

**INTEGRATION OF ICT IN EDUCATION IN KENYA: A CASE
STUDY OF THE NAIROBI SCHOOL.**

BY

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DECLARATION

This research project is my original work and has not been presented to any university for any award or anywhere else for academic purposes.


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DEDICATION

This work is a special dedication to Carol Mwendwa Munene my spouse, my best friend who has given me encouragement throughout my years of study.

ACKNOWLEDGEMENTS

Special thanks go to the Almighty God who is the pillar behind my every step and for giving me the strength to undertake and complete this project. Sincere gratitude and appreciation goes to my supervisor Mr. Michael Ochula for his guidance and supervision. I would also like to thank my dear wife Carol Mwendwa who gave me the support morally, financially and for her understanding and being there for me all the time.

Am grateful to my parents Silas & Janet Mutuma for their support both morally and financially that has brought me this far. To my sister Julie Karimi for her support and love. To my brothers who have supported me. God bless you.

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LIST OF ABBREVIATIONS AND ACRONYMS

AD	After Death
CCK	Communications Commission of Kenya
CPE	Certificate of Primary Education
EAACE	East African Advanced Certificate of Education
EACE	East African Certificate of Education examination
EACPE	East African Certificate of Primary Education
E-Commerce	Electronic Commerce
EPZA	Export Processing Zone Authority
IBEA	Imperial British East Africa
ICT	Information and Communication Technology
IS	Information Systems
IT	Information Technology
KACE	Kenya Advanced Certificate of Education
KCE	Kenya Certificate of Education
KCSE	Kenya Certificate of Secondary Education
KICTANET	Kenya ICT Network
KIF	Kenya ICT Federation
KNEC	Kenya National Examination Council
KP&TC	Kenya Post and Telecommunication Corporation
KTN	Kenya Television Network
M-PESA	Mobile Money
NEPAD	New Partnership for Africa Development
QoS	Quality of Service
SPSS	Statistical Package for Social Science
TAM	Technology Acceptance Model
TRA	Theory of Reasoned Action
UNESCO	United Nations Educational, Scientific and Cultural Organization
VOIP	Voice over Internet Protocol
VOK	Voice of Kenya

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ABSTRACT

This research aimed at studying the integration of ICT in education in Kenya: a case study of the Nairobi school; guided by two theories: Diffusion of Innovation and Technology Acceptance Model theories. ICTs are viewed as sources of information that can improve education, yet they have not been fully used in the education sector in Kenya, in as much as most students have used ICT outside the classroom, their use in schools has been largely limited. The study focused on computers and the internet as the major ICTs available in the education sector. The objectives of the study were: To find out the use of ICTs in teaching and learning, to examine whether the use ICTs enhances teaching and learning, to determine whether the use of ICTs in teaching and learning increases the cost of education and to find out the obstacles in the implementation of ICTs.

The study was descriptive in nature using both qualitative and quantitative techniques having adopted a case study of the Nairobi School which is a boys' national school in Kenya. Stratified and simple random sampling techniques facilitated the choice of 80 respondents from whom data was collected using self-administered questionnaires. Data was analyzed and presented using descriptive statistics, graphs and pie charts, by the use of Statistical Package for Social Sciences (SPSS).

All the 40 teachers and 40 students targeted were successfully contacted through questionnaires. 60% of the respondents indicated that their subjects were catered for in ICT use, but unfortunately they do not use ICT in teaching these subjects, citing difficulty. Among the students, proficiency was very high in the use of Microsoft Word program and the internet, which offers a good basis for ICT integration in school.

The study recommended formulation of ICT policy through developing a vision; performing an ICT audit, and setting target and performance indicators, teachers' training, infrastructure plan, costing and funding as means for an effective integration of ICT in education in Kenya.

CHAPTER ONE: INTRODUCTION

1.1 Background information

ICTs are a diverse set of technological tools and resources used to create, disseminate, store, bring value addition and manage information. The ICT sector consists of segments as diverse as telecommunications, television and radio broadcasting, computer hardware, software and services and electronic media, for example the internet and electronic mail. According to Search CIO – Midmarket, ICT is as an umbrella term that includes any communication device or application, encompassing; radio, television, cellular phones, computer and network hardware and software, satellite systems and so on, as well as the various services and applications associated with them, such as videoconferencing and distance learning.

Information and communication technology (ICT) has become one of the basic building blocks of modern society. Many countries now understand the importance of ICT and are mastering the basic skills and concepts of it as part of the core of education. Many people directly or indirectly involved in the education sector are increasingly recognizing the importance of ICT in supporting educational improvement and reform.

Education encompasses teaching and learning specific skills, and also something less tangible but more profound: the imparting of knowledge, positive judgment and well developed wisdom. Education has as one of its fundamental aspects the imparting of culture from generation to generation. Education means ‘to draw out’ facilitating realization of self-potential and latent talents of an individual. It is an application of pedagogy, a body of theoretical and applied research relating to teaching and learning and draws on many disciplines such as psychology, philosophy, computer science, linguistics, neuroscience, sociology and anthropology (Raju Kumar, 2008).

In relation to ICT, education can be viewed in terms of online learning, distance education or better still an integration of ICT in the traditional teaching methods. Dawes (2001) is of the view that new technologies have the potential to support education across the curriculum and provide

opportunities for effective communication between teachers and students in ways that have not been possible before. ICT education has the potential to be influential in bringing about changes in ways of teaching.

Previous studies focusing on ICT integration demonstrate that a substantial proportion of the variation in educational ICT use is due to school improvement related aspects, in a study conducted by Reid S. (2002) the integration of information and communication technology into classroom teaching, indicates that the use of ICT is changing teaching in several ways. With ICT, teachers are able to create their own material and thus have more control over the material used in the classroom than they have had in the past. The technology is requiring teachers to be more creative in customizing their own material. Also, using Web pages to enhance an activity demonstrates that technology can be used to complement other aspects of good teaching rather than replace them. It is evident that involving students in the creation of useful material as a part of a learning exercise is a way to make school more meaningful for students. The use of peripheral devices on computers to help with physics experiments again shows how ICT can be used to aid the learning process and help students focus on higher level concepts rather than less meaningful tasks.

In yet another paper written by UCV/British Council (2006), Integration of ICT in education has been viewed to offer numerous benefits ranging from being a tool that can be used to motivate students to learn in different ways; give learner access (internet) to richer sources of material as well as facilitate interaction and dynamism.

Tondeur J. et al. (2007) highlights the potential impact of policy-related factors on the actual integration of ICT in daily classroom instruction. First, the study confirmed that teachers in schools with an explicit ICT school policy that stresses shared goals are using ICT more regularly in their classroom. This corroborates previous research findings, suggesting that successful ICT integration depends upon the development of a shared vision (Hughes & Zachariah, 2001; Otto & Albion, 2002). It then follows that, an ICT policy plan seems to be an important incentive to foster the integration of ICT use in classroom, but only when teachers are aware of its content. In other words, successful ICT integration becomes much more likely when teachers share the values expressed within the policy and understand their implications.

Closer home in Ghana, Buabeng-Andoh C. (2012) examines the factors influencing teachers' adoption and integration of information and communication technology into teaching, in which he argues that despite the investments on ICT infrastructure, equipments and professional development to improve education in many countries, huge educational investment have produced little evidence of ICT adoption and use in teaching and learning especially. Evidence suggests that education sector is investing heavily on ICT but ICT adoption in education sector lagged behind the business sector (Leidner & Jarvenpaa, 1995). He goes on to suggest several factors that will easily facilitates the adoption of ICT including personal characteristics such as educational level, age, gender, educational experience, experience with the computer for educational purpose and attitude towards computers can influence the adoption of a technology; If teachers' attitudes are positive toward the use of educational technology then they can easily provide useful insight about the adoption and integration of ICT into teaching and learning processes. Teachers with more experience with computers have greater confidence in their ability to use them effectively. Jones (2004) reports that teachers' competence relate directly to confidence. Self-efficacy is reported to have greater effect on the use of ICT. Self-efficacy is defined as a belief in one's own abilities to perform an action or activity necessary to achieve a goal or task (Bandura, 1997). Gender differences and the use of ICT have been reported in several studies. However, studies concerning teachers' gender and ICT use have cited female teachers' low levels of computer use due to their limited technology access, skill, and interest (Volman & van Eck, 2001). Other factors mentioned include teacher experience, workload, institutional characteristics, professional development, accessibility and technical support.

Nangue C. R. (2011) in giving guidelines for the successful integration of ICT in schools in Cameroon recognizes ICT as a catalyst; as it could aid in overturning the current trend and ensure a swift move towards an information society. However, lack of financial resources and poor and inadequate planning and the under-usage of available resources have resulted in the current status quo. The ICT in schools is believed to provide an enhanced learning, teaching and administrative environment, and a greater access to education.

In a survey of ICT and education in Africa: Kenya Country Report, Farrel G. (2007) says that Kenya has placed considerable emphasis on the importance of ICT in its Education Sector Support Programme as evidenced in the recent promulgation of the National ICT Strategy for

Education and Training. The Ministry of Education has taken steps to support the implementation of the strategy either by direct action or through the various institutions and agencies with which it works. In addition, there are many other organisations not involved directly with the Ministry of Education that continue to be active in implementing and supporting projects involving ICT in education.

Kenya has put in place an ICT policy that aims to improve the livelihoods of Kenyans by ensuring the availability of accessible, efficient, reliable and affordable ICT services. The national policy addresses several sections, among them includes; Information technology, Broadcasting, Telecommunications and Postal services. However, it is the section on information technology that sets out the objectives and strategies pertaining to ICT and education. This therefore indicates that integration of ICT in education is an idea whose time has come.

1.2 Statement of the problem

Every day, many students are spending countless hours immersed in popular technologies such as *Facebook, twitter or MySpace*, which at first glance may seem like a waste of time, and brain cells. But these genres of technologies, Social Networking, Digital Gaming, and Simulations deserve a second, deeper, look at what's actually going on. Although these examples are mainly centered on social purposes, there are deeper educational benefits of ICT. Yet educational institutions have been reluctant to embrace these technologies. Likewise, where schools have often shied away from giving students an online identity in a digital networking platforms to increase opportunities for learning, professional organizations are leveraging networking technologies to increase collaboration, knowledge-sharing, and production amongst their employees. Traditionally, education has been impeded by the security and other potential dangers of employing ICT (Classroom technologies, 2011). ICT Integration could also be seen as a whole configuration of events, activities, contents, and interpersonal processes taking place in the context in which ICT is used. However, the right conditions need to be in place before the educational benefits of ICT can be fully harnessed, and a systematic approach is required when integrating ICTs into the education system. This fact is often overlooked, and in their eagerness to jump onto the technology bandwagon, many education systems end up with technologies that are

either unsuitable for their needs or cannot be used optimally – due to the lack of adequately trained personnel or an ICT shy student population (Ng, Miao, & Lee, 2009).

Yet another issue arises in which many have seen ICT as a formidable tool to close the gap between the developing world and the developed world – by skipping certain stages of industrial development and leapfrogging into the Information Economy (Osterwalder, 2007). This interest was accompanied by a commonly accepted rhetoric that education systems would need to prepare citizens for lifelong learning in an ‘information society’ (Pelgrum & Law, 2003). As a result, an information society was to be changed by ICT; citizens in these information societies would need new competencies that had not yet been sufficiently attained in the traditional education systems; educational innovations would need to be implemented – with the aid of ICT to attain these new skills. There are those from marginalized groups and communities for whom ICT can play a significant role in equalizing opportunities. But the paradox is that for those groups that are unable to cross the technology divide, ICT is yet another means to further marginalize them. Education has a major role to play in resolving this problem. Thus, unless ICT becomes part of both the delivery and content of education, the disadvantage will deepen and development will suffer.

But the failure to use ICT is itself a result of the digital and knowledge divides as well as poor that exists, and their causes are deeply embedded in the complex historical and socio-cultural context of the country. Fortunately, with the Vision 2030 goals, the Kenyan government has begun to implement strategies that will address these paradoxes.

1.3 Objectives of the study

1.3.1 General Objective

The general objective of this research was to find out the importance of integrating ICT in education in Kenya.

1.3.2 Specific objectives

- i. To identify the type of ICT available to schools in Kenya
- ii. To find out the uses of ICT in teaching and learning.
- iii. To examine whether the use ICT enhances teaching and learning.

1.4 Research questions

- i. What are the ICT available to schools in Kenya?
- ii. How has ICT been used in teaching and learning?
- iii. Does the integration of ICTs in education increase access to learning?
- iv. How can the integration of ICTs in teaching and learning promote improved learning?
- v. How does increased access to ICTs lead to improved teaching and learning?

1.5 Justification of the study

In 2004, government of Kenya was committed to providing 2500 of the 3500 public secondary schools in Kenya with computers by the year 2008. The ministry of Education embarked on this ambitious programme to connect all primary and secondary schools to the Internet in 10 years. Consequently the government of Kenya through the Ministry of Education launched a multi-million Information and Communication Technology Trust Fund. In 2005 the government announced that six secondary schools would benefit from a pilot programme to be officially launched on September 29 (Daily Nation, July 6, 2005).

Besides, Kenya was among 16 countries selected to benefit from the first phase of the e-initiative by the New Partnership for Africa's Development (Commonwealth Secretariat, 2006).

The programme was to provide knowledge and real-life experience by implementing information communication technologies (ICT) in secondary schools across Africa that will inform the model for a large-scale rollout. The Government entered into an agreement with Microsoft to supply computers to secondary schools and that Sh1.5 million was been released to buy the machines, New Partnership for Africa's Development (NEPAD).

It is against this backdrop that this study sought to establish the importance of integrating ICT in education in Kenya.

