a major challenge facing most African countries, with a computer to student ratio of 1:150 per
school. This was against a ration of 1:15 per school in the developed countries, which has improved with time to 1:5 per school. An ideal computer to student ratio would be 1:1, but due to the advantage of collaboration, 1:2 would be best.

According to the World Bank (2011), despite efforts by corporate organizations, governments, NGOs and individuals to offer computers to as many schools as possible, they were still not adequate. This is despite the fact that teachers must have adequate access to functioning computers (and other ICT facilities) and sufficient technical support to be able to implement ICT integration in classroom instruction. Farrell (2007) argues that despite the ICT policy in Kenya, few schools have satisfactory ICT resources.

All interviewed principals pointed out that there was a plan in their schools to add more resources in the future though the timeline was not very clear because it was an expensive venture. However, it is worth the cost due to the advantages that come with ICT. Apart from improving learners’ interest in Physics and making abstract content easy to understand, ICT in form of video clips and animations is a good reinforcement as well as a substitute for laboratory apparatus that some schools may not be able to afford, hence enabling learners to see how they operate. It can also help the teacher bring in the classroom a ‘field trip’ in a far off country which is relevant to the study content yet would be impossible to go due to the cost that would be incurred.
The teachers responded on the frequency of use of the available ICT resources in classroom instruction of Physics. The findings on this item are as shown in Figure 4.16.

![Figure 4.16 Frequency of use of ICT resources by Physics teachers](image)

**Figure 4.16 Frequency of use of ICT resources by Physics teachers**

Most of the resources were rarely used in classroom instruction of Physics. For example, 61% of the teachers rarely used desktop computers, 16% never used them at all and only 6% of the teachers used the desktop computers often. Overhead projectors were rarely used by 56% of the teachers. Only 17% of the teachers used the overhead projectors often while another 11% of them never used the projectors at all. Laptops were rarely used by 44% while 22% of Physics
teachers often used them. On the other hand, 11% of the teachers never used laptops at all.

Digital content by KIE was never used by 56% of the teachers of Physics. Other digital softwares were never used by 56% of the teachers of Physics. Fifty (50%) percent of the teachers rarely used the Internet whereas 17% of the teachers often used internet to get relevant content for classroom instruction for example video clips and animations. However, 11% of Physics teachers never used internet to get material for classroom teaching. Majority of the teachers never or rarely used radios, TVs and cameras. Generally, from the findings, Physics teachers rarely used ICT resources in classroom instruction.

The findings on frequency of use of ICT in classroom instruction are in agreement with the findings of Migwi (2009), in whose study the use of computers for classroom instruction was as low as 9%. Kirimi (2012) found that only 35% of the teachers were able to access the ICT resources on a daily basis. Majority of the teachers alleged that inadequate number of computers hindered them from using ICT in classroom teaching. In Mwingirwa’s (2012) study, 67% of the schools had computers, but 26% used them for general purposes and not for classroom instruction. Wambeti (2009) found that 25% of the teachers did not use computers at all, 36% did not use Internet and 37% did not use softwares at all.
Most of the teachers used ICT once in a while when they got relevant content from the internet, especially on You Tube. The few teachers (17%) who indicated that they always used the projector, had ICT supported lessons by use of video clips, simulations and animations to explain abstract content, since the desktop computers were few the teachers were using personal laptops and the school projector to project animations and videos on the walls for the learners. It was evident the learners were enthusiastic and liked it when the teacher used ICT than the traditional chalk and board. However, this was only possible because the teachers were using personal laptops and acquired digital content from the internet and from collaborating with other teachers. Despite having own arrangement for laptop and digital content, the teachers faced challenges when other teachers required to use the one projector in the school.

The low use of ICT by the teachers can be explained by the fact that the resources are inadequate as reported by the teachers as well as observed. Kumar, et al., (2008) and Hennessy, et al., (2010) in their respective studies concluded that teachers falter to use ICT if resources are inadequate to meet the learners’ needs or if they are dysfunctional. However, the findings in this study are in contrast with those of studies by Teo, Lee and Chai (2007) and Kiptalam and Rodrigues (2010) who found out that resources were not very important in influencing the teachers’ attitudes towards accepting and using ICT. In this study, resources were a great influence because majority of the teachers reported that the resources were limited
and when it came to use, about the same percentage of teachers reported they rarely used those resources. On the other hand, the percentage of teachers who reported that ICT resources were enough, correlated with the percentage of teachers who reported that they used the resources often or always.

Physics teachers responded on how time was affecting their use of ICT in classroom instruction. The results on this item are as shown in Figure 4.17.

