A framework for e-readiness and implementation of digital schools in Naivasha District, Nakuru County, Kenya

By
Nderitu James Ndegwa

A Thesis Submitted in Partial Fulfilment of the Requirements for the Award of the Degree of Master of Philosophy in Information Technology,
School of information Sciences,
Moi University

November, 2011
Declaration by Candidate

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__________________________  _______________________
James Ndegwa Nderitu          Date

Declaration by Supervisors

This thesis has been submitted for examination with our approval as University supervisors.

__________________________  _______________________
Dr Gregory Wanyembi          Date
Department of Information Technology

__________________________  _______________________
Dr Henry Kemoni              Date
Department of Library, Records Management and Information Studies
ABSTRACT

The introduction of computer skills in secondary schools in Kenya has been taking roots since the introduction of Computer studies as a subject in 1996. Many areas both urban and rural have taken these skills with a lot of seriously hence investing in the hardware, software and liveware needed. This research aimed at developing a framework for the implementation of digital schools. This was after investigating the schools in Naivasha district so as to establish their e-readiness in terms of physical, technical and human resources. The objectives of the study were: to find out how many schools were providing computer lessons; to examine how the schools make use of the ICTs in teaching and administration; to determine whether the infrastructure needed to support the digital schools is available in Naivasha district; to assess the level of e-readiness in the district in terms of physical, technical and human resources and lastly to design and develop a framework for implementing and sustaining digital schools.

It used McConnell International (MI) e-readiness tool as its theoretical framework which rates countries in five categories on a scale of one to three. The study was a case study and it used interviews and observation for data collection. Data was collected from 39 primary schools and 21 secondary schools. The schools were stratified sampled into private and public schools. It interviewed 41 respondents including the area Member of Parliament and a coordinator of some digital schools in the area. It was a qualitative research.

The research found that Naivasha district is on average at red scale meaning that it was not e-ready for the implementation of digital schools. In terms of power connectivity, it was at amber, while for Internet connectivity, the study puts it at red. The study put it at the scale of red as well in information security and e-business, but for e-leadership, it was at amber. Amber indicates that some improvements are needed and red indicates that substantial improvement is expected for the conduct of e-services.

The study recommended a framework that can be used in any setup in Kenya to introduce and sustain digital schools. To develop the framework, the research used spiral model, which embraces both the waterfall and the prototype models of system design and development. The framework designed and developed was to be both online and offline.
Dedications

I whole heartedly dedicate this thesis to my family members: My wife Virginia Wanjiku Ndegwa, my son Vincent Nderitu my daughters Susan Wambui and the my little flower Marianne Nduta.
Acknowledgements
I would like to acknowledge the following people for their support in carrying out this research:

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I would also like to appreciate all the principals, head teachers and teachers I collected data from in Naivasha District. The staff at the DEOs office, deputy DEO Mr Erick Ombiri. I can not forget Naivasha MP, Hon John Mututho who spent his money and time explaining issues concerning his constituency.

My research assistants: Mr Josto Macharia(My Brother), Mrs Beatrice Njoki, Miss Anne Mburu of Naivasha Girls, Mr Simon Maina Githua, Mr Mathew Gakiria of Gilgil and Mr Alfred Waweru can not go unmentioned.

My Brothers Mathai George, Paul Mwangi and Philip Wanjoji and their families also played a crucial part in this research.

Lastly, my dear mum and dad Susana Wambui and Nderitu Mathai who have always encouraged me to move above where they left me.