Significantly, this study will benefit, school who are the key targets of the research in implementing a workable and effective ICT programme in their schools. Kenya Institute of Education, the curriculum developers, can glean from this study the major areas of concentration in curriculum development. Other stakeholders such as the Ministry of Education in Kenya and

largely the government will gain in assessing effectiveness of ICT already provided to school aiming at effective integration.

1.6 Scope of the study

The subject area of this study is ICT and how they can be integrated in the education system in Kenya. The ICTs that this study majorly looked at was the computer and internet due to its international leaning and its increased popularity among Kenyans. ICTs are believed to simplify the way we do things. The world has embraced ICT and Kenya is on the forefront in Africa of adopting ICT in all the major sectors. ICT has brought many opportunities to improve student learning. Internet, which hosts billions of documents, allows students to have wider sources of information for their learning. Teachers are no more the only source of knowledge for students. As a result of this technological impact, the role of teachers will be a facilitator in networked classroom. The teacher suggests and guides students to access relevant sources of information in their learning process.

The study further narrows down the subject area to concentrate on education. The study adopted a case study of the Nairobi School – a boy school located in Nairobi’s Westlands division. Nairobi school was chosen due to its proximity to the city. The school is well equipped with IT facilities and has been using them effectively. The study mainly focused on the integration of ICTs in Education in Kenya as opposed to the wider inclusion of ICTs in Kenya.

Stratified random sampling was adopted for this study, in which case the population was stratified into four groups (form 1, form 2, form 3 and form 4 pupils) from which random samples of 10 pupils each were drawn to facilitate the 40 pupil sample for the study. A further 40 teachers made part of the study.

1.7 Definition of key terms

There are various terms in this study and these have been defined in context with the subject area of the study.

Integrate is to seamlessly combine components, parts or elements into a complex but harmonious whole. The notion of seamlessness is implicit in the definition that ICT integration is the degree to which ICT “vanishes into the background” of the classroom (Fluck, 2003).

Information is the summarization of data. Technically, data are raw facts and figures that are processed into information, such as summaries and totals. But since information can also be the raw data for the next job or person, the two terms cannot be precisely defined, and both are used interchangeably.

Communication is any act by which one person gives to or receives from another person information about that person's needs, desires, perceptions, knowledge, or affective states. Communication may be intentional or unintentional, may involve conventional or unconventional signals, may take linguistic or nonlinguistic forms, and may occur through spoken or other modes.

Technology is the purposeful application of information in the design, production, and utilization of goods and services and in the organization of human activities

ICT integration connotes a range of learning environments from a stand-alone computer in a classroom to a situation where the teaching is done by the computer through pre-packaged teacher-proof courseware (Lloyd M., 2005). Integration is taken to be one of a set of typologies referring to how ICT is used in schools used to describe the introduction of ICTs as an integral component of broader curricular reforms that are changing not only how learning occurs but what is learned.

Computer is a programmable machine that responds to a specific set of instructions in a well-defined manner and can execute a prerecorded list of instructions.

Internet is a global digital infrastructure that connects millions of computers. It is a global internetwork (network of networks), with cross platform compatibility, using the Internet protocol (IP) to communicate between computers. It uses existing public telephone and communication (including satellites) networks to relay data between networks using routers. In the field of ICT and education, the internet is seen as a library of information from which numerous researches and innovations have come up. The fastest growing part of the Internet is the World Wide Web.

World Wide Web – www, is a uniform method of accessing and retrieving information on the Internet.

ICT can be defined as the computing and communication facilities and features that variously support teaching and learning and a range of activities in education. While education is the act or process of imparting or acquiring general knowledge, developing the powers of reasoning and judgment, and generally of preparing oneself or others intellectually for mature life.

1.8 Theoretical framework

The study will adopt a theoretical framework to show the interrelations that are assumed to exist between the different concepts of the study. This study adopted three theories: diffusion of innovation, uses and gratification theory and Technology Acceptance Model (TAM). Diffusion of innovation theory by Everett Rogers (1995) is a set of generalizations regarding the typical spread of innovations within a social system. Diffusion of innovation centers on the conditions which increase or decrease the likelihood that a new idea, product, or practice will be adopted by members of a given culture. Diffusion of innovation theory predicts that media as well as interpersonal contacts provide information and influence opinion and judgment. Innovation is one of the essential attributes that drive competitiveness in the informal sector and so an ability to effectively diffuse ICT innovation throughout the sector is pivotal for achieving its useful deployment.

Strong interpersonal ties with people who use ICTs for business information would be more effective in the formation and change of strongly held attitudes.

The Technology Acceptance Model (TAM) is a specification of the Theory of Reasoned Action (TRA) by Ajzen and Fishbein's to the case of technology adoption. It is an information systems theory that models how users accept and use technology. Developed by Fred Davis (1986) and Richard Bagozzi (1989) to explain software adoption based on TRA, technology acceptance model has become a widely used version of diffusion of innovation theory. Compared to classic diffusion theory of Rogers and others, TAM places more emphasis on subjective/psychological predispositions and social influences on behavioral intention to adopt an innovation. It was therefore necessary to facilitate the acceptance of ICTs in the education sector. By making the educationist aware of the significance that ICT plays in enhancing academics, then there is going to be an intention to use the ICTs which will be actualized in the integration of ICT in the education system in Kenya.

Unlike traditional methods, ICT require continuous interaction from users. The users can select one web site or move through a series of web sites, which usually have several layers of screens of information to access. It is the users who choose the amount of information they want or need. The users can and have to seek ICTs which will best fit the motives of education, and then they determine if the ICTs are fulfilling their sought gratifications. These various levels of audience activity suggest that the uses and gratifications theory is an appropriate strategy to explore ICT.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

In this chapter the researcher examines the relevant literature written in the field of education, Information and Communication Technology (ICT), as well as the theoretical framework that support the study. It basically covers relevant contributions to this area of study that is, integration of ICT in education in Kenya.

2.2 Education sector in Kenya

According to UNESCO (2011) on world data on education, education is a fundamental right which must be provided to every Kenyan, according to the following principles; political equality, national unity, social justice and human dignity, freedom of religion and conscience, freedom from ignorance and disease, equal opportunities for all citizens irrespective of race, religion, sex or color. Equitable distribution of the national income and the promotion and preservation of the cultural heritage.

Before independence elementary education was based on the colonial system of education. In 1967, Kenya, with Uganda and Tanzania, formed the East African Community. The three countries adopted a single system of education, the 7-4-2-3, which consisted of 7 years of primary education, 4 years of secondary education, 2 years of high school and 3–5 years of university education. Under the system, which was similar to the British system of education, children began their primary education at the age of 7 and completed at the age of 13 after sitting for a regional examination known as the East African Certificate of Primary Education (EACPE). After primary education those who passed very well proceeded to secondary school which ended four years later with the writing of the East African Certificate of Education examination (EACE). The highest level of education that qualified one to attend university was attained after two years of high school at that time distinct from secondary school with students sitting for the East African Advanced Certificate of Education (EAACE).

With the collapse of the East African community in 1977, Kenya continued with the same system of education but changed the examination names from their regional identity to a national identity. The East African Certificate of Primary Education became the Certificate of Primary

Education (CPE), the East African Certificate of Education became the Kenya Certificate of Education (KCE) and the East African Advanced Certificate of Education became the Kenya Advanced Certificate of Education (KACE). In 1985 the then President Daniel arap Moi, introduced the 8-4-4 system of education, which adopted 8 years of primary education, 4 years of secondary education and 4 years of university education. With the introduction of the 8-4-4 system CPE became KCPE (Kenya Certificate of Primary Education) while KCE became the Kenya Certificate of Secondary Education (KCSE).

2.2.1 Nairobi School

Nairobi school was started in 1902 around the present Nairobi Railways club as a European school to serve the families of the Imperial British East Africa - I.B.E.A Company and later the white settler community. Out of the foresight and wisdom of the late Lord Delamere in proposing the building a senior Boys school (now Nairobi Primary), and the support of the then governor, Sir Edward Grigg, the railway reserve grounds near Kabete home for the school.

In 1928, Sir Herbart Baker was commissioned to plan a school similar to Winchester school, attended by both Lord Delamere and the then Governor-Kenya colony, in Winchester, an old town in Southern England dating from about 516AD, after the Romans left England. It was a major administrative and silver minting center, and hence, a Saxon Capital of England from 1066AD.

The school named after this town was originally founded to educate boy choristers. It was later re-founded in 1541 after King Henry VIII had destroyed the monasteries. Today the school is one of the leading independent schools in England. Captain Nicholson (recently retired from the loyal navy college, Dartmouth) designed the uniform and prepared school rules and regulations to match the discipline of the navy tradition. In the meantime Mrs. Nicholson planned the gardens.

On the 24th September 1929 the foundation stone was laid by his Excellency Lt. Col. Sir Edward Grigg, Governor of Kenya colony, for a school with a capacity of 80 boys.

Located on the outskirts of Nairobi, about 11 km from the city center. Nairobi School is a National Boys Boarding school admitting boys from the Ages of 12-19 yrs. It offers the Kenya Secondary Certificate of Education (KCSE) upon completion of a 4 year course. The Examination is administered by the Kenya National examination Council (KNEC) a National examining body.

At its picturesque 200-Acre campus established in 1929, Nairobi school provides a well-rounded education to approximately 1104 students who come from the 47 counties make up Kenya.

Source: Nairobi School (n.d.) The School retrieved May 11, 2012, from http://www.nairobischool.ac.ke/index.php?option=com_content&view=article&id=52&Itemid=53)

2.3 Review of theoretical framework

This research explores three theories; Diffusion of Innovation, Uses and Gratification theory and Technology Acceptance Model that have been viewed as appropriate regarding ICTs and their integration in education and how they have been tailored to suit this research project.

2.3.1 Diffusion of Innovation Theory

Diffusion theory whose proponent is Everett Rogers can be described as a set of generalizations regarding the typical spread of innovations within a social system. Rogers (1995) defines diffusion as the process by which an innovation is communicated through certain channels over time among the members of a social system. Diffusion research centers on the conditions which increase or decrease the likelihood that a new idea, product, or practice will be adopted by members of a given culture. Diffusion of innovation theory predicts that media as well as interpersonal contacts provide information and influence opinion and judgment.

Studying how innovation occurs, Rogers (1995) argues that it consists of four stages: invention, diffusion (or communication) through the social system, time and consequences. The information flows through networks. The nature of networks and the roles opinion leaders play in them determine the likelihood that the innovation will be adopted. Innovation diffusion

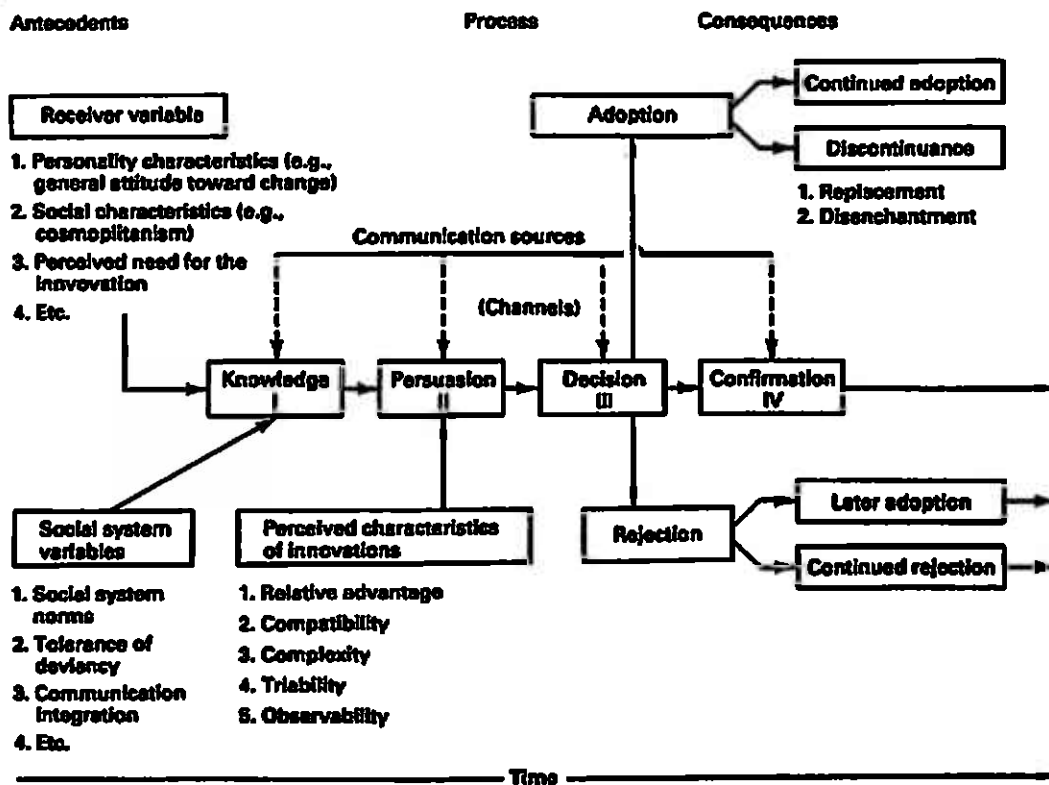
research has attempted to explain the variables that influence how and why users adopt a new information medium/ICT, such as the Internet. Opinion leaders exert influence on audience behaviour via their personal contact, but additional intermediaries called change agents and gatekeepers are also included in the process of diffusion. Five adopter categories are: Knowledge – person becomes aware of an innovation and has some idea of how it functions; Persuasion – person forms a favorable or unfavorable attitude toward the innovation; Decision – person engages in activities that lead to a choice to adopt or reject the innovation; Implementation – person puts an innovation into use; Confirmation – person evaluates the results of an innovation-decision already made.