Figure 4.17 Effect of time on ICT use by Physics teachers

The percentage of teachers who alleged that there was no time to use ICT was 66%. On the other hand, 44% of the teachers alleged that there was time to integrate ICT in classroom teaching. This shows that more than half of the teachers felt there were many other activities (co-curricular activities like sports, drama, clubs, committees) requiring their time in the school, leaving no time for ICT use.
This is in tandem with the teachers in the Philippines, who felt that adding technology to their current responsibilities would be an added demand on their time and energy (Blomeryer and Martin, 1991).

Over half of the teachers (55%) felt the school timetable was not favorable to ICT use. However, only 38% of the principals felt the timetable was not favourable to ICT use. All the same, 60% of the teachers were optimistic that there was enough time for them to train in ICT use. On the contrary, only 43% of the principals felt that teachers had time to train in ICT use. The principals argued that teachers could attend training during the school holidays. Concerning time for preparing ICT supported lessons, majority of the teachers (56%) indicated that they had time to prepare for ICT supported lessons. However, a good number of Physics teachers (44%) indicated that they did not have adequate time to prepare ICT supported lessons.

Fifty seven percent (57%) of the principals agreed there was adequate time for preparation of ICT supported lessons. They argued that it is a teacher’s responsibility to create time for their own lesson preparation. However, another 43% of the principals argued that some teachers had many lessons and that some of Physics teachers were not yet even trained on how to use ICT. This scenario made it hard for the said teachers to prepare ICT supported lessons. A teacher needs time to prepare a lesson, and time to deliver the lesson as well as
evaluate it. School programs and curriculum content are organized in a timetable and therefore the teacher must be able to work in the stipulated time frames to achieve his/her lesson objectives.

Dang’s (2011) and Sim and Theng’s (2008) studies identified lack of time for planning and using ICT in the classroom as a hindrance. The teachers complained that the class time was too limited to use ICT and that ICT use takes a lot of time to prepare. On average, an hour ICT-enhanced lesson requires around three to four hours to prepare. Mastering ICT requires time and teachers’ preparation involves both the training and trying out with ICT before using it in the classroom.

Studies by Kirimi (2012) and Mwingirwa (2012) indicate that a number of teachers complained of having many lessons per day, and hence could not get time to plan and prepare for ICT integrated lesson, considering that they also had co-curricular activities to take care of. Makau (1989) asserts teachers put all their energy on the strategies that can help them complete the syllabus, and avoid any technology that may disrupt syllabus completion in any way. Even though most Physics teachers (66%) felt there was no time for ICT, time can be created because (60%) of them admitted that there was time for training meaning they were willing to spare time for training, so that they can eventually be able to use ICT in classroom instruction.
4.6 Support for ICT Integration in Classroom Instruction

The fourth objective of this study was to establish ICT support available to Physics teachers for effective ICT integration in classroom instruction. The ICT support includes both the administrative and technical support. The teachers responded to whether there was an onsite ICT technician, readily available in the school to assist them with technical problems or not. Sixty seven percent (67%) of the teachers did not have ICT technicians. Only 33% of the teachers had ICT technicians as shown in the Figure 4.18.

![Figure 4.18 Availability of ICT Technician](image)

**Figure 4.18 Availability of ICT Technician**

On the contrary, 93% of the principals indicated that they had put in place technical support to assist Physics teachers whenever they encountered technical issues and/or hitches in class, and for repairs and maintenance of the ICT
resources. The principals also responded to the questions as to how else they supported the teachers. Sixty nine percent (69%) of them indicated that they provided ICT resources; 13% reported that they allowed teachers time to train in ICT use, 6% reported that they ensured Internet was available for use; and another 6% ensured that ICT resources were well serviced.

The teachers responded on specific issues on ICT technical support as shown in Figure 4.19.

**Figure 4.19 Technical and administrative ICT Support**
Of the teachers sampled, about half of them (50%) disagreed that specialized guidance was available to them and that they had support to solve technical problems. Sixty-six percent (66%) also felt that they did not have technical support in regard to repair and maintenance of ICT equipment. Further, during observing the schools, limited schools had an ICT technician to assist the teachers of Physics. In most cases, it was an ICT Champion teacher (trained by KICD) who was entrusted to assist the rest of the teachers and to be in charge of the computer lab. This was ineffective because ICT Champions were representing regions and therefore not every school had an ICT Champion. The ICT Champions were teachers with lessons to attend to so the practicability of them visiting other schools to assist teachers was so minimal. They therefore benefited the teachers in their own schools more, and that would also be on a limited scale due to their normal responsibility as teachers.