To all above: May God reward you abundantly.
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<thead>
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<th>Acronym</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>BOG</td>
<td>Board of Governors</td>
</tr>
<tr>
<td>CAL</td>
<td>Computer Aided Learning</td>
</tr>
<tr>
<td>CCK</td>
<td>Communication Commission of Kenya</td>
</tr>
<tr>
<td>CDF</td>
<td>Constituency Development Fund</td>
</tr>
<tr>
<td>CEO</td>
<td>Chief Executive Officer</td>
</tr>
<tr>
<td>CFSK</td>
<td>Computer for Schools Kenya</td>
</tr>
<tr>
<td>CICT</td>
<td>Certified Information Communication Technologists</td>
</tr>
<tr>
<td>CIE</td>
<td>Cambridge International Education</td>
</tr>
<tr>
<td>CNN</td>
<td>Cable News Network</td>
</tr>
<tr>
<td>COMESA</td>
<td>Common Market for East and South Africa</td>
</tr>
<tr>
<td>CTS</td>
<td>Carpal tunnel Syndrome</td>
</tr>
<tr>
<td>ECK</td>
<td>Electro Commission of Kenya</td>
</tr>
<tr>
<td>EMIS</td>
<td>Education Management Information System</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>GIS</td>
<td>Geographic Information System</td>
</tr>
<tr>
<td>IB</td>
<td>International Baccalaureate</td>
</tr>
<tr>
<td>IBO</td>
<td>International Baccalaureate</td>
</tr>
<tr>
<td>ICT</td>
<td>Information Communication Technology</td>
</tr>
<tr>
<td>IFAD</td>
<td>International Fund for Agricultural Development</td>
</tr>
<tr>
<td>KCPE</td>
<td>Kenya Certificate of Primary Education</td>
</tr>
<tr>
<td>KCSE</td>
<td>Kenya Certificate of Secondary Education</td>
</tr>
<tr>
<td>KDN</td>
<td>Kenya Data Network</td>
</tr>
<tr>
<td>KIE</td>
<td>Kenya Institute of Education</td>
</tr>
<tr>
<td>KNEC</td>
<td>Kenya National Examinations Council</td>
</tr>
<tr>
<td>MDG</td>
<td>Millennium Development Goals</td>
</tr>
<tr>
<td>MI</td>
<td>McConnell International</td>
</tr>
<tr>
<td>NGO</td>
<td>Non Governmental Organisation</td>
</tr>
<tr>
<td>PTA</td>
<td>Parents Teachers’ Association</td>
</tr>
<tr>
<td>TTC</td>
<td>Teachers Training College</td>
</tr>
<tr>
<td>UPS</td>
<td>Uninterruptible Power Supply</td>
</tr>
</tbody>
</table>
CHAPTER ONE
INTRODUCTION

1.1 Background to the problem
The introduction of computer studies by the Ministry of Education, Science and Technology was received with mixed feelings by parents and school administrators in the late 90s. According to the MOEST (2005), this technology if adopted helps in developing knowledge, skills, values and attitudes for schools that may invest in it as stipulated by Kenya Institute Education (2003). As a result, a few schools ventured into this expensive project while others sat back to see the results of their investment. Others did not have an idea on what they could do with the technological change. The computer studies syllabus was introduced in 1996. The first group of the candidates did their form four examination in 1998 after studying it for only three years.

The original objectives of the Kenya Institute of Education (1996: viii) in introducing computer studies in secondary schools were for the learners to:

(i) appreciate computers and their components,
(ii) develop basic skills in the safe use and care of computers and their peripheral devices,
(iii) be acquainted with the fundamental concepts of computing,
(iv) appreciate the use of computers in different areas of application,
(v) appreciate the impact of computer technology on society,
(vi) develop the skills to use application packages,
(vii) appreciate programming and acquire the knowledge to write and run simple programs,
(viii) identify different educational and occupational opportunities available in the computing field, and
(ix) acquire a firm base for further education, training and the world of work.

A school that invests in computer systems for learning becomes a digital school. Though an expensive investment, it makes the learners to be part of the global village especially if connected to the Internet. Before a school invests in this technology, it must carry out a feasibility study to find out whether it is going to be sustainable. This is called e-readiness.

According to Economist Intelligence Unit (2009: 1),”e-readiness is a measure of the quality of a country’s ICT infrastructure and the ability of its consumers, businesses and governments to use ICT to their benefit”. This suggests that thorough ground work needs to be done if schools are to fully benefit from the establishment of digital schools.
According to Intermediate White Board Network (IWBnet), a digital school is a place where the teaching resources and the administration and communications systems are predominantly digital in nature (2008). The term digital is defined by the TechTerms Computer dictionary (2009) as forms of storage that can easily be copied, edited, and moved without losing any quality for example through compression. IWBnet is a body which acts as an independent intermediary between interested parties out to promote digital schools by using its consultancy work, research, writings, publications, conference and seminar program, teacher professional development programs and its various web services to constantly inform, and help lead the way forward. It helps schools to realize the many benefits of the Commonwealth Government Digital Education Revolution.

A digital school continually strives to take advantage of the opportunities afforded within the digital paradigm to further enhance the quality and effectiveness of the education it provides. It is the growth of digital resources such as CDs, DVDs, and websites among other e-resources used in the teaching and learning process that is showing the way for digital development in the schools’ total operations.

According to Ministry of Information and Broadcasting (2007), digital schools should have the following characteristics:

i. equipped with computer hardware and software,
ii. equipped with ICT tools to provide the learners and teachers with skills and

iii. have Internet connection.

This means that the Ministry is aware of what is needed in terms of hardware and software to make digitization a success.

MOEST (2005) notes that the growth of digital schools since the advent of the micro computers has been rising steadily in many countries. Most of the developed countries have fully gone digital in the provision of education. In most of the countries in Africa, only the schools offering the international curriculum have digital systems to conduct teaching and learning. The rest still hold to the traditional way of pedagogy.