The most striking feature of diffusion theory is that, for most members of a social system, the innovation-decision depends heavily on the innovation-decisions of the other members of the system. The innovation-decision is made through a cost-benefit analysis where the major obstacle is uncertainty. People will adopt an innovation if they believe that it will, all things considered, enhance their utility. So they must believe that the innovation may yield some relative advantage to the idea it supersedes. Also, in consideration of costs, people determine to what degree the innovation would disrupt other functioning facets of their daily life. Is it compatible with existing habits and values? Is it hard to use? The newness and unfamiliarity of an innovation infuse the cost-benefit analysis with a large dose of uncertainty. It sounds good, but does it work? Will it break? If I adopt it, will people think I'm weird?

Since people are on average risk-averse, the uncertainty will often result in a postponement of the decision until further evidence can be gathered. But the key is that this is not the case for everyone. Each individual's innovation-decision is largely framed by personal characteristics, and this diversity is what makes diffusion possible. Diffusion scholars divide the bell-shaped curve to characterize five categories of system member innovativeness, where innovativeness is defined as the degree to which an individual is relatively earlier in adopting new ideas than other members of a system. These groups are: 1) innovators, 2) early adopters, 3) early majority, 4) late majority, and 5) laggards. Figure 1, gives a breakdown of how an innovation diffuses and is either adopted or rejected by people in a given society and the influencing factors. The figure 1 focuses on five elements: (i) the characteristics of an innovation which may influence its

adoption; (ii) the decision-making process that occurs when individuals consider adopting a new idea, product or practice; (iii) the characteristics of individuals that make them likely to adopt an innovation; (iv) the consequences for individuals and society of adopting an innovation; and (v) communication channels used in the adoption process (Rogers, 1995).

Figure 1: Conceptual framework for Diffusion of Innovation Theory



Source: Rogers, E.M. (1995). *Diffusion of innovations (4th edition)*. New York: The Free Press. 290-300

Now that we know the mechanisms of diffusion, we have a basis for considering what efforts are most successful in encouraging the spread of the innovation that is ICTs. It used to be assumed that the mass media had direct, immediate, and powerful effects on the mass audience. But diffusion theory argues that, since opinion leaders directly affect the tipping of an innovation, a powerful way to facilitate the integration of ICTs in education is to affect the diffusion of this innovation (ICTs) which is to affect opinion leader attitudes.

Innovation is one of the essential attributes that drive competitiveness in the education sector and so an ability to effectively diffuse ICT innovation throughout the sector is pivotal for achieving its useful deployment. According to Peansupap ...et al (2006) diffusion provides the capacity for delivering two types of benefits: process improvement and product development. Process innovation is focused on the '*how to*' capacity that leads to improve or change traditional work processes by introducing cleverer or more effective ways to do things—this in turn can lead to management process productivity improvements. Product innovation is focused upon developing new products in response to market forces.

The mass media's most powerful effect on diffusion is that it spreads knowledge of innovations to a large audience rapidly. It can even lead to changes in weakly held attitudes. But strong interpersonal ties with people who use ICTs for education are usually more effective in the formation and change of strongly held attitudes. Research has shown that firm attitudes are developed through communication exchanges about the innovation with peers and opinion leaders. These channels are more trusted and have greater effectiveness in dealing with resistance or apathy on the part of the target audience. Successful efforts to diffuse an innovation depend on characteristics of the situation. To eliminate a deficit of awareness of an innovation, ICTs are most appropriate. To change prevailing attitudes about an innovation, it is best to persuade opinion leaders.

ICT projects could be considered as attempts at diffusion of new technology. Diffusion of innovation occurs through learning. An individual learns about an innovation by copying someone else's adoption of the innovation, implying that diffusion is a social process of interpersonal communication processes. ICT come as a new innovation for use in the classrooms by both teachers and students. The teachers in this case will act as the gatekeeper, and thus for ease of adoption, this technology must diffuse amongst teachers before it easily penetrates among the students who in most cases may have used these technologies for something other than education and learning.

2.3.2 Technology Acceptance Model

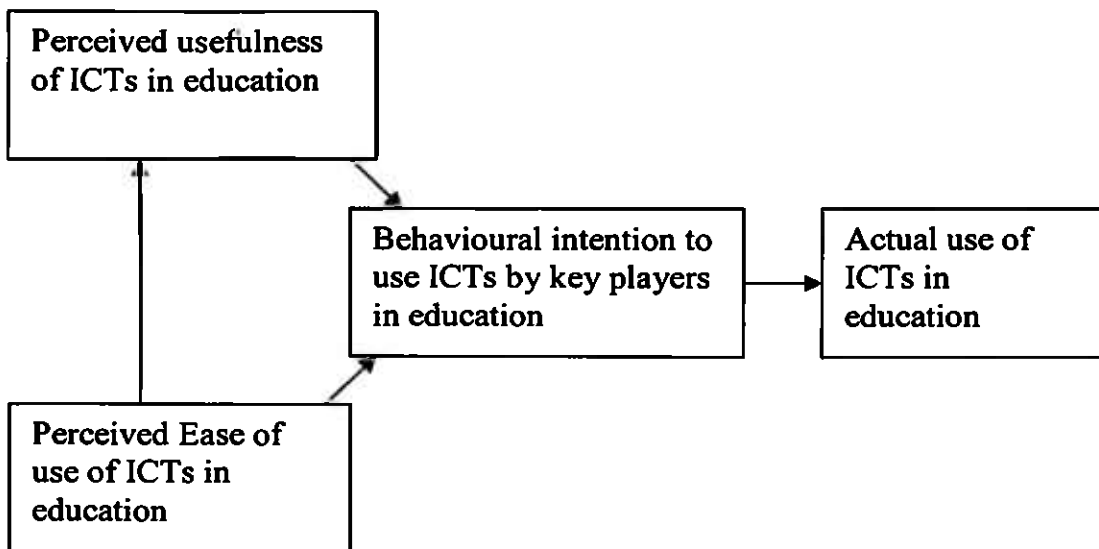
The Technology Acceptance Model (TAM) is a specification of the Theory of Reasoned Action (TRA) by Ajzen and Fishbein's to the case of technology adoption. It is an information systems theory that models how users accept and use technology. Developed by Fred Davis (1986) and Richard Bagozzi (1989) to explain software adoption based on theory of reasoned action, Technology Acceptance Model has become a widely used version of Diffusion of Innovation Theory. Compared to classic diffusion theory of Rogers and others, TAM places more emphasis on subjective/psychological predispositions and social influences on behavioral intention to adopt an innovation.

Venkatesh and Davis (2000) identified some of the key terms and concepts of Technology Acceptance Model as:

- (i) Usefulness and ease of use - perceived usefulness and perceived ease of use are key psychological determinants of decision to adopt. A wide variety of studies has confirmed the correlation of perceived usefulness and/or ease of use with adoption of technology, regardless of gender or level of experience.
- (ii) Usefulness to whom? - Venkatesh and Davis (2000) define perceived usefulness specifically as the extent to which the object of adoption is thought to enhance the individual's performance on the job. Others, however, define perceived usefulness as subjective utility to the citizen or consumer, depending on the context.

It can therefore be illustratively hypothesized as shown in figure 2, that the more the perceived usefulness of the innovation, the more likely adoption; the more the ease of use of an innovation, the more likely adoption and the lower the control by the subject over the benefits of the innovation, the less likely adoption.

Figure 2: Conceptual framework for Technology Acceptance Model



Sources: Davis et al... (1989) *Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly, 13(3)* AND Venkatesh et al... (2003) *User acceptance of information technology: Toward a unified view. MIS Quarterly, 27(3)*

The study looked at ICT as a new technology being introduced in the education sector in Kenya and thus the need to ensure that the users accept the technology and further assess how they use the same technology.

In line with TAM, as depicted in figure 2, it is necessary to facilitate the acceptance of ICTs in the education sector. By making the education players aware of the importance that ICTs would enhance education through speedy learning and improve performance, then there is going to be an intention to use the ICTs which will definitely result to the actual integration of ICT in the education sector in Kenya.

2.4 Information and Communication Technology (ICT)

According EPZA (2005) Information and Communication Technology (ICT) may be defined as computer hardware and software and telecommunications technology. Basically the convergence of telecommunications, broadcasting and computer technologies in creating new products and services, as well as new ways of learning, entertainment and doing business.

Okado (200?) ICTS are technologies for processing information (presenting it in various forms, storing it, searching for it, reproducing it, etc.) and transmitting information from one geographical point to another, from one person to another, to a group of people or to the whole community

This study looked at computers and the internet as ICT that are available in the education sector. These ICTs are also believed to have a big influence to any form of business. According to O'Brien (2006), as cited by Muhu (2007) IT plays three fundamental roles in education. Firstly, information systems (IS) are used to support education processes and operations. Secondly, IS play a vital role in supporting decision making. Thirdly, IS are used to support education as a business' competitive advantage through the innovative use of ICT for example through innovations that enhance learning.

IS therefore play a vital role in the success of education by providing the information needed for efficient operation, effective management and competitive advantage.

If the sector is to reap the benefits and strategic uses of ICT, they need to begin using the most accessible or available ICTs to them as they advance to the complex ones like computers that require great literacy. Education players, by identifying the most viable ICT areas can easily match them with the most appropriate ICT to facilitate success.

2.4.1 Brief history of ICT in Kenya

Kenya is rapidly gaining a reputation as one of Africa's forerunners in the development of ICT. Kenya has always been in the forefront of developments in ICT and is emerging as one of Africa's leaders in this area. Indeed, ICT is one of the fastest growing sectors in the country (Export Processing Zones Authority - EPZA, 2005). From the introduction of telecommunication services in Kenya up to 1977, the services in Kenya were managed as part of a regional network with neighboring Tanzania and Uganda, until 1977 when the East African Community collapsed and as a result, the Government of Kenya established Kenya Posts and Telecommunications Corporation (KP&TC) to run the services.

A telecommunications policy statement was issued in 1997 that set out the government vision on telecommunications development to the year 2015. The challenge at that time was to transform the existing policy structure from one designed for a monopoly to a policy managing a liberalized telecommunication market. This clarified roles for the policy, regulatory and operational responsibilities with the government and specifically the Ministry of Transport and Communications retaining policy guidance.

In recent years, there has been a considerable drop in the cost of hardware and software, and this has further led to the growth of this sector. In the past decade, Kenya's has had one of the largest and fastest growing Internet sectors in Africa. ICT is now in use in various sectors of the economy such as banking, accounting, medical services, transportation, mining, research, defense, agriculture, and communications. Key Kenyan para-statal organizations and some government institutions are also progressively making use of ICT and there is a strategy in place to link all Government departments, agencies and service providers with a view to providing efficient, effective and citizen focused public services on a 24/7 basis (Ministry of Information and Communication, 2006).

The development of radio and television in Kenya dates back to 1928 with an English radio broadcasting targeted at the white settlers. Voice of Kenya (VOK) was established by the British colonial administration in 1959 with the objective of providing radio and television broadcasting.

It later changed its name to Kenya Broadcasting Corporation in 1989. Since March 1990, a second television station, the Kenya Television Network (KTN) has been in operation. In 1996, the first FM station, Metro FM was started by KBC. Between 1997 and 2005 the broadcasting industry in Kenya experienced a significant growth in the number of broadcasting channels.

Mobile telephone in Kenya dates back to the late 90s and it was a preserve for the rich. Safaricom, being the first mobile telephone service provider was formed in 1997. Kencell, currently Airtel rolled out its operation in 2011. Currently the price of mobile telephone handsets and services are affordable amongst many Kenyans. The introduction of Orange mobile telephone service provider has further led to the reduction in service prices. The mobile telephone in Kenya is offering many services including internet, money transfers and mobile banking. Selected mobile telephone handsets have made it possible to listen to radio, watch television, surf the internet and even take photographs.

Internet was introduced in Kenya in early 1990s, largely led by Kenyans returning from overseas studies. Commercial Internet Service Providers - ISPs, led by Africa Online, entered the internet market by the mid-1990s. The notable early adopters included import/export sector, industries which had overseas operations and clients and the academic sector, with most of their users confined to Nairobi. With increasing number of ISPs and internet users, the need for an Internet backbone became evident and KP&TC introduced Jambonet by 1998. The internet is currently spreading countrywide and with the rolling out of the fiber optics, the internet is bound to be widely available and cheap.

EPZA (2005) indicates that while the growth of the ICT sector in Kenya has been significantly influenced by global trends, it can be evaluated in terms of number of fixed and mobile telephone lines; the teledensity; the number of computers and services; Internet Service Providers (ISPs), the number of Internet users; broadcasting stations; and market share of each one of them.

2.4.2 Types of ICT

APC (2003) has identified that while ICTs include a variety of technologies, the Internet has proved the most innovative and fastest growing new technology. This network of networks has become critically important in the development of the new information and/or knowledge society, contributing to the development of what many are now calling the new knowledge-based global economy. Many of the more traditional ICTs such as radio and television broadcasting are converging on the Internet, using it, becoming part of it, and often becoming indistinguishable from it.

Information Technology (IT) uses computers, which have become indispensable in modern societies, to process data and save time and effort. IT employs the use of computer hardware and peripherals, as well as software, and requires computer literacy on the part of its users.

Telecommunication Technologies include telephones (with fax) and the broadcasting of radio and television, often through satellites. Networking Technologies of which the best known is the Internet, but which has extended to mobile phone technology, Voice Over Internet Protocol (VOIP) telephony, satellite communications, and other forms of communication that are still in their infancy. Networking technologies include the Internet, mobile telephones and cables, Digital Subscriber Line, satellite and other broadband connectivity. With the introduction of the fiber optic, this has become the main source of internet in Kenya.