These findings are in agreement with a number of studies. For example, a study by Tella, *et al.* (2007), Keong, Horani and Daniel (2005), Sim and Theng (2008) found that lack of technical support was a factor hindering teachers’ willingness and confidence in using ICT in classroom instruction. According to Cuban (2001), lack of technical support is likely to make teachers avoid using ICT, for fear of technical faults that may not be rectified, and hence lead to unsuccessful lessons.
Likewise, the teachers responded to specific issues on administrative support as shown in Figure 4.19. Half of Physics teachers (50%) agreed and half others (50%) disagreed that they were allowed to attend ICT integration courses. On the hand, 79% of the principals indicated that they allowed the teachers to go for training whenever they requested to and during the school holidays. Wanjala et al. (2011) emphasizes that the administrators should encourage the teachers to develop skills in technology. They should also ensure that the teachers are putting into practice what they have learnt.

Majority of the teachers (89%) pointed out that they were not encouraged to use ICT nor given incentives by the school administration. The principals (80%) concurred that they do not offer incentives, arguing that the schools had no funds while others indicated that the teachers had never asked for incentives to use ICT. According to Hennessy, et al., (2010) and (Kumar, et al., 2008), lack of incentives and administrative support may discourage teachers from using ICT in classroom instruction.

The teachers (88%) indicated that the school administration did not allocate money for ICT integration. This was contrary to the principals’ responses, whereby 67% of them indicated that they allocated money for ICT. Only 33% of the principals admitted that they did not allocate money for ICT and if they did, it was not done regularly. According to Wanjala, et al., (2011), administrators in schools are key
leaders of change and therefore, they can expedite the decision to integrate ICT into classroom teaching and learning because they are in control of policy-making and financial allocation. In fact, ICT integration involves decision-making, influence, support to teachers and being a role model in ICT use (Afshari et al., 2009). A principal who supports ICT will be approachable in issues related to ICT and he or she will ensure smooth running of the process by making sure that the teachers are well trained, have the right equipment and are using ICT in their classroom instruction.

Drawing from several research sources, Leng(2008) contends that effective leadership is critical for successful integration of ICT in the classrooms. Therefore, the Nairobi County school administrators need to support ICT use in the classrooms to encourage Physics teachers to use ICT as expected and to feel the administrative support. Lack of encouragement and support could have been a reason for the low integration of ICT by the teachers in Nairobi County.

It is generally evident that Physics teachers in Nairobi County did not have sufficient technical support necessary to allow them use ICT in classroom instruction. The same was true for administrative support. A number of studies (Wambeti, 2012; Kirimi, 2012; and Mwingirwa, 2012) supports these findings, which found that majority of the teachers did not have necessary ICT support. Physics teachers require both administrative and technical support to be able to
adopt ICT in their classroom instruction. This support acts as a motivation to them and encourages them to integrate ICT in their lessons.
CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5. 1 Introduction

This chapter gives a summary of the findings, conclusions, recommendations and suggestions for further research.

5. 2 Summary of Findings

The purpose of the study was to assess integration of ICT in classroom instruction of Physics by the Nairobi County public secondary school Physics teachers. The study was guided by the following objectives: i) Determine Physics teachers’ perceptions as regards CT integration in classroom instruction; ii) Examine Physics teachers’ ICT competence for ICT integration in classroom instruction; iii) Assess adequacy of ICT resources available to Physics teachers for ICT integration in classroom instruction; and iv) Establish ICT support available to Physics teachers for effective ICT integration in classroom instruction.

A summary of the findings are given in accordance with the objectives of the study as follows:

5.2.1 Teachers’ Perceptions on ICT Integration in Classroom Instruction

Nairobi County Physics teachers had strong perceptions on the usefulness and ease of use of ICT. They alleged that ICT was easy to use and that it made physics
interesting to the learners as well as helped learners to understand abstract concepts. They also believed that ICT is capable of improving performance. A strong positive perception on the usefulness of ICT is a good foundation for teachers to accept and integrate ICT in classroom instruction. However, despite having positive perceptions on usefulness and ease of use of ICT, their perceptions did not translate into actual use of ICT in classroom instruction of Physics.

5.2.2 Teachers’ Competence in ICT Integration in the Classroom Instruction

Majority of Physics teachers in Nairobi County were computer literate and had had at least some form of formal training to use ICT in classroom instruction. However, the formal training for the physics teachers was done by different institutions, therefore scope and quality of the training was not guaranteed. As a result, majority cited that the training was not adequate and hence majority were just fairly competent in various ICT skills and fairly confidence to use ICT in classroom instruction. On frequency of use of ICT in classroom instruction of Physics, majority rarely or never used ICT in classroom instruction and none used ICT always. Therefore, ICT integration in classroom instruction by Physics teachers was still very low in Nairobi County schools because of the inadequate training and lack of refresher courses as indicated by more than half of the physics teachers since computer literacy alone is not enough to influence use of ICT.
5.2.3 Adequacy of ICT Resources for ICT Integration in Classroom Instruction

Most schools had inadequate ICT resources like desktop computers, overhead projectors, digital content and laptops and thus the resources were not sufficient for use by the physics teachers in their classroom instruction. There is a correlation between adequacy of resources and actual usage, since the resources were not adequate; most teachers either rarely used them or never used them at all in classroom instruction and hence, there was very low use of ICT in classroom instruction.