In Kenya, the number of candidates taking computers studies is too small compared to other subjects. This is as shown in table 1.1. The number is still very small compared with the time when the syllabus was introduced into the education system. According to KNEC(2009), majority of the schools offering the subject are private schools while the rest are the big public schools in the country. The provision of computer studies as a subject in the curriculum is a good base for digitization of learning activities. Though the government of Kenya through the Ministry of Information and Broadcasting(2007) recognizes the role ICT through the digital schools and villages
will play in the development of the country, little e-readiness seem to have been done by the stakeholders both from private and public sectors.

KNEC (2001) notes that it was in the year 2000 when the candidates studied the course for four years. This means that the previous groups never had the maximum time one would require to study the course. It also suggests that there was an anomaly in the introduction of the subject into the curriculum.

The table below generated from KNEC reports show how the candidature has been for the last twelve years.

Table 1.1: Enrolment of candidates in computer studies over years

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Candidature</th>
<th>Computer Studies Candidates</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>172883</td>
<td>114</td>
<td>0.0659</td>
</tr>
<tr>
<td>2000</td>
<td>181966</td>
<td>611</td>
<td>0.3358</td>
</tr>
<tr>
<td>2001</td>
<td>194883</td>
<td>1115</td>
<td>0.5721</td>
</tr>
<tr>
<td>2002</td>
<td>198356</td>
<td>2176</td>
<td>1.097</td>
</tr>
<tr>
<td>2003</td>
<td>207730</td>
<td>2955</td>
<td>1.4225</td>
</tr>
<tr>
<td>2004</td>
<td>222676</td>
<td>3140</td>
<td>1.4101</td>
</tr>
<tr>
<td>2005</td>
<td>260665</td>
<td>3414</td>
<td>1.3097</td>
</tr>
<tr>
<td>2006</td>
<td>243453</td>
<td>4183</td>
<td>1.7182</td>
</tr>
<tr>
<td>2007</td>
<td>276239</td>
<td>4500</td>
<td>1.629</td>
</tr>
<tr>
<td>2008</td>
<td>304000</td>
<td>5498</td>
<td>1.8085</td>
</tr>
<tr>
<td>2009</td>
<td>376000</td>
<td>6198</td>
<td>1.6484</td>
</tr>
<tr>
<td>2010</td>
<td>354951</td>
<td>7045</td>
<td>1.9847</td>
</tr>
</tbody>
</table>
This research used Naivasha as its case study. It is in Nakuru county of the Rift Valley Province in the Republic of Kenya. It was a new district curved from the larger Nakuru district in 2007. It has five divisions which are: Mai Mahiu, Kongoni, Elementaita, Naivasha and Gilgil. The district is served by one public library which is located in Naivasha town which was opened in 1996.

The place is rich with natural resources especially sand and diatomite. According to Harttey (1985) the area has major attraction sites to tourists such as Mt Longonot National park, Mt Margaret, Lake Naivasha, Lake Elementaita, The Hells Gate, and Olkaria among others. The area around the lake has agricultural activities such as a fishing, horticulture and floriculture which help in boosting the economy of Kenya. It therefore can be considered a major contributor to the country’s Gross Domestic Product (GDP).

According to the statistics obtained from the DEOs office in January 2009, there are 117 public and 33 private registered primary schools and 32 public and 21 private secondary schools. Of the secondary schools in the area, only 6 schools were offering computer studies as an examinable subject at KCSE. These schools were Koelel, Utumishi, Naivasha girls, St Anne Delamere, Shiners girls and Gilgil High school.
The Ministry of Information and Broadcasting (2007) provides the following as its specific objectives:

i. formulation of policy for the Development of ICT Infrastructure,

ii. promote Equity in the provision of ICT in the country,

iii. facilitate development of skilled human resources for the ICT sector,

iv. encourage the development of ICT capacity in the country,

v. formulation of policy for the implementation of universal service access fund,

vi. disseminate information to the public,

vii. promote and project the positive image of the Government,

viii. promote film production in the country, and

ix. mainstreaming HIV/AIDS, health and safety activities in the core functions of the Ministry.

All these can become a reality through the digital schools and villages.

The teacher and the learner in the rural area are forced to rely on what is written in books and what is aired by the media houses without much verification. Even with the prices of the hardware and software going down, and more open source software being made available, very few schools have taken this advantage. This acts as a proof that e-readiness was never given keen seriousness it deserved when the subject was introduced. If the different ministries concerned with e-readiness such as Education,
Information and Broadcasting, Office of the President, Energy were to approach it with a common front in every area of Naivasha, then digital schools would have become a success.

Kamar (2006) observes that information, which is both a resource and an asset when characterised by relevancy, quality and timeliness helps in increasing knowledge, reducing uncertainties and adding value when in place rightly.