2.4.3 ICT policy

Marcelle (2000) defines a national ICT policy as an integrated set of decisions, guidelines, laws, regulations, and other mechanisms geared to directing and shaping the production, acquisition, and use of ICTs. Because the ICT sector is heterogeneous, extending beyond traditional classifications of industrial or services sectors and because production and diffusion of ICTs are of equal importance, national policies in the ICT sector intersect with a number of other areas of policy-making, technology, media, industrial, and telecommunications policy.

ICT policy as the Web Dictionary defines it is the rules and regulations set by the organization. Policy determines the type of internal and external information resources employees can access,

the kinds of programs they may install on their own computers as well as their authority for reserving network resources. Policy is also related to network quality of service (QoS), because it can define priorities by user, workgroup or application with regard to reserving network bandwidth.

ICT is the World's fastest growing economic activity; the sector has turned the globe into an increasingly interconnected network of individuals, firms, schools and governments communicating and interacting with each other through a variety of channels and providing economic opportunities transcending borders, languages and cultures.

Reijswoud (2006) says that Kenya published an ICT Policy document in March 2006. This document incorporated comments from the public. However, this document does not have any legislative status. It does not have the force of law. Currently, the Kenyan Ministry of Information and Communications has circulated an ICT Bill. The Ministry is in the process of collecting comments on that bill. There is not a clear linkage between the bill and the policy.

The ICT Policymaking process has been an elite driven process. The main drivers have been the private sector, through a trade association called the Kenya ICT Federation (KIF), as well as civil society, through an organization called the Kenya ICT Network (Kictanet). To some extent, Kictanet represents social justice interests, by including representatives of open source organizations, gender activists and the youth. However, there is also a high level of private sector participation in Kictanet. Finally, the government is under to legal or regulatory obligation to consider the public's comments on the ICT policy in Kenya, which weakens the democratic implications of the policy.

The policy probably is good for the Kenyan economy. It stabilizes and clarifies the market to some extent for both large multinationals as well as for smaller technology focused businesses in Kenya.

UNCSTD (1997) produced a comprehensive set of best-practice guidelines for ICT policy-making in developing countries. Topics covered are producing and using ICTs; developing human-resources; managing ICTs for development; facilitating access to ICT networks; promoting and financing ICTs; creating and accessing Science Technology knowledge;

monitoring and influencing the rules of the game in the global information society; and the role of the United Nations system.

2.5 ICT and education

Information and Communication Technology has permeated in every walk of life affecting the technology fields such as launching satellites, managing businesses across the globe and also enabling social networking. The convergence of computer, communication and content technologies, being known as ICT, have attracted attention of academia, business, government and communities to use it for innovative profitable propositions. Year by year it is becoming simpler to use devices such as desktop palm top, iPod, iPad and even smart phones. (ICBSE, 2010)

The modern world is characterized with the emergence of knowledge based society wherein ICT plays a pivotal role. The importance of ICT in school education cannot therefore be overlooked. With this backdrop, a major paradigm shift is imperative in education characterized by imparting instructions, collaborative learning, multi-disciplinary problem-solving and promoting critical thinking skills.

Through the Vision 2030, the government of Kenya has identified ICT as one of its flagship projects for this to be a reality, we must begin at the lowest cadres of life and that can only be attained through integrating the ICT in education. This means that if ICT are introduced in education in the year 2012, then by the year 2030, they will be joining university as technical savvy high school graduates.

According to Sonone A. K. B. & Pathak R. N. (2007) in a paper on Perspectives on ICT Education in India, ICT in education can be alternative instructional delivery systems such as radio, educational TV, and audio-visual communication or computers and computer-based systems for instructional delivery and management, such as CAI (Computer Assisted Instruction), use of multi-media and Internet/web based education (Rai & Bhattacharya)

From the use of radio to satellite-based television, to today's thrust for the use of open and distance learning models to serve the larger populations, Kenya has tried it all, with varying degrees of success. Radio has a penetration of almost 100 per cent in the country while satellite and terrestrial television cover a smaller percentage of the country. Giving the radio an upper hand as an ICT that can effectively be used in education, however with the advent of the fibre optic and the almost ubiquitous mobile phone, ICTs are becoming mandatory in education. In a school in Kilgoris, the students are already using Amazon Kindle as an alternative to paper based text book.

2.5.1 Implementing ICT in Education Hindrances/Challenges

The high subscription and infrastructure costs coupled with the poor quality of service by service providers is a major hindrance to the use of ICT in education, generally the commitment to improving the quality of education through ICTs is high both at the presidential and ministerial levels. However, there are several inhibiting factors as pointed out by Sonone A. K. B. & Pathak R. N. (2007) including access to ICTs still remains highly inadequate and unevenly distributed throughout with an urban bias and the capacity of teachers and educators to deliver policy still remains low with many averse to adopting ICTs in the classroom or with inadequate skills. In a situation where there is severe shortage of computer access by students and low and deteriorated internet bandwidth, alternative solution will not be a better solution to address the current educational problems.

2.6 Current and emerging issues in the use of ICT in education

The current level of ICT integration in education is established from the status of the five basic components of ICT development in schools, according to Fluck's Model. These are: i) Policies; ii) curriculum; iii) professional development; iv) infrastructure; and v) school organization. ICT is becoming increasingly important in our daily lives and in our educational system. Therefore, there is a growing demand on educational institutions to use ICT to teach the skills and knowledge students in this area. Realizing the effect of ICT on the workplace and everyday life, today's educational institutions try to restructure their educational curricula and classroom facilities, in order to bridge the existing technology gap in teaching and learning (Tomei, 2005).

Global investment in ICT to improve teaching and learning in schools have been initiated by many governments. Evidence suggests that education sector is investing heavily on ICT but ICT adoption in education sector lags behind the business sector (Leidner & Jarvenpaa, 1995). Currently we are seeing teacher attitude changing towards technology and intentions to use technology in their classroom. The schools are also providing excellent ICT facilities like internet enabled computers and projectors which are an improvement in the current global ICT trends.

CHAPTER THREE: METHODOLOGY

3.1 Introduction

This chapter briefly describes the procedure that was undertaken in accomplishing the study. The chapter highlights the research design, area of study, population, sampling procedure, data collection methods and instruments, data presentation and analysis.

3.2 Research design

It is evident that, research problems of the research study determine the research design that leads to the desired results. Research design must answer the research question that is based on the research problem (Beri, 2000). The researcher therefore adopted a case study research method involving the Nairobi School, because the case study provides more realistic responses. According to Gerring (2004) a case study can best be defined as an intensive study of a single unit with an aim to generalize across a larger set of units. A case study emphasizes detailed contextual analysis of a limited number of events or conditions and their relationships. This allows for a concentrated focus on a single phenomenon, which is the integration of ICT in education, zeroing in the Nairobi School.

This case study enabled the selection of random samples from a small population obtaining empirical knowledge of a contemporary nature. This allowed the researcher to come up with knowledge that facilitated generalizations to be made about characteristics, opinions, beliefs and attributes of the entire population to be studied.

3.3 Area of study

The study was conducted at the Nairobi School located on Waiyaki Way in Nairobi County. The school offers the local secondary education system that culminates in the fourth year with the pupils sitting for the Kenya Certificate of Secondary Education - KCSE. The Nairobi School was selected as the most appropriate case study because it is a national school within easy reach; it has better facilities than most public schools and a student population that is highly exposed.

3.4 Population of the study

The Nairobi School serves 1,500 pupils spread through form 1 and 4 and a teacher population of 76.

3.5 Sampling and sampling techniques

The study was conducted at a confidence level of 95% and a confidence interval of 8.9. Given the population of 1,500, which makes the total number of pupils, 40 students were sampled. The population was then be stratified into the four groups (form 1, form 2, form 3 and form 4 pupils) from which random samples of 10 pupils each were drawn to facilitate the 40 pupil sample for the study.

A further 40 teachers made part of the study, mainly to get their perspective on ICTs in education, the teachers make a larger sample in comparison to the two populations because they are the implementers of the curriculum. These teachers were stratified into the different areas of teaching which included humanities, languages, Arts, Sciences and Technical subjects. From each stratum, 8 teachers were randomly selected.

3.6 Data collection methods and procedure

Different data gathering methods were employed in the study, including pre-designed questionnaires, literature survey and surfing the internet.

3.6.1 Researcher administered questionnaires

Based on the fact that it was difficult to make a follow up after issuing questionnaires, the researcher chose to administer them personally so as to minimize any losses that may have occurred. 40 pupils and teachers respectively were issued with questionnaires. The researcher helped in interpreting the questions to the respondents where there was some difficulty and had the respondents record the responses by themselves on the questionnaire.

3.6.2 Literature surveys

Wide ranges of literature related to the research topic were consulted; these resources included books, journals and publications with the relevant literature as well as through surfing the Internet. This method of data collection was preferred because it gave the researcher an insight into what other researchers had written on ICT and education. Through this method, the researcher was able to relate the findings of the study to those of other researches which allowed for confirmation in cases of similarities and explanation of disparities.

3.7 Ethical considerations

Individual consent was the basis for one to participate in the study. No respondent was coerced into giving information he/she felt was not worth revealing in terms of security or personal reasons. This information is being treated with confidentiality incase of need for that. Data collected was used for this research alone and will therefore not be revealed to any other party with need to carry out a similar study.

According to Social Research Association (2003) Social researchers must strive to protect subjects from undue harm arising as a consequence of their participation in research. This requires that subjects' participation should be voluntary and as fully informed as possible and no group should be disadvantaged by routinely being excluded from consideration.

For mutual trust, a letter of introduction to carry out the research was obtained from the Director of School of Journalism, University of Nairobi and presented to the concerned authorities/individuals for purposes of identification of the researcher and the study to be carried out.

3.8 Data analysis and presentation

This involved the preparation of data collected into useful, clear and understandable information. Data analysis and processing involved coding, editing and tabulating. The data collected from the field was analyzed and processed into meaningful and relevant information. It was then accorded percentages to facilitate analysis. Statistical Package for Social Science (SPSS) was used to analyze the primary data that was collected. Data was then presented in headings and raw data converted into totals. To better the understanding of the findings, the data was presented into percentages, pie charts and tables with an analysis discussed in chapter four.

CHAPTER FOUR: DATA ANALYSIS, PRESENTATION AND INTERPRETATION OF FINDINGS

4.1 Introduction

This chapter presents a detailed analysis and interpretation of data that was collected from the respondents. The data was collected from the students and teachers of the Nairobi School. The researcher collected data by the use of questionnaires and reviewing of literature. All the targeted 80 respondents were successfully contacted, thus there was a 100% response rate. This demonstrates that the respondents were very cooperative to the researcher. This further added to the research's success. This chapter has been divided into subheadings that reflect the objectives of the study.

4.2 Demographic information of respondents

ICTs adoption and use can be affected by demographics. The demographic information of the respondents covered in this study were: age, gender, level of education and years of computer use.

4.2.1 Age of respondents

The general assumption of the study was that all students are of an average age of between 14 years and 19 years, which is the age at which most students attend secondary school in Kenya. The teachers however, were of different age brackets with 35% under 30 years, 22.5% were between 30 and 40 years, and 42.5% were aged between 40 and 50 years, an indicator that the school has a large number of teachers in their old age. Age is a great determinant of ICT use in school and a cross tabulation on the use of computer and age will give further details. Table 1 gives a breakdown of the ages of the teachers at Nairobi School.

Table 1: Age

Age		Frequency	Percent	Valid Percent	Cumulative Percent
	Under 30 Years	14	35.0	35.0	35.0
	30-40 Years	9	22.5	22.5	57.5
	40-50 Years	17	42.5	42.5	100.0
	Total	40	100.0	100.0	

Source: *Research data*

4.2.1 Gender

Nairobi school is a boy school and there was therefore no assumption about the gender of the students who were purely male. The school though, has a teaching staff that is of mixed gender. The study sought to know the gender of the teachers at the Nairobi school and the responses indicated that 22(55%) of them were male and 18(45%) were female. The population of the teachers was largely male, which may be attributed to the nature of the school being a single gender school.

The table 2 below enumerates the gender of the teaching fraternity at the school.

Table 2: Gender

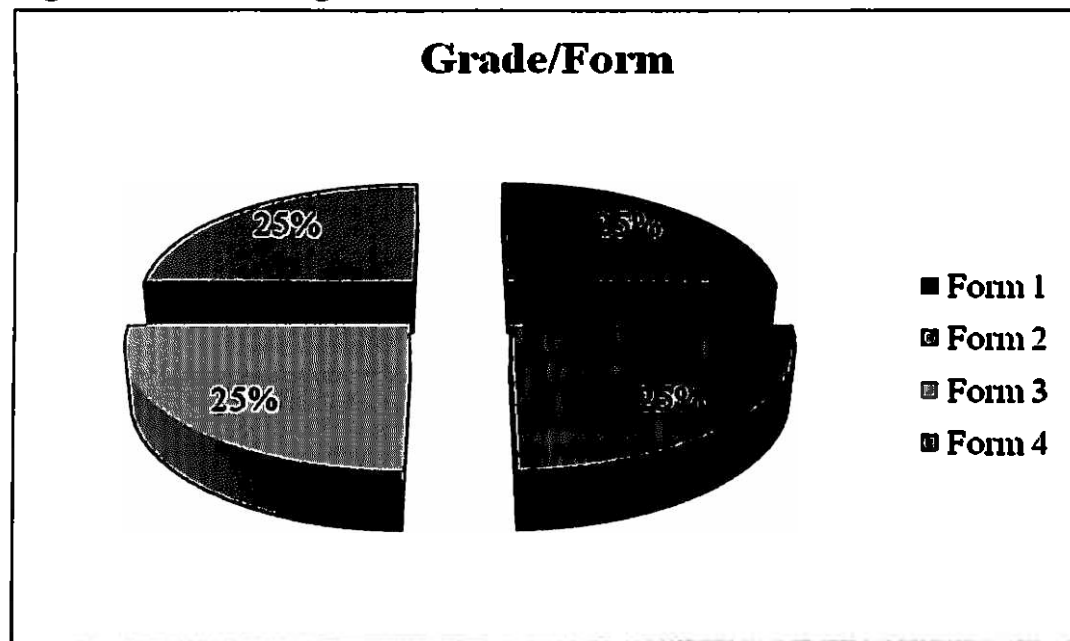
Gender	Frequency	Percent	Valid Percent	Cumulative Percent
Male	22	55.0	55.0	55.0
Female	18	45.0	45.0	100.0
Total	40	100.0	100.0	

Source: *Research Data*

4.2.2 Highest level of education attained

Among the students of Nairobi school, the respondents were evenly distributed among the four different classes, with each making 25% of the sample as shown on figure 3.