5.2.4 Support for ICT Integration in Classroom Instruction

Most schools did not have ICT technicians required to assist the physics teachers in case of technical hitches while using ICT in their lessons, and/or to assist in repairs and maintenance of the ICT resources. Majority of the teachers did not get full support of the administration in terms of financial investment in ICT and necessary incentives. As a result, there was low use of ICT in classroom instruction.

5.3 Conclusion

This study has resulted in various conclusions based on the findings as per the objectives as follows:
5.3.1 Teachers’ Perceptions on ICT Integration in Classroom Instruction

Nairobi County Physics teachers had strong perceptions on the usefulness and ease of use of ICT, however, their perceptions did not translate into actual use of ICT in classroom instruction of Physics. Therefore, it is fitting to conclude that perceptions alone are not enough to influence use of ICT in classroom in classroom instruction.

5.3.2 Teacher Competence in ICT Integration in Classroom Instruction

The training of Physics teachers was inadequate and the teachers were not attending refresher courses to enhance ICT skills, as a result, ICT integration in classroom instruction was still very low in Nairobi County schools.

5.3.3 Adequacy of ICT Resources for ICT integration in classroom instruction

Most schools had inadequate ICT resources like desktop computers, projectors, digital content and thus the resources were not sufficient for use by the physics teachers in their classroom instruction, hence, there was very low use of ICT in classroom instruction.

5.3.4 Support for ICT Integration in Classroom Instruction of Physics

Most schools did not have ICT technicians required to offer technical support in the lessons, repair and maintain the resources. The Physics teachers did not have support of the administration in terms of financial investment in ICT and necessary incentives. As a result, there was low use of ICT in classroom instruction.
5.3.5 General Conclusion

This study has resulted in two (2) main conclusions as follows, first, Physics teachers in Nairobi County have not yet implemented ICT integration in classroom instruction as required due to lack of; adequate training and refresher courses, inadequate resources and inadequate support from technicians and administration. Secondly, teachers’ perceptions and their competence in ICT, availability of adequate and functional resources and administrative and technical support influence use of ICT in classroom instruction.

5.4 Policy Recommendations

The study makes the following recommendations according to objectives:

5.4.1 Teacher Perceptions on ICT Integration in Classroom Instruction

i. The MOEST to sensitize Physics teachers on the importance of ICT use in classroom instruction through seminars and encourage them to use ICT in classroom instruction.

5.4.2 Teacher Competence in ICT Integration in classroom Instruction

i. All teacher-training institutions should introduce ICT in their curriculum so that the teacher trainees leave the institutions when they have already acquired knowledge and skills to integrate ICT in classroom instruction, this will ensure uniformity and quality of training.
ii. The Ministry of Education should introduce frequent in-service refresher courses to help keep Physics teachers up-to-date with emerging new ICT skills and hence establish competence and hence confidence in the teachers to use ICT in classroom instruction.

5.4.3 Adequacy of ICT Resources for ICT Integration in Classroom instruction

i. The school management, with the assistance of the Ministry of Education and other stakeholders should adequately equip schools with ICT resources such as computers, laptops, projectors, digital content and internet. The resources should be adequate in relation to the school population to facilitate effective ICT integration in classroom instruction.

ii. The resources should be insured so that in case of vandalism, they can easily be replaced to ensure uninterrupted use of ICT in classroom instruction.

5.4.4 Support for ICT Integration in Classroom instruction

i. The school management should ensure that the school has their own ICT technical support assistant to assist the teachers in case of technical hitches and help the teachers boost their confidence in ICT use in classroom instruction.
ii. The school principals should take ICT as a priority, and give the necessary support to the teachers in terms of financial investment to ensure smooth integration of ICT in classroom instruction.

5. 5 Recommendations for Further Research

i. A similar study should be done on Physics teachers’ integration of ICT in other counties in Kenya.

ii. A longitudinal research should be conducted on Physics teachers on the use of ICT in Nairobi after a period of five years.

iii. A comparative study on the performance of Physics in secondary schools in Nairobi County that use ICT and those do not to be done.

iv. A similar study using experimental design or qualitative design can show more details on ICT integration in classroom instruction.
REFERENCES


Boudah, J. D. (2011). *Conducting research, guide to completing a major research*. Sage


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APPENDICES

APPENDIX I

LETTER OF INTRODUCTION

Alma Mwanaszumbah,
Kenyatta University, School of Education,
P.O Box 43844-00100, NAIROBI.
Tel: 0710541747
Date……………………….

The Principal,
…………………………………………..

Dear Sir/ Madam,

RE: REQUEST TO COLLECT DATA IN YOUR SCHOOL.

I am a postgraduate student at Kenyatta University and a teacher of Physics and Chemistry. I am doing a research on ‘Assessing Integration of Information and Communication Technology in Classroom Instruction by Physics teachers in Nairobi County, Kenya,’ for my postgraduate degree.

I am collecting data in ESP beneficiary schools to find out how far the MOEST has ensured success of the programme after the provision of the resources. Your school was randomly selected and the data collected is purely academic.

Kindly allow me to collect data from you and Physics teachers in your school within the next two weeks.

Thanking you in advance,

Yours faithfully,

Alma Mwanaszumbah
APPENDIX 11
PHYSICS TEACHERS’ QUESTIONNAIRE ON ICT INTEGRATION IN
CLASSROOM INSTRUCTION

Dear Physics Teacher,

Kindly fill in this questionnaire. There is no right or wrong answer. Just give your personal opinion(s). You do not need to write your name nor the name of the school for confidentiality purposes. The information that you will give will be treated with confidence and will not be used for any other purpose apart from for this research. The findings are meant to assess ICT integration by Physics teachers in classroom teaching. The findings may also assist in improving ICT integration to make it easy for the Physics teachers to use ICT in classroom teaching in the future. Your opinions will be of great importance towards the success of this research. Thank you in advance.

SECTION A: Personal and General Information

1. Type of School □ Boys □ Girls □ Mixed
2. Teaching subjects .................................................................
3. Your gender □ Male □ Female
4. Age bracket □ 21-30 □ 31-40 □ 41-50 □ 51 & Above
5. Years of experience □ 0-5 years □ 6-10 years □ 11-15 years □ 16 + years
SECTION B: Teacher Perceptions on ICT Integration in Classroom Teaching

6. Please indicate which statements below you agree or disagree with.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICT improves my lesson preparation and teaching of Physics.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICT use motivates my students and makes them participate in learning of Physics hence improves their performance.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICT makes physics interesting and helps learners visualize and understand difficult and abstract concepts through real life examples.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICT encourages collaboration among students and among teachers.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICT is very easy to use in teaching Physics.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am not ready for ICT and do not need ICT for my students to pass Physics.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SECTION C: Teacher Competence in ICT integration in Classroom Teaching of Physics

7. Are you computer literate? Yes ☐ No ☐

8. If Yes in (6) above, what level of computer training certification do you have?
   ☐ Degree ☐ Diploma ☐ Certificate ☐ None (Self Taught)

9. Are you trained on how to use computers and other ICT resources in classroom teaching of Physics? Yes ☐ No ☐

10. If yes in (8) above, who provided the training?
    ☐ DQASO office ☐ KICD ICT Champion ☐ Pre-service training
    ☐ SMASSE/ Participation in workshops / seminars
    ☐ Personal Initiative
    ☐ Other (Specify)..........................
11. If you were trained, was the training adequate to you as a teacher to enable you use ICT in classroom teaching of Physics? Yes □ No □ Not Trained □

12. If No in (10) above, why do you think the training was not adequate? Tick (√) as many reasons as is applicable to you.

<table>
<thead>
<tr>
<th>Reason</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>The time for training was short</td>
<td></td>
</tr>
<tr>
<td>The training was difficult to understand.</td>
<td></td>
</tr>
<tr>
<td>The training was not continuous to enable mastery of skills.</td>
<td></td>
</tr>
<tr>
<td>Some ICT equipment are difficult to use.</td>
<td></td>
</tr>
<tr>
<td>There are no refresher courses to enable teachers update their initial skills</td>
<td></td>
</tr>
<tr>
<td>(Other reasons specify)</td>
<td></td>
</tr>
</tbody>
</table>

13. What is the extent of your confidence? Kindly tick (√) appropriately.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Highly Competent</th>
<th>Fairly Competent</th>
<th>Not Competent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of Microsoft office e.g. Word, Excel, PowerPoint.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finding useful information on the internet to support student learning.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use of internet to collaborate with fellow teachers through email.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use of different softwares to prepare lessons for Physics teaching.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use of Physics digital Content in my class.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delivering subject content through use of ICT in the classroom</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solving minor ICT problems I encounter in class.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

14. Have you attended any ICT related teacher development refresher course after your initial training? Yes □ No □
15. How can you rate your frequency of use of the following ICT applications and hardware in classroom teaching of Physics?