Figure 3: Students' grade



Source: *Research Data*

Among the teachers 7.5% of them were diploma holders, 82.5% were first degree holders and 10% were holders of masters degrees. The high number of degree holders is based on the current minimum qualification set by the Teachers Service Commission for employment of secondary school teachers. Table 3 gives a breakdown of the teacher qualification at the school.

Table 3: Qualification of teachers

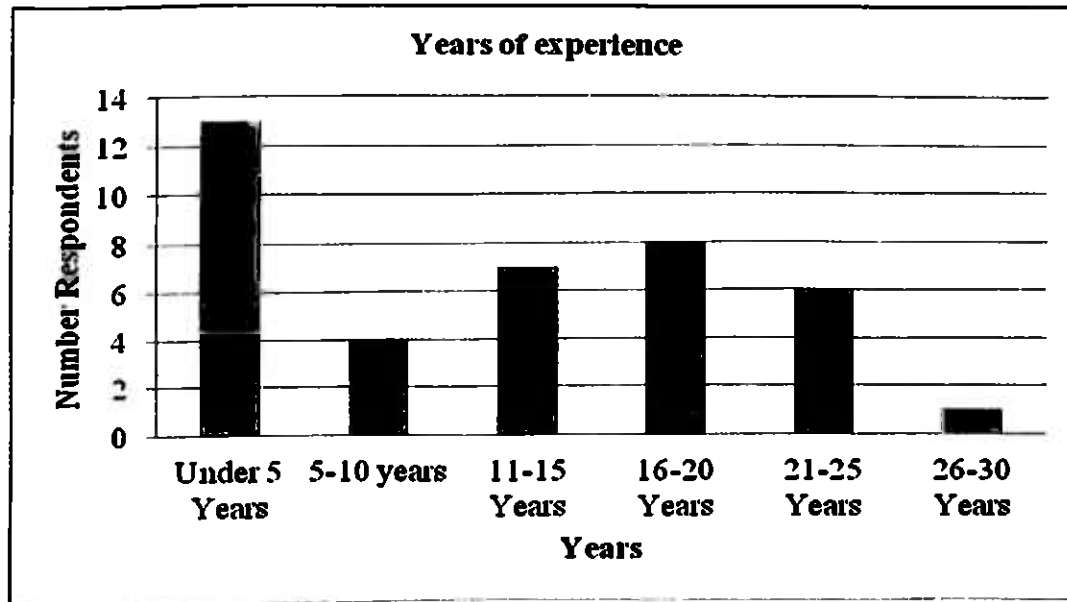
Qualification	Frequency	Percent	Valid Percent	Cumulative Percent
Diploma	3	7.5	7.5	7.5
Degree	33	82.5	82.5	90.0
Masters	4	10.0	10.0	100.0
Total	40	100.0	100.0	

Source: *Research Data*

4.2.3 Experience

Experience is considered as one of the main requirements for job entry in Kenya; this study posed the question of experience as a means of gaining an understanding of how the teachers have transitioned over time from the traditional teaching methods to more sophisticated ones and the various syllabus changes in school. The research noted that 13(32.5%) of the teachers had taught for less than 5 years, 4(10%) had taught for between 5 and 10 years, 7(17.5%) had taught for 11-15 years, 8(20%) had taught for 16-20 years, 6(15%) had taught for 21-25 years, 1(2.5%) had taught for 26-30 years and another 1(2.5%) did not indicate how many years he had taught. The bar graph on figure 4, enumerates the years of experience among the teachers.

Figure 4: Years of Experience

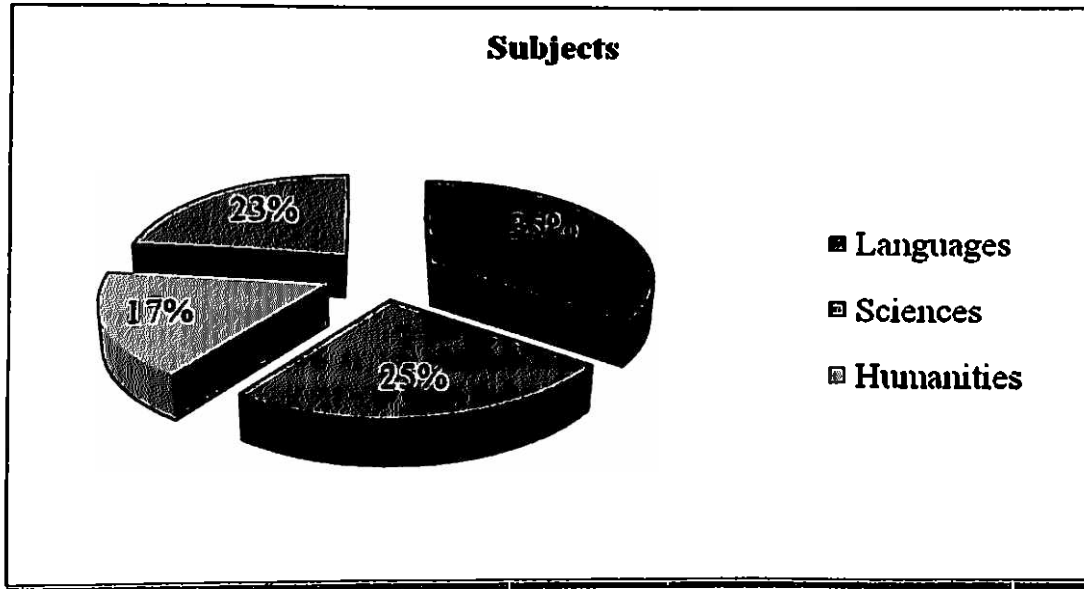


Source: *Research Data*

4.2.4 Teaching subjects

The respondents gave their areas of teaching in a broad perspective as required by the researcher; of which 14(35%) teach languages, 10(25%) Sciences, 7(17.5%) Humanities and 9(22.5%) were technical subject teachers.

Figure 5: Teaching subjects



Source: *Research Data*

4.3 Computer use

The experience the respondents have had with computer is quite significant in their use in education. Among the teachers, 15% had less than two years of experience, 35% had more than 2 years but less than 6 years of computer use, 47.5% of the teachers had been using computers for more than 6 years and 2.5%(1) did not indicate their experience with computers. The responses give a good basis for integration considering most of the teachers have had experience with computers as depicted on table 4.

Table 4: Years of computer Use

Years of computer use	Frequency	Percent	Valid Percent	Cumulative Percent
Less than 2 years	6	15.0	15.4	15.4
More than 2 years, less than 6 years	14	35.0	35.9	51.3
More than 6 Years	19	47.5	48.7	100.0
Total	39	97.5	100.0	
Missing	1	2.5		
Total		40	100.0	

Source: *Research Data*

The research sought to know where the students first had an encounter with computers and 45% first used computers at home while 47.5% used computers for the first time in school, a paltry 7.5% did not indicate where they first used computers. As a result of parents extensively using computers at home, children are more likely to have an encounter with computers at an early age making it very easy to adopt in school. This early encounter can also be attributed to the population becoming more urban with activities like computer games being available in cyber cafes even in the rural areas. Digital villages have also ensured that the rural population is not left out in computer use.

4.3.1 ICT training and computer expertise

In order to use ICT effectively for teaching, there is a common agreement in literature that teachers must possess basic ICT skills. Teachers' professional development has been identified as a key factor in the successful integration of ICT in schools (Fluck, 2003) (Pelgrum & Law, 2003) (Webb, 2007).

While 45% of the teachers had prior ICT training, 52.5% had not had any training in ICT before joining the teaching profession. On expertise, 22.5% believed that they had excellent computer skills, 30% said they were very good, while 17.5% were good, 27.5% had fair expertise and 2.5% had no expertise at all. As for the student respondents, 25% had excellent computer

expertise, 32.5% were very good, 15% were simply good, 22.5% had fair expertise on computer skills and 5% had no expertise at all. The results simply confirm the fact that most urbanized Kenyans have some skills in computer use, which gives a good point through which ICT can be easily integrated in the education system.

In diffusion of innovation, the innovation-decision is made through a cost-benefit analysis where the major obstacle is uncertainty. People will adopt an innovation if they believe that it will, all things considered, enhance their utility. By the fact that there is some use among members of the school then based on their continued use, the adoption of the technology becomes easy.

4.3.2 Access to computers and internet

A large body of literature indicates that the access to ICT is a prerequisite for its integration and adoption by schools members (UNESCO, 2010). Access to ICT can be done in a formal way in a school environment, as well as in a less co-ordinated manner from homes and cybercafés. This section presents the findings relating to where, when, and how access to ICT takes place.

The respondents were allowed to give multiple responses in terms of access and 97.5% of the teachers indicated that they accessed computers in the institution, besides the institution, 70% also accessed computers from home and 80% accessed computers in the nearest town(cybercafés). As for internet use, 97.5% were able to access it from the institution, homes only offered 62.5% access to the internet, while nearest towns, and mainly cybercafés offered access to 70.5% of the teachers. The school is the most popular places in as far as computer and internet use is concerned, considering the fact that the teachers spend most of their working hours there. Internet access is also offered for free, thus making the school to be the most popular place for internet use among the teachers. The table 5 gives the standard deviation and means of access to computers and internet among the teaching respondents.

Table 5: Access to computers and internet

Place	N	Minimum	Maximum	Mean	Std. Deviation
Institution	40	1.00	2.00	1.0250	.15811
Home	40	1.00	2.00	1.3000	.46410
Nearest Town	39	1.00	2.00	1.1795	.38878
Others Specify	40	1.00	2.00	1.9000	.30382
Internet access in Institution	40	1.00	2.00	1.0250	.15811
Internet access at home	40	1.00	2.00	1.3750	.49029
Internet in the nearest town	38	1.00	2.00	1.2105	.41315
Internet access elsewhere Specify	32	1.00	2.00	1.9687	.17678
Valid N (list wise)	32				

Source: *Research data*

4.3.3 Computer use in school

The Nairobi School has provided computer for use at various places within the institution. Once again the respondents had an opportunity to give multiple answers; and in the individual offices, 47.5% were able to access computers, the staffroom was only preferred by 22%, the computer laboratory seemed to have been the most popular with 70% gaining access there, 30% accessed computers in the classroom, the assumption being, that these are computer teachers, the library was a preference to 12.5% and 20% chose the departments as the most appropriate place besides the other areas where they would access computers. The descriptive statistics in table 6, give a summary of areas of computer access in the institution.

Table 6: Access to computers in the institution by teachers

	N	Minimum	Maximum	Mean	Std. Deviation
Individual Office	40	1.00	2.00	1.5250	.50574
Staffroom	40	1.00	2.00	1.7750	.42290
Computer Lab	40	1.00	2.00	1.3000	.46410
Classroom	40	1.00	2.00	1.7000	.46410
Library	40	1.00	2.00	1.8750	.33493
Department	40	1.00	2.00	1.8000	.40510
Valid N (list wise)	40				

Source: *Research data*

The students also indicated the likely places of computer use in the school and 2.5% accessed computers in the classrooms, most of whom were computer studies students, 92.5% used the computer lab, which is the main public access area for all the students and 2.5% indicated that besides the classroom and lab, the library was a preferred choice for them.

Apart from school the researcher also wanted to know where else the students accessed computers and the internet, and this question also gave the respondents liberty to pick multiple answers. From home, 28(70%) of the students accessed computers while cybercafés were accessed by 18(45%) of the students. Though half of the students were able to access computers from home, the study cannot rule out the fact that Nairobi School is a national school that admits students from all corners of the nation of Kenya; with some poverty stricken areas where computers are a luxury, yet others come from affluent homes where computers are a necessity.

4.3.4 Hours of computer and internet use

The amount of time spent on computers is necessary in determining how effective they can be if introduced in all areas of learning in school. Both the teachers and students were expected to respond to this question and 12 (30%) of the students spent less than 2 hours of computer use, 6(15%) spent 2-4 hours on computers, and 20(50%) spent more than 5 hours on computers. In all these, the students were further asked to indicate how much of this time they spent on the

internet and 11(27.5%) spent less than 2 hours, 1(2.5%) spent 2-4 hours and 9(22.%) spent more than 5 hours on the internet. The lower number of hours on the internet can be attributed to the high costs of internet access, downtimes and school work, most of which is not conducted over the internet.

As for the teachers 3(7.5%) spent less than 5 hours on the computers, while 36(90%) spent more than 5 hours on computers. Of these hours spent on computers, 2(5%) spent less than 5 hours on the internet and an equal 36(90%) spent more than 5 hours on the internet. Beside the hours in school, the teachers are also able to access the internet from many other sources. In both cases 1(2.5%) and 2(5%) did not respond to either questions respectively.

4.4 Computers and school work

It is apparent that many schools provide computers that end up being misused for personal gain. In this regard, it was necessary for the researcher to know what uses the computers were put into by the respondents, of which a likert scale of very often, often, rarely and never was used to test various aspects of computer use for school work. On teaching specific subjects, 17.5% (7) of the respondents indicated that they do it very often, 30% (12) often, 35 % (14) rarely and 17.5 % (7) never use computers for teaching any subjects. This was not strange because most of the computers in school are used for computer studies, which is one of the examinable subjects by the Kenya National Examination Council-KNEC.

In learning specific disciplines, 30 % (12) of the teachers used the computers very often, another 30 % (12) used them often, while 27.5 % (11) rarely used them and 12.5 % (5) never used computers at all.

In as far as the use of computers for teaching computer skills, 22.5% (9) used computers very often, 10 % (4) often, 35 % (14) rarely and 32.5% (13) never used them at all. It can also be assumed that the teaching of computer skills is a preserve for the computer studies teachers and therefore the other teachers may not primarily teach computer introductory courses.

Computers and specifically the internet, offer a great tool for research and interaction with members of a similar profession. There was a slightly high use of computers for accessing

education materials, in which case 37.5 %(15) used computers very often, 27.5 %(11) often, 30 %(12) rarely and a peltry 5 %(2) never used computers for finding education material. Most of the materials can be assumed to be online which may be impeded by issues of downtime, bandwidth and even the financial obligation for accessing the internet.

Though a rare occurrence in many public schools, presentation of lectures by the use of computers was very often used by 2.5 %(1) respondent, often by 32.5 %(13), rarely by 40 % (16) and never by 25 %(10) of the respondents.

10 %(4) of the teachers very often used computers to prepare lessons, 27.5 %(11) often, 37.5 %(15) rarely and 25 %(10) never used computers for lesson preparation. The numbers may be low, but the fact that there is an effort for computer use in lesson preparation means the integration of ICT would be a positive move for the education stakeholders.

Communicating with students may be seen as crossing boundaries of teacher-student interaction. However, this was performed on a very often basis by 2.5 %(1) respondent, 22.5 %(9) often, 47.5 %(19) rarely and 27.5% (11) never communicated with students using computers.

On communicating with other teacher professionals, only 7.5% (3) very often used computers, 42.5 %(17) often, 32.5 %(13) rarely and 17.5 %(7) never used them for communication.

By the virtue of Nairobi School being a boarding school, a lot of communication takes place between the teachers and the parents and in that case, the study sought to know how much of these is conducted on computers, via the internet and 2.5%(1) respondent seemed to be doing it very often, 20%(8) often, 40%(16) rarely and 37.5%(15) never communicate to parents by the use of computers (internet).

Keeping track of students' performance is very necessary because their academic work is of utmost importance. 22.5 %(9) of the teachers did it very often, 27.5 %(11) often, 37.5 %(15) rarely and 12.5 %(5) didn't do it at all. In as far as preparing reports was concerned, 22.5 %(9) used computers very often, 35 %(14) often, 27.5 %(11) rarely and 12.5 %(5) never prepared reports using computers. Once again it can be argued that not all teachers do report preparation.

It is mainly a preserve of class teachers and heads of department. Table 7 gives a detailed analysis of the standard deviations and means of how teachers used computers in school.

Table 7: Computer and school work

	N	Minimum	Maximum	Mean	Std. Deviation
Teaching specific subject	40	1.00	4.00	2.5250	.98677
Learning specific subject discipline	40	1.00	4.00	2.2250	1.02501
Teaching computer skills	40	1.00	4.00	2.7750	1.14326
Finding accessing/ educational materials	40	1.00	4.00	2.0250	.94699
Presentation of lectures	40	1.00	4.00	2.8750	.82236
Preparing lessons	40	1.00	4.00	2.7750	.94699
Communicating with students	40	1.00	4.00	3.0000	.78446
Communicating with teacher professionals	40	1.00	4.00	2.6000	.87119
Communicating with parents	40	1.00	4.00	3.1250	.82236
Keeping track of student performance	40	1.00	4.00	2.4000	.98189
Preparing reports	39	1.00	4.00	2.3077	.97748
Valid N (list wise)	39				

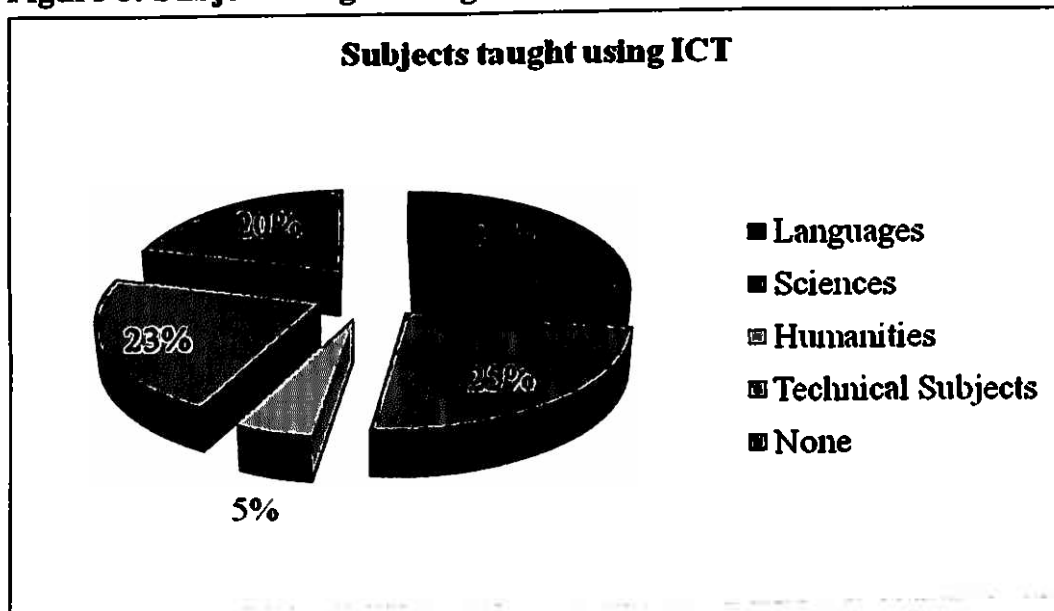
Source: *Research data*

The traditional education system and environment are not suitable for preparing learners to function effectively in the current job market. If teachers can embrace the use of ICT for teaching, then students will be prepared to face the future with a proper understanding of the job market. Computer is therefore a good tool to enhance student achievement and teacher learning. Computers can lessen the amount of work teachers have to do by reducing the amount of direct instruction to students and give them (teachers) an opportunity to help those students with particular needs. Unfortunately there is a common view from literature that ICT could increase the existing load on teachers and may constitute a barrier towards ICT adoption.

4.4.1 Subjects taught using ICT

Bitner and Bitner (2002) stated that using technology as a teaching and learning tool in the classroom brings fear, anxiety and concerns to a greater extent, since it involves both changes in classroom procedures and the use of often-unfamiliar technologies. This prompted the researcher to seek to know from the teacher respondents the subjects that they taught using ICT and the responses are as indicated on the figure 6.

Figure 6: Subjects taught using ICT



Source: *Research data*

60 %(24) of the teacher respondents stated that their subjects were planned for ICT in the scheme of work. While on developing the software for their subject use, only 35% had done it. There is a notion that using ICT to teach other subjects may be very difficult.

4.4.2 Other educational uses of ICT

Motivation builds up a person and it is necessary for purposes of rewarding or encouraging performance. 75% look at ICT as a motivational way of encouraging student performance. While 57.5% consider ICT as a means of keeping students busy and 30% of the same respondents look at ICT as a way of impressing inspectors and other stakeholders.

4.5 ICT Training

ICT training is imperative for any effective implementation. Among the teacher respondents, 47.5 %(19) had received training in the last 3 years while 50 %(20) had not. However, 2.5 %(1) did not respond to this question.

Teachers play a crucial role in the adoption and implementation of ICT in education, since they are the key to making learning happen. It is widely believed that all education professionals need to be equipped with technological skills and capabilities to support the delivery of high quality education in the 21st century (BECTA, 2009). The identification of training as a factor influencing adoption of ICT is capital to the successful implementation, and adoption of ICT in schools.

4.5.1 Reasons for acquiring ICT skills

ICT training does not necessarily have to be offered by the institutions for education purposes. The study sought to know some of the reasons as to why the respondents would acquire ICT skills, for prestige 10(4%) would go for further ICT skills, changing profession was preferred by 15 %(6), promotion requirements would drive 15%(6) of the respondents to seek further ICT

skills, in enhancing learning and teaching 80%(32) of the respondents would take up training in ICT and 20% (8) of the respondents indicated that starting an ICT business would make them get advanced skills in ICT.

The responses on enhancing learning and teaching were more and this would help boost ICT integration. A stand-alone technology course should be given to address the instruction of the use of technology in teaching. This should be possible due to the fact that teachers have already expressed the need to further teaching and learning if they gained advanced ICT skills.

Table 8: Reasons for acquiring further ICT skills

Reason	N	Minimum	Maximum	Mean	Std. Deviation
Prestige	39	1.00	2.00	1.8974	.30735
Change Profession	39	1.00	2.00	1.8462	.36552
Promotion Requirement	39	1.00	2.00	1.8462	.36552
Enhance Learning and Teaching	39	1.00	2.00	1.1795	.38878
Start ICT Business	39	1.00	2.00	1.7949	.40907
Others	39	1.00	2.00	1.9744	.16013
Valid N (list wise)	39				

Source: *Research Data*

4.7 ICT skills in teacher education

A set of likert-statements were presented to the teacher respondents, from which they were to indicate how necessary a number of proposed teacher related skills should be emphasized in teachers education. In demonstrating sound understanding of ICT operations and concepts, 62.5% felt that it was very necessary, 30% thought it was just necessary, and 5% believed it was

not necessary, while there was 1 missing response. On demonstrating interest in continual growth in technology knowledge so as to stay abreast with current and emerging technology, another 62.5% deemed it very necessary, 32.5% necessary and 2.5% not necessary, once again one teacher did not respond to this question.

The teachers were also asked how necessary designing learning strategies that use ICT to support the diverse needs of learning was and 70% of the respondents saw it as being very necessary, 27.5% as necessary and one had no response to this question.

The study also sought to know the necessity of applying current research on teaching and learning with ICT when planning for learning environment and 60% felt that it is very necessary, 32.5% necessary and 5% not necessary. It became important as to what emphasis would be placed on identifying and allocating technology resources suitable for meeting learning objectives, from which 57.5% pointed out that it was very necessary, 35% necessary and 2.5% as not being necessary at all. Planning students learning in a technology enhanced context was rated very necessary by 47.5%, necessary by 50% and not necessary 2.5%. On the other hand management and care of ICT resources was identified as being very necessary by 52.5%, necessary by 35%, not necessary by 10% and yet one respondent did not rate this variable.

In relation to students, the study sought to know from the teachers the importance of applying ICT to develop student creativity, the responses stood at 77.5% very necessary, 17.5% necessary and 2.5% not necessary. Managing student learning in a technology enhanced environment was rated as very necessary by 52.5%, 42.5% necessary and no response was received from 5% of the respondents. A total of 50% of the respondents believed that facilitating technology enhanced experiences that address content standards and student IT standards was very necessary, 42.5% saw it as being necessary and 2.5% did not see any necessity in it. Assessment of students determines understanding and areas of weakness. The use of technology in assessing student learning of subject matter using a variety of assessing techniques was very important to 47.5% of the teachers, necessary to 42.5% of them and not necessary to 5% of the respondents. On collection and analysis of data using technology 67.5% stated that it was very necessary, 15% necessary and 12.5% as not necessary.

Professional development is a motivator to any employee; the respondent rated the use of technology resources to engage in on-going professional development and lifelong learning as very necessary by 57.5% of the teachers, 30% necessary and 7.5% not necessary. A follow up to this question needed to confirm how necessary use of technology in collaborating with peers and stakeholders is and the responses show that 47.5% of the respondents deemed it very necessary, 37.5% necessary and 10% not necessary. Reflection on professional practice to make informed decisions regarding using technology for teaching and learning was very necessary to 47.5% of the respondents, necessary to 42.5% and not necessary to 5% of the respondents, with 5% of the respondents not stating their thoughts on the same.

Currently, active teachers often acquire ICT skills through informal learning; self-sponsored training courses or institutional support. Identifying and using technology resources that affirm diversity was very necessary to 45% of the respondents, necessary to 37.5% of the respondents and not necessary to 12.5% of the respondents. For purpose of a safe working environment, promoting safe and healthy use of technology resource was very necessary to 52.5% of the respondents, necessary to 40% of them and not necessary to 2.5% of the respondents. In as far as promoting equal access of technology resources for all students, 47.5% of the teachers believed that it was very necessary, 42.5% necessary and 5% not necessary. Finally, the need to model and teach legal and ethical practices related to technology use was viewed as being very necessary by 52.5% of the respondents, necessary to 30% of the respondents and not necessary to 12.5% of the teachers sampled. Table 9 gives detailed descriptive statistics of ICT skills in teacher education.