<table>
<thead>
<tr>
<th></th>
<th>Always</th>
<th>Often</th>
<th>When necessary</th>
<th>Rarely</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excel</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PowerPoint</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internet</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Software CDs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Digital content</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E-mail</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graphical Design</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Video Clips</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Projector</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SECTION D: ICT Resources for ICT Integration in Classroom Teaching**

16. Kindly fill in the table below by ticking √ in the appropriate boxes for each resource.
ICT Resource | Available and Enough/Sufficient | Available but Not Enough/Sufficient | Available but in bad condition | Not Available | How often do you use for teaching Physics. | Often | Rarely | Never
---|---|---|---|---|---|---|---|---
Desktop Computers | | | | | |
Laptops | | | | | |
Overhead Projectors | | | | | |
Internet | | | | | |
DVD player | | | | | |
Computer labs | | | | | |
CDs, DVDs | | | | | |
KIE digital content | | | | | |
Other Softwares | | | | | |
Others (specify) | | | | | |

17. To what extent do you agree or disagree with the following statements about time as a resource.

| | Strongly Agree. | Agree | Disagree | Strongly Disagree |
---|---|---|---|---|
Many other activities in the school require time hence leaving no time for ICT. | | | | |
There is enough time on the timetable to use ICT in class. | | | | |
There is enough time for training on how to use the ICT resources. | | | | |
There is time for preparing an ICT supported lesson, which needs more time. | | | | |

SECTION E: Support for ICT Integration in Classroom Teaching

18. Is there an on-site ICT technician readily available to assist Physics teachers with ICT technical problems in your school? Yes ☐ No ☐ ☐
19. Do you receive support from the administration in the use ICT in teaching of Physics in your school? Yes ☐ No ☐

20. To what extent do you agree or disagree with the following statements on ICT support?

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Agree.</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>When I need help to use ICT, specialized guidance is available from ICT technician</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technical support is available to solve technical problems teachers encounter while using ICT.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technical support is available for repair and maintenance of ICT resources.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The administration allows time for ICT training and for practice on timetable</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incentives are given to encourage teachers to use ICT in teaching of Physics.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Administration encourages teachers to attend ICT integration related courses</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The administration allocates money for ICT integration.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Recommendation(s)**

21. Please give recommendations that can help improve the use of ICT in the classroom teaching by teachers of Physics:………………………………………..
APPENDIX III
PRINCIPALS’ INTERVIEW SCHEDULE ON ICT INTEGRATION IN CLASSROOM INSTRUCTION

SECTION A: Personal and General Information
1. Which subjects do you teach? .................................................................
2. Type of School □ Boys □ Girls □ Mixed
3. Your gender □ Male □ Female
4. Age bracket □ 21-30 □ 31-40 □ 41-50 □ 51& Above
5. Years of experience □ 0-5 years □ 6-10 years □ 11-15 years □ 16 + years

SECTION B: Teachers of Physics’ ICT Competence in ICT Integration in Classroom Teaching
6. Are you computer literate? Yes □ No □
7. What level of ICT training certification do you have?
   Degree □ Diploma □ Certificate □ ICDL □ one □
8. Are your Physics teachers computer literate? Yes □ No □
9. Have Physics teachers in your school been trained on how to use ICT in classroom teaching? Yes □ No □
10. If yes to (10) above, who has trained them?
    KIE □ DQASO office □ ICT Champion □ SMASSE □
    Pre-service training □ Participation in workshops / seminars □
    Personal Initiative □ Other (Specify) ……………………..
11. If they have been trained, do you think the training is adequate to enable them use ICT in classroom teaching of Physics? Yes □ No □
SECTION C: Perceptions on ICT Integration in Classroom Teaching

12. Fill in the table below by ticking in the appropriate box

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you believe that ICT is important in their classroom teaching?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you believe that ICT can improve student achievement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you feel that ICT is easy to use in classroom teaching</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you perceive ICT to stimulate interest in learners</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you feel comfortable using ICT in classroom teaching</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SECTION D: ICT Resources for ICT Integration in Classroom Teaching

13. Is your school well equipped with all necessary ICT Resources? Yes ☐ No ☐

14. Apart from the ICT resources supplied by the Ministry of Education under the ESP, do you have more resources from other sources? Yes ☐ No ☐

15. Is there a plan of adding more resources to your school? Yes ☐ No ☐

16. If Yes to (15) above:
   When? Soon ☐ Not sure ☐
   By whom? ☐ PTA ☐ BOG ☐ Donors/ NGO ☐ MOEST

17. Kindly answer the following questions.

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is there enough time to allow Physics teachers to go for ICT training courses?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do Physics teachers have time to prepare for the ICT integrated lessons</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does the timetable allow for ICT integrated lessons?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do Physics teachers utilize ICT resources available?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SECTION E: ICT Support for ICT Integration in Classroom Teaching