Table 9: ICT skills in teacher education

Skills	N	Minimum	Maximum	Mean	Std. Deviation
Demonstrate sound understanding of ICT	39	1.00	3.00	1.4103	.59462
Interest in continual growth in technology	39	1.00	3.00	1.3846	.54364
Design learning strategies for use in ICT	39	1.00	2.00	1.2821	.45588
Apply research on teaching and learning ICT	39	1.00	3.00	1.4359	.59802

Identify and allocate technology resources	38	1.00	3.00	1.4211	.55173
Plan students learning in technology	39	1.00	2.00	1.5128	.50637
Management and care of ICT resources	39	1.00	3.00	1.5641	.68036
Apply ICT to develop student creativity	39	1.00	3.00	1.2308	.48458
Manage student learning in technology enhanced environment	38	1.00	2.00	1.4474	.50390
Facilitate Technology	38	1.00	3.00	1.5000	.55750
Using technology in assessing student learning	38	1.00	3.00	1.5526	.60168
Use technology to collect and analyse data	38	1.00	3.00	1.4211	.72154
Use technology for professional development	38	1.00	3.00	1.4737	.64669
Use technology to collaborate with peers and stakeholders	38	1.00	3.00	1.6053	.67941
Reflection on professional practice to for decision making	38	1.00	3.00	1.5526	.60168
Use technology to affirm diversity	38	1.00	3.00	1.6579	.70811
Promote safe and healthy use of Technology	38	1.00	3.00	1.4737	.55687
Equal access to technology by Students	38	1.00	3.00	1.5526	.60168
Model and teach Legal Ethical Practices in Technology	38	1.00	3.00	1.5789	.72154
Any Other Necessary Skills for Secondary Education	28	1.00	3.00	2.1071	.49735
Valid N (list wise)	28				

Source: *Research data*

4.8 Competencies

In terms of ICT skills and concept 25 % (10) of the respondents believed that they were really emphasized, 47.5 % (19) felt that they were slightly emphasized and 20 % (8) did not see any emphasis at all as depicted in table 10.

Table 10: ICT Skills and Concept

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Really Emphasized	10	25.0	27.0	27.0
	Slightly Emphasized	19	47.5	51.4	78.4
	Not Emphasized	8	20.0	21.6	100.0
	Total	37	92.5	100.0	
Missing	System	3	7.5		
Total		40	100.0		

Source: *Research data*

On the use of ICT for planning, learning, teaching, assessment and evaluation, 20% of the respondents indicated that it was really emphasized, 50% saw it as slightly emphasized and 22.5% felt it was not emphasized. Table 11 gives a breakdown of the emphasis as stated by the respondents.

Table 11: Use of ICT for planning learning teaching assessment and evaluation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Really Emphasized	8	20.0	21.6	21.6
	Slightly Emphasized	20	50.0	54.1	75.7
	Not Emphasized	9	22.5	24.3	100.0
	Total	37	92.5	100.0	
Missing	System	3	7.5		
Total		40	100.0		

Source: *Research data*

The respondents were also asked to rate the emphasis placed on collaboration and networking amongst the teaching professionals and the responses are relayed on table 12 of which 12.5% see this as really emphasized, 50% slightly emphasized and 30% not emphasized at all.

Table 12: Collaboration and Networking

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Really Emphasized	5	12.5	13.5	13.5
	Slightly Emphasized	20	50.0	54.1	67.6
	Not Emphasized	12	30.0	32.4	100.0
	Total	37	92.5	100.0	
Missing	System	3	7.5		
Total		40	100.0		

Source: *Research data*

Other competencies whose emphasis was tested include social, ethical, legal and human issues in ICT use, of which 20% believed they are really emphasized, 35% slightly emphasized and 37.5% thought that they are not emphasized at all.

Table 13: Social, ethical, legal and human issues in ICT

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Really Emphasized	8	20.0	21.6	21.6
	Slightly Emphasized	14	35.0	37.8	59.5
	Not Emphasized	15	37.5	40.5	100.0
	Total	37	92.5	100.0	
Missing	System	3	7.5		
Total		40	100.0		

Source: *Research data*

4.8.1 Inadequacy in competencies

The study later asked the respondents to mention the area of competencies mentioned in section 4.8, they felt most inadequate in. 12.5% felt inadequate in ICT skills and concepts, 22.5% felt inadequate in the use of ICT for planning, learning, teaching and assessment, 5% felt inadequate in collaboration and networking amongst the teaching professionals, 25% in social, ethical, legal and human issues in ICT use and 5% felt inadequate in all the areas, while 7.5% did not feel inadequate in any areas.

Table 14: Inadequacy in competencies

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	ICT Skills and Concept	5	12.5	13.9	13.9
	Use of ICT for planning, learning, teaching, assessment	9	22.5	25.0	38.9
	Collaboration and networking amongst the teaching professionals	2	5.0	5.6	44.4
	Social, ethical, legal and human issues in ICT use	10	25.0	27.8	72.2
	All	2	5.0	5.6	77.8
	None	3	7.5	8.3	86.1
	Not sure	5	12.5	13.9	100.0
	Total	36	90.0	100.0	
Missing	System	4	10.0		
Total		40	100.0		

Source: *Research data*

Teachers need to be proficient in advising and guiding students through more autonomous, self-directed learning processes, while at the same time monitoring the curriculum standards achieved by students. Preparing teachers for this new role is a major challenge for staff development. Also, while teachers are often the focus of staff-development provisions, they are not the only stakeholders that require training to cope with the introduction of ICT into schools. First of all, the presence of large quantities and varieties of ICT equipment in schools has created the need for dedicated technology co-coordinators and technical support staff to train the teachers and

ensure a smooth operation of these facilities. The availability of support, both technical and pedagogical, is vital for the successful implementation of ICT in education in Kenya.

4.9 Students and ICT

This area seeks to establish various factors concerning student respondents in relations to ICT.

4.9.1 Availability of computers

The research sought to know how often the computers were available to the students before or after school, during school hours and on weekends

From the students' perspective, computers were often available to 27.5% of them before school, sometimes to 25%, rarely to 22.5% and never to 25% of them. While during school, 7.5% of the respondents often access computers, 22.5% sometimes did access computers, 12.5% rarely had access and 50% never had access to computers during school. Those that had access to computers during school can be assumed to be computer studies students, thus making it possible for them to access the machines during school. On weekends, only 2.5% could often access the machines, 15% could rarely access, 75% never had access and 7.5% did not respond to this question. It is quite ironical that on weekend when the students should have more machine hours, they almost have none. This can only be attributed to unavailability of the authority in charge of the areas where the computers can be accessed.

4.9.2 Proficiency in computer use

A total of 42.5% of the student respondents were proficient in Microsoft office word, 15% had intermediate skills, 37.5% had basic skills and 5% had no skills at all in working with this program. In as far as spreadsheet is concerned 20% indicated proficiency, another 20% intermediate skills, 27.5% basic and 32.5% no skills at all in operating the package. Desktop publishing softwares could only be operated proficiently by 7.5% of the students, with 17.5% having intermediate skills, 32.5% basic and 40% had no skills in these softwares. 15% of the respondent were proficient in databases, yet another 15% had intermediate understanding, 40% basic and 30% none. On presentation, 25% could proficiently use the package, 22.5% had intermediate skills, 32.5% basic skills and 20% could not use any computer presentation tools.

Internet which is one of the most interesting tools in ICT among the teenagers and youth could be proficiently run by 50% of the students, while 20% had intermediate skills in accessing and operating the internet while 17.5% had basics and 10% could not at all operate a website over the internet. Though rare among many computer users, repair and maintenance is a necessary skill which had a 12.5% response in terms of proficiency, 17.5% intermediate skills, 30% basic skills and 40% response of no skills at all. Descriptive statistics on proficiency are presented on table 15.

Table 15: Computer proficiency

Area	N	Minimum	Maximum	Mean	Std. Deviation
Word Processing	40	1.00	4.00	2.0500	1.01147
Spreadsheet	40	1.00	4.00	2.7250	1.13199
DTPs	39	1.00	4.00	3.0769	.95655
Database	40	1.00	4.00	2.8500	1.02657
Presentation tools	40	1.00	4.00	2.4750	1.08575
Internet	39	1.00	4.00	1.8718	1.05580
Basic Repair and Maintenance	40	1.00	4.00	2.9750	1.04973
Valid N (list wise)	38				

Source: *Research data*

4.9.3 ICT as a learning tool

The study asked the students to either agree or disagree to a set of questions relating to ICT use in learning. The respondents had an opportunity to pick multiple answers. 77.5% used computers to learn subjects independently. 82.5% used computers to help them change their attitudes on certain subjects. 65% used the internet to share knowledge with other students. In terms of self study, only 45% found computers appropriate. Hypermedia has been used to enhance learning as well as organize and make presentation in a more appealing outlook, this was actively applied to use by only 12.5% of the students, reason being the need for thorough proficiency.

4.9.4 Adequacy of ICT facilities

The main challenge for ICT-enhanced education is the availability of information and communication technologies infrastructure. Before any ICT-based program is launched, policymakers and planners must ensure the availability of the following: appropriate rooms or buildings to house the technology, computers as well as affordable Internet service for online learning, and availability of electricity. In developing countries large areas are still without a reliable supply of electricity and the nearest telephones are miles away. It is against this background that the researcher needed to know the adequacy of ICT facilities in the school and 25 % (10) respondents believed they were sufficient, while 75% thought otherwise as shown on table 16.

Table 16: Adequacy of ICT facilities in School

Adequacy	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	10	25.0	25.0	25.0
No	30	75.0	75.0	100.0
Total	40	100.0	100.0	

Source: *Research data*

Conclusively, despite the claims for many opportunities of ICT in education and the many efforts made to integrate ICT in education, the contribution of ICT in addressing real educational problems in the schools is not promising. In terms of access and use, there was a significant expertise among the respondents. The data revealed non-existence of an ICT guidelines document leading to not knowing how to proceed beyond the examinable computer studies. In terms of the infrastructure, a state of acute shortage of basic ICT infrastructure was confirmed by the students who expressed concern. These findings led us to the conclusion that ICT in the schools was at the introductory stage of integration.

To investigate factors affecting or promoting ICT in schools, data gained from teachers' and students' questionnaires were used to confirm the state of ICT at the school. The documented structured questionnaires with students and teachers revealed several driving factors, such as teachers' positive attitude towards ICT and increased ownership of computers at home, as well as opposing factors, such as few hours of computer use among student, lack of infrastructure, training (teachers) and support.

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The aim of this chapter is to provide a summary, conclusion and recommendations based on set objectives and findings and opinions from the respondents. The study used questionnaires and literature as sources of the findings.

The general objective of this research was to find out the importance of integrating ICT in education in Kenya.

The specific objectives of the study were:

- i. To identify the type of ICT available to schools in Kenya
- ii. To find out the uses of ICT in teaching and learning.
- iii. To examine whether the use ICT enhances teaching and learning.

5.2. Summary of findings

The summary of findings for this study is divided into demographic details of respondents. These findings have been summarized as earlier presented on chapter four of the study.

5.2.1 Demographic information of respondents

The highest number of teacher respondents were aged between 40 and 50 years, with 55% of them being male, while the students were mainly teenagers of between 14 and 18 years of age all male by the virtue of Nairobi School being a single sex school. 82% of the teachers had attained a first degree with 32.5% of them being first degree holders, while a similar number was drawn from all the classes as representatives for the students.

5.2.2 Computer use

47.5% of the teachers had been using computers for more than 6 years at the time of the study, with only 45% of them having had prior training in computer use before joining the profession. 97.5% of the teachers indicated having continuous access to computers and the internet within the institution, 80% at home and 62.5% in nearby towns (cybercafés). From this areas of access, 90% of the teacher respondents spent up to 5 hours on computer use, while 50% of the students spent a similar number of hours on computer access.

5.2.3 Computers and school work

The teachers indicated that they often use computers to teach specific subjects at a rate of 35%, while 30% very often used the computer to learn specific disciplines. 37.5% used the internet to access education materials as another 37.5% used computers to prepare lessons for class. In as far as communication with students is concerned 22.5% often did it and 42.5% used the same means to communicate with fellow teachers. With regard to parents, only 40% of the teachers used the internet to communicate with them.

Students' performance is fundamental in any learning institution and only 22.5% of the teacher respondents used computers very often to facilitate this.

5.2.4 Subjects taught using ICT

Though 60% of the teachers indicated that their subjects are planned for in ICT use, only 27% of the teacher respondents used ICT to teach languages and 25% used computers mainly for technical subject. The argument for low use was the difficulty of using computers for certain subjects and the point of connection of these subjects to computers.

5.2.5 Reasons for acquiring ICT skills

To enhance learning and teaching, 80% of the teacher respondents would seek further ICT skills. 62.5% of the respondents believed it was very necessary to demonstrate sound understanding of

ICT. Another 70% of the total sample of teachers believed it was very necessary to design learning strategies that use or otherwise require ICT.

In relations to applying current research on teaching and learning with ICT when planning for learning environment, 60% regarded it as being very important. Emphasis was also placed on planning students learning a technology enhanced context as the management and care of ICT was viewed as being very necessary by 52.5% of the teachers.

77.5% of the responses rated application of ICT to develop student creativity as very necessary. Asked how necessary managing student learning in a technology enhanced environment was, 52.5% of the teachers believed it is very necessary. On collection and analysis of data using technology 67.5% stated that it was very necessary.

Professional development in engaging on-going and lifelong learning was thought important by 57.5% of the respondents. Followed up by necessity of use of technology in collaborating with peers and stakeholders, 47.5% of the teachers, equally viewed this as very necessary.

Reflection on professional practice to make informed decisions regarding using technology for teaching and learning was very necessary to 47.5% of the respondents

5.3 Students and ICT

In relation to access to computers, 27.5% indicated that computers were available to them either before or after school. Of the total number of student respondents, 42.5% of them were proficient in Microsoft word, 20% in spread sheet, 7.5% in desktop publishing softwares, 15% indicated proficiency in databases, while 25% were proficient in presentation packages and 70% were good in operating the internet as a mere 12.5% only could effectively carry out basic repair and maintenance.

On ICT as a learning tool, 77.5% of the students used computers to study subjects independently. 82.5% used computers to help them change their attitudes on certain subjects. 65% used the internet to share knowledge with other students. In terms of self study, only 45% found computers appropriate. Hypermedia has been used to enhance learning as well as organize and

make presentation in a more appealing outlook, this was actively applied to use by only 12.5% of the students, reason being the need for through proficiency. In as far as adequacy is concerned only 25% of the student respondents believed the facilities were enough.

5.4 Conclusion

Integration of ICT in the education system in Kenya is not an easy task as may have been thought. It requires concerted effort not only from the school heads, but the stakeholders that may include the curriculum developers to the government. By simply supplying computers and giving them an online presence, does not guarantee integration into the education system. It is apparent that very little of ICT is applied to learning in school, apart from an examinable subject like computer studies, the rest of the subjects are still traditionally administered. The beauty though is that a number of institutions and stakeholders have recognized the need for ICT in education. The computer for schools by the government is a good initiative, for the first phase of this process.

5.4 Recommendations to facilitate integration of ICT in education in Kenya

In a study conducted by Nangue (2011) on guidelines for the successful integration of ICT in schools in Cameroon, a number of recommendations can be extrapolated to the Kenyan situation. He mentions policies, teachers' training, infrastructure and funding as good basis for commencement.

5.4.1 ICT policies

With policies regarded as a compulsory guide for the integration process, principals and school decision-makers should consider this as a first step towards the adoption of ICT into their respective schools, guided by the Kenya Institute of Education which is the body mandated to develop curriculum for schools. Nangue (2011) states that the preparation of ICT policies could be done in four distinct steps:

i. Develop a vision

Where are we and where do we want to be? A vision for implementing technology across the school must first be established. This vision is important, as it defines the outcomes for learning and teaching, relationships and behaviours (BECTA, 2009). An effective vision for technology supports and enhances the school's aims, in terms of learning, teaching, management and administration. A vision must be inspiring, helping the transformation of education to take place, and achievable. A school's vision is generally aligned with that of the Ministry of Education.

ii. Performing an ICT audit

An ICT audit aims at establishing the current status of ICT in a school. It should reveal information regarding the access, use and opportunities provided by ICT within the school. The focus should be on the:

School: This provides the current state of ICT use in the school, such as to provide information on what ICTs are being used, where, how, by whom and how often they are being used.

- The teaching staff: The strengths and weaknesses of the teaching staff must be revealed, such as their level of skills, confidence, attitude to change, an understanding of pedagogical issues. This audit should also reveal whether teachers use computers at home or in school, as well as the related technologies. The sort and type, the use of these technologies, the challenges, as well as achievements must be documented.

- Students and their access to ICT at home: This includes how many and what types of students have access to information technology equipment. What equipment do they have? How is it used? And whether there is an existing Internet connection.

- Students and access to ICT at School: What is the current use of ICT? What are their views on the current ICT provision and use in the school, as well as their expectations?

iii. Developing the School ICT Policy

BECTA (2009) suggested two approaches when preparing ICT policies for secondary schools: The first approach is a cross-curricular delivery model, where consideration is given to ensuring that subject teachers have the necessary ICT skills and knowledge to deliver the ICT learning objectives. The second approach is a discrete delivery model, where ICT is taught as a

timetabled subject. This approach is the recommended approach for an introductory stage, due to the prevailing limited resources.

iv. Setting targets and performance indicators

Strategic targets and associated performance indicators could now be set up by the school. These will start to make the vision a reality by providing a set of measurable achievements. This would also assist in assessing which projects and initiatives are more likely to contribute towards the overall success of the adopted plan. Strategic targets are simply areas where there are significant gaps between the school's vision and the current use of ICT. Performance indicators describe performances the school wishes to measure. These should be worded so as to indicate the sort of data which need to be collected, so that progress can be evaluated against strategic targets.

5.4.2 Teachers' training

The outcome of ICT in Education projects ultimately depends on those at the heart of education: Teachers (UNESCO, 2010). From the study, few teachers claimed to have gained basic ICT skills before joining the teaching profession and many indicated the desire to gain advanced skills to enhance teaching and learning.

With teachers recognizing the need for computers in their future career, the impact it may have on student's learning outcome and the need for a new educational approach.

Based on the above, teachers' training should not only be on basic computer literacy courses, but could also address key issues on using ICT for teaching. A recommendation, therefore, would be that a stand-alone technology course should be given that addresses the instruction of the use of technology in teaching. This should be possible due to the fact that teachers have already gained informal skills, and are more excited about discovering the impact this could have on their teaching. Maseno University has been on the forefront of this, offering a Bachelor of Education with IT.

5.4.3 Infrastructure plan

A big percentage of the student decried the facilities in the school. ICT infrastructure has been identified as a key enabler, and at the same time, as the main opposing factor of ICT development in school. Schools need to plan the development and management of their ICT infrastructure carefully. The government of Kenya through the Ministry of Education has steadily been supplying computers to schools in the rural areas in Kenya. The Kenya Power company also connects electricity to schools free of charge within a stipulated radius of the electric lines.

5.4.4 Costing

ICT costing has been as an opposing factor, since most principals are ignorant of its exact cost, thus not offering sufficient care to this equipment, especially in public schools where the government supplies them. This can be done in relation to the hardware, software, maintenance and support as well as internet connectivity and other accessories such as power cables. It is believed that this will be a motivator towards proper care and concern for the facilities.

5.4.5 Funding

Funding for ICT development programmes has been a key issue in all public schools. Besides the Ministry of Education funding, school heads could, consequently, have a minimum budget to invest in procuring ICT equipment, and consider other alternatives for funding as it remains one of the most important ingredients in the successful integration of ICT in schools.

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APPENDICES

APPENDIX I: INTRODUCTION LETTER

Charles Munene,
P.O. Box30231 00100,
Nairobi

14th July, 2012.

Dear Sir/Madam,

RE: RESEARCH INFORMATION FOR AN MA PROJECT

I am a postgraduate student undertaking a Master of Arts in Communication Studies degree at the School of Journalism and Mass Communication, of the University of Nairobi. As a partial fulfillment of the requirements for the award of the MA degree, I am conducting a study on **“Integration of ICT in education: a case study of the Nairobi School”**. You are one of the key respondents and I would like to kindly request for information regarding ICT in your daily teaching and learning activities.

The information you provide in this study will not be used for any other purpose apart from its intended academic use. I hereby undertake not to make any reference to your name in any presentation or report hitherto the study.

I am aware that filling the questionnaire is time consuming and I will greatly appreciate your assistance. Any additional information in form of suggestions and comments that you deem necessary to make my research findings more conclusive, relevant and reflective of the study area will be highly appreciated.

Thank you in advance.

Yours faithfully,

Charles Munene
MA Communication Studies Student

APPENDIX II: QUESTIONNAIRE FOR TEACHERS

Part 1: Bio Data

What is your gender?

- a) Male
- b) Female

How old are you?

- a) Under 30
- b) 30-40
- c) 40-50
- d) Over 50

Part 2: Qualification and Years of Experience

What is your qualification, and please indicate specialization (check all that apply)

- a) Masters
- b) Certificate
- c) Degree
- d) Diploma
- e) Others

How many years have you been in teaching position/ role?

What are your teaching subjects?

Part 3: Computer and Teaching

How many years have been using computer related technology?

- a) Less than 2 years
- b) More than 2 years, but less than 6 years
- c) More than 6 years

Indicate whether you have access to computers and internet in the following locations

Location	Access to computer		Access to internet	
	Yes	No	Yes	No
Institution				
Home				
Nearest town				
Others(specify)				

Where do you use computer in your institution? (tick all that apply)

- a) In my office
- b) Staff room
- c) Computer lab

- d) Classroom
- e) Library
- f) Others(state)

How many hours per week are the computers available to you?

How many hours per week is internet available to you?

Did you receive any ICT training before joining the teaching profession?

Yes

No

How would you rate your level of expertise in computer use?

	NO EXPERTISE-cannot use computer at all
	FAIR- able to operate basic computer functions and a word processing application
	GOOD- able to use office applications(word processor, spreadsheets, presentation software) for school assignments.
	VERY GOOD-All the above skills including use of internet and internet resources.
	EXCELLENT-All of the above including the use of e-mail; internet surfing and searching; development of web pages; participation on e-learning and online classes

How frequently do you use computers for your school work related to the following purposes?

	Very often- every day	Often- twice or more a week	Rarely- few times each month	Never
Teaching specific subjects				
Learning specific subjects/discipline(to stay abreast with emerging professional issues				
Teaching computer skills				
Finding and accessing educational materials				
Making presentation/ lectures				
Preparing lessons				
Communicating with students				
Communicating with other teachers/				

professionals				
Communicating with parents				
Keeping track of student performance				
Preparing reports				
Others(state)				

State the subject(s) in which you have used ICT as a teaching/learning tool

How is the use of ICT in your subject planned for in the scheme of work?

- a) Yes
- b) No

Did you develop the tool/software?

- a) Yes
- b) No

Do you think ICTs can be used for the purposes below?

	No	Yes	Not sure
Motivate/ reward students e.g. give extra computer time as a reward to a student			
Keep the students busy while the teacher do something else			
To impress inspector, students and other stakeholders			

Have you received any training in ICT in the last 3 year?

- a) Yes
- b) No

What would be your main reason for acquiring further ICT skills?

- a) Prestige
- b) Change profession
- c) It is requirement for promotion
- d) Use to enhance teaching and learning
- e) Start ICT oriented business
- f) Others

The following are some of the proposed ICT related skills that should be emphasized in teachers education. According to you, how would you rank them in order of relevance to secondary education

		3=Very necessary; 2=necessary; 1=not necessary(tick in the box)	3	2	1
I	a)	Demonstrate sound understandings of ICT operations and concepts			
	b)	Demonstrate interest in continual growth in technology knowledge so as to stay abreast of current and emerging technology			
II	a)	Design learning strategies that use ICT to support the diverse needs of learning			

	b)	Apply the current research on teaching and learning with ICT when planning for learning environment			
	c)	Identify and allocate technology resources suitable for meeting learning objective			
	d)	Plan students learning in a technology enhanced context			
	e)	Management and care of ICT resources			
III	a)	Apply ICT to develop student creativity			
	b)	Manage student learning in technology enhanced environment			
	c)	Facilitate technology enhanced experiences that address content standards and student IT standards			
IV	a)	Use technology resources in assessing student learning of subject matter using a variety of assessment techniques			
	b)	Using technology to collect and analyse data			
V	a)	Use technology resources to engage in on-going professional development and lifelong learning			
	b)	Use technology to collaborate with peers and stakeholders			
	c)	Reflection on professional practice to make informed decisions regarding using technology for teaching/ learning			
VI	a)	Identify and use technology resources that affirm diversity			
	b)	Promote safe and healthy use of technology resources			
	c)	Promote equal access of technology resources for all students			
	d)	Model and teach legal and ethical practices related to technology use			

Apart from the above mention skills, state any other skill that you think are useful in secondary school education.

Information and Communication Technology secondary school education can be clustered around four competencies given below. Please rank the competencies in terms of the emphasis given to each in secondary school education program.

	3	2	1
1=Really emphasized 2= Slightly emphasized 3=Not emphasized			
ICT skills and concept			
Use of ICT for planning, learning , teaching, assessment and evaluation			
Collaboration and networking amongst the teaching professional			
Social, ethical, legal and human issues in ICT use			

In which of the above mentioned competencies do you feel inadequate as in secondary school learning and teaching.

Thank you for completing the questionnaire

APPENDIX II: QUESTIONNAIRE FOR STUDENTS

Part A

BIO DATA

Name of institution -----

Where is your school located? [Check]: () urban () rural

Your name-----

What is your gender?

- a) Male
- b) Female

Which form are you in? [Fill in]:

- Form 1 ()
- Form 2 ()
- Form 3 ()
- Form 4 ()

Part B

Where did you first encounter computer

Where do you use computer in your school? (Tick all that apply)

- a) Classroom
- b) Computer lab
- c) Library
- d) Others (state)

Apart from you school, where else do you have access to computers?

- a) Home
- b) Nearby cyber cafe
- c) None

How many hours per week are the computers available to you?

How many hours per week is internet available to you?

How would you rate your level of expertise in computer use?

	NO EXPERTISE -cannot use computer at all
	FAIR - able to operate basic computer functions and a word processing application
	GOOD - able to use office applications (word processor, spreadsheets, presentation software) for school assignments.
	VERY GOOD -All the above skills including use of internet and internet resources.
	EXCELLENT -All of the above including the use of e-mail; internet surfing and searching; development of web pages; participation on e-learning and online classes

How often are the computers in your school available to you outside instructional (teaching) hours? *Please mark one answer in each row.*

	Often	Sometimes	Rarely	Never
Before and/or after school				
During school (e.g. at lunch, breaks)				
On weekends				

How would you rate yourself in the following computer areas ?

	None	Basic	Intermediate	Proficient
Word processing				
Spreadsheet				
DTPs				
Database				
Presentation tools				
Internet				
Basic repairs and maintenance				

Answer the following questions related to using ICT as a learning tool

	No	Yes
Do you use computer to learn other school subjects		
Do you use computer to assist you in preparing assignment reports and presentation		
Do you use computer to work on project as groups		
Do you think you can learn some of the subject independently with computer		
Does using computer to learn change your attitude towards a subject		
Do you use internet to share knowledge with other student/teachers		
Do you use any computer software to learn on your own		
Do you use any form of hypermedia to organize/present what you have learnt to your teacher or classmates		
Do you think the ICT facilities in your School are adequate for your learning process?		
Are there any disruptions in the ICT learning process in your School?		
Has the learning with ICT influenced your other School activities?		
Have you ever used computer/internet to gather and organize learning materials on emerging issue such as HIV/AIDS, drugs abuse b, environment degradation, violence against vulnerable groups etc		

If you use computer to learn other subject, state the subject.

Do you learn ICT in other subjects

- a) Yes
- b) No

If yes, state some of those subjects

Do you think ICTs can be used for the purposes below?

	No	Yes	Not sure
Motivate/ reward students e,g give extra computer time as a reward to a student			
Keep the students busy while the teacher do something else			
To impress inspector, students and other stakeholders			

Thank you for completing the questionnaire