18. As an administrator, how do you support Physics teachers to ensure they are using ICT in classroom instruction?

<table>
<thead>
<tr>
<th>Provide resources (computers, projectors, internet)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Give incentives</td>
<td></td>
</tr>
<tr>
<td>Permission for training</td>
<td></td>
</tr>
<tr>
<td>Maintain the resources through constant servicing</td>
<td></td>
</tr>
<tr>
<td>ICT technician</td>
<td></td>
</tr>
</tbody>
</table>

19. Kindly respond to the following statements.

| Do you give Physics teachers incentives such as paid time off to encourage them to attend training and use ICT in classroom teaching? | Yes | No |
| Do you allow Physics teachers to continue developing technology-based skills and attend ICT integration related courses? |  |  |
| Do you allocate funds to support ICT? |  |  |
| Have you put in place technical support in the school to support Physics teachers when they encounter a technical issue in class, for repairs and for maintenance? |  |  |

20. How can you rate the extent of ICT integration by Physics teachers so far your school in?

| Excellent | V. Good | Good | Fair | Poor |

21. What do you think can be done to improve ICT integration in classroom teaching of Physics?...............................................................
APPENDIX IV: OBSERVATION SCHEDULE ON ICT INTEGRATION IN CLASSROOM INSTRUCTION

1. Confirm availability of a computer lab

2. Confirm availability and adequacy of the following resources in the computer lab.

<table>
<thead>
<tr>
<th>ICT Resource</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Computers</td>
<td></td>
</tr>
<tr>
<td>Printers</td>
<td></td>
</tr>
<tr>
<td>Mobile phone</td>
<td></td>
</tr>
<tr>
<td>Laptop</td>
<td></td>
</tr>
<tr>
<td>Projector</td>
<td></td>
</tr>
<tr>
<td>Internet</td>
<td></td>
</tr>
<tr>
<td>Smart Boards</td>
<td></td>
</tr>
<tr>
<td>Video</td>
<td></td>
</tr>
<tr>
<td>CDs, DVD</td>
<td></td>
</tr>
<tr>
<td>Other Softwares</td>
<td></td>
</tr>
<tr>
<td>KIE Digital Curriculum DVD</td>
<td></td>
</tr>
<tr>
<td>Radio</td>
<td></td>
</tr>
<tr>
<td>TV</td>
<td></td>
</tr>
<tr>
<td>ICT Technician</td>
<td></td>
</tr>
<tr>
<td>(other Specify)</td>
<td></td>
</tr>
</tbody>
</table>

3. Observe the classrooms for sockets.

4. Observe an ICT supported class session
## APPENDIX V NAIROBI COUNTY SCHOOLS WITH ICT RESOURCES

<table>
<thead>
<tr>
<th>CONSTITUENCY</th>
<th>SCHOOL</th>
<th>SCHOOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dagoretti</td>
<td>01</td>
<td>Mutuini High School</td>
</tr>
<tr>
<td>Dagoretti</td>
<td>02</td>
<td>Dagoretti Mixed Secondary School</td>
</tr>
<tr>
<td>Dagoretti</td>
<td>03</td>
<td>Ruthimitu Mixed Secondary School</td>
</tr>
<tr>
<td>Dagoretti</td>
<td>04</td>
<td>Ruthimitu Girls Secondary School</td>
</tr>
<tr>
<td>Dagoretti</td>
<td>05</td>
<td>Dagoretti High School</td>
</tr>
<tr>
<td>Embakasi</td>
<td>06</td>
<td>Mwangaza Secondary School</td>
</tr>
<tr>
<td>Embakasi</td>
<td>07</td>
<td>Kayole South Secondary School</td>
</tr>
<tr>
<td>Embakasi</td>
<td>08</td>
<td>Dandora Secondary</td>
</tr>
<tr>
<td>Embakasi</td>
<td>09</td>
<td>Ruai Girls</td>
</tr>
<tr>
<td>Embakasi</td>
<td>10</td>
<td>Jehova Jire Secondary</td>
</tr>
<tr>
<td>Kamukunji</td>
<td>11</td>
<td>Maina Wanjigi Secondary School</td>
</tr>
<tr>
<td>Kamukunji</td>
<td>12</td>
<td>Uhuru Secondary School</td>
</tr>
<tr>
<td>Kamukunji</td>
<td>13</td>
<td>Eastleigh Secondary School</td>
</tr>
<tr>
<td>Kamukunji</td>
<td>14</td>
<td>Kamukunji Secondary School</td>
</tr>
<tr>
<td>Kamukunji</td>
<td>15</td>
<td>Our Lady of Mercy – Shauri Moyo</td>
</tr>
<tr>
<td>Kasarani</td>
<td>16</td>
<td>Baba Ndogo Secondary School</td>
</tr>
<tr>
<td>Kasarani</td>
<td>17</td>
<td>Kahawa Garrison Secondary School</td>
</tr>
<tr>
<td>Kasarani</td>
<td>18</td>
<td>Our Lady of Fatima</td>
</tr>
<tr>
<td>Kasarani</td>
<td>19</td>
<td>Kamiti Secondary School</td>
</tr>
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</tr>
<tr>
<td>Langata</td>
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<tr>
<td>Langata</td>
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</tr>
<tr>
<td>Langata</td>
<td>23</td>
<td>Langata Barracks Secondary School</td>
</tr>
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<td>Langata</td>
<td>24</td>
<td>Raila Education Centre</td>
</tr>
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<td>Karen C Secondary School</td>
</tr>
<tr>
<td>Makadara</td>
<td>26</td>
<td>Buruburu Girls Secondary School</td>
</tr>
<tr>
<td>Makadara</td>
<td>27</td>
<td>Ofafa Jericho Secondary School</td>
</tr>
<tr>
<td>Makadara</td>
<td>28</td>
<td>Nile Road Secondary School</td>
</tr>
<tr>
<td>Makadara</td>
<td>29</td>
<td>Makongeni Mixed Secondary School</td>
</tr>
<tr>
<td>Makadara</td>
<td>30</td>
<td>Our Lady of Mercy South B Secondary</td>
</tr>
<tr>
<td>Starehe</td>
<td>31</td>
<td>Muranga Road Boys Secondary</td>
</tr>
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<td>32</td>
<td>C.G.H.U. Mixed Day Secondary</td>
</tr>
<tr>
<td>Starehe</td>
<td>33</td>
<td>St.Teresas Girls Day Sec.</td>
</tr>
<tr>
<td>Starehe</td>
<td>34</td>
<td>Pumwani Boys Secondary</td>
</tr>
<tr>
<td>Starehe</td>
<td>35</td>
<td>Ndururuno Mixed Secondary</td>
</tr>
<tr>
<td>Westlands</td>
<td>36</td>
<td>Hospital Hill High School</td>
</tr>
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<td>Westlands</td>
<td>37</td>
<td>State House Girls</td>
</tr>
<tr>
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<td>38</td>
<td>Kangemi High School</td>
</tr>
<tr>
<td>Westlands</td>
<td>39</td>
<td>Parklands Arya girls High School</td>
</tr>
<tr>
<td>Westlands</td>
<td>40</td>
<td>St.Georges Girls School</td>
</tr>
</tbody>
</table>
APPENDIX VI

MAP OF NAIROBI COUNTY SHOWING THE CONSTITUENCIES

Source: http://www.flickr.com/photos/albertkenyaniinima/4729795674/
The Population density is 4,515 PER SQ.
APPENDIX VII LETTER OF AUTHORIZATION AND PERMIT

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone: +254-20-2213471, 2241349, 310571, 2219620
Fax: +254-20-318245, 318249
Email: secretary@nacosti.go.ke
Website: www.nacosti.go.ke
When replying please quote

Ref: No.

NACOSTI/P/14/3049/946

Alma Rubia Mwanaszumbah
Kenyatta University
P.O.Box 43844-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on "Assessing integration of Information and Communication Technology in classroom instruction by Physics teachers in Nairobi County, Kenya," I am pleased to inform you that you have been authorized to undertake research in Nairobi County for a period ending 3rd April, 2014.

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

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

DR. M. K. RUGUTI, PhD, HSC.
FOR: SECRETARY/CEO

Copy to:

The County Commissioner
The County Director of Education
Nairobi County.
**THIS IS TO CERTIFY THAT**

**MISS. ALMA RUBIA MWANASZUMBAH**

_of KENYATTA UNIVERSITY, 53711-200-

Nairobi, has been permitted to conduct research in Nairobi County on the topic: **ASSESSING INTEGRATION OF INFORMATION AND COMMUNICATION TECHNOLOGY IN CLASSROOM INSTRUCTION BY PHYSICS TEACHERS IN NAIROBI COUNTY, KENYA**

for the period ending: **3rd April, 2014**

**Applicant's Signature**

**National Commission for Science, Technology and Innovation**

**Secretary**

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**CONDITIONS**

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

---

**RESEARCH CLEARANCE PERMIT**

**Serial No. A1199**

**National Commission for Science, Technology and Innovation**

**REPUBLIC OF KENYA**

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**CONDITIONS:** see back page