It is worth noting that information and its availability and uses are basic needs in the modern society in this ICT era. Wagacha (2007) notes that it can be used in bridging gender equality gap as both men and women become knowledgeable on how to take care of themselves and their families. She observes that improvement in the quality of life has been witnessed in many parts where women are exposed to information, as such men. The results are far reaching in the improvement of overall development in general.

Digitally available information helps learners to move at their own pace getting a lot of information without solely relying on printed work and the traditional teacher. This is only possible if the right ICTs are introduced which are sustainable after e-readiness has been done.
1. 2 Statement of the problem

Ministry of Information and Broadcasting(2007) notes that the Government of Kenya has for the last five years been busy laying foundation for the digital villages and schools in all parts of Kenya. It has laid down fiber optic cables to most of the major towns in Kenya. The government has also been active in rural electrification through Constituency Development Fund (CDF) and the Kenya Power. Among the TV stations, issues of rural development and ICT have become quite common discussions in different forums. Daily newspapers especially the Nation and the Standard dedicate a lot of features on ICT issues every Sunday, Tuesday and Wednesdays. All these as Economist Intelligence Unit (2009) notes, constitute towards e-readiness.

The Ministry of Education on the other hand sensitizes the CEOs in schools on the importance of adopting ICT in their operations through workshops and seminars. The Ministry is also concerned with the performance of science subjects and mathematics and feels that ICT should be incorporated in their teaching MOEST (2005). The big hardware and software companies are dedicating some of their profits to the promotion of ICT in Africa, Kenya inclusive. Such companies include: Microsoft Corporation, IBM and Hewlett Packard. There are also many exhibitions in the ICT field by universities and companies which inform people on the latest technologies that have been developed. Many institutions and NGOs have also taken the issue of promoting ICT seriously. These include: Nepad through the e-school project and
World Bank. This has been observed by NEPAD (2008), Wangui (2008) and Economist Intelligence Unit (2009).

DVN(2009: 1) notes that the National ICT Policy recognizes schools and other institutions capable of providing e-education and e-learning as principal partners in the delivery of the Government of Kenya’s overarching policy objective of a prosperous ICT driven society with widely accessible and affordable ICT products and services. It observes that “digital schools will be equipped with computer hardware and software plus other ICT tools capable of equipping students and teachers with ICT skills. They will also be points of Internet access for educational, research and other curriculum-related online content.” With this in mind, then the government needs to be at the fore front in encouraging schools to invest in computer education. If the digital villages are to succeed, then the government ought to help first the digital schools which are already on the ground in a number of schools through the provision and additions of the needed infrastructure in both rural and urban areas.

Ministry of Information and Broadcasting (2007) underscores the commitment of the government to helping in the development of digital schools. It notes that “the Government will continue to develop appropriate institutional and policy frameworks to facilitate the use of ICTs to foster the development of its skilled human resource base and will in particular encourage the development and use of e-education
applications and on-line training programmes as a means of improving the delivery of education to the population and ensuring a constant supply of skilled manpower resources.”

The 8-4-4 syllabus is quite detailed in content to motivate the learners. The unfortunate thing is that only 1.7% of all the candidates presented to take KCSE sat for the computer studies papers in 2007 exam, 1.8% in 2008, 1.6% in 2009 and 1.9% in 2010 of the total candidature. This creates a situation in the society where we will have only a small population of the youths being digitally compliant to even motivate others in the rural areas to appreciate the computers. Majority of the schools that provide candidates in computer studies are from the urban areas and private schools which are out to make business from the subject. This suggests that many schools in the district may not be adequately ready for these technologies.

E-readiness entails that schools have the needed hardware, software and qualified manpower to handle the imparting of skills. It is also important that a policy be in place to guide the operations of the digitals schools. Through this, the digital schools can be used to teach the ICT skills and also be used for e-learning purposes. The absence of e-readiness means that schools may have the facilities that are not utilized or are under utilized. Due to the foregoing, there is need to carry out a study to examine e-readiness among the schools in the Naivasha district with the aim of designing a framework to guide in the implementation of digital schools. The
framework would provide information on hardware, software and liveware in digital schools, the setup expected and also provide updates on ICT trends. It would also provide a portal of teaching materials in ICTs and give feedbacks to the users through online interactions.

1.3 **Aim of the study**

The aim of the study was to investigate e-readiness with the view of developing a framework for implementing and sustaining digital schools in Naivasha district.

1.4 **Objectives of the research**

The study had the following objectives:

(i) To find out how many schools are providing computer lessons

(ii) To examine how the schools make use of the ICTs in teaching and administration

(iii) To determine whether the infrastructure needed to support the digital schools is available in Naivasha district

(iv) To assess the level of e-readiness in the district in terms of physical, technical and human resources

(v) To design and develop a framework for implementing and sustaining digital schools.
1.5 Research questions

The research had the following research questions:

(i) Do schools in Naivasha district use ICTs in teaching, administration and communication?

(ii) How e-ready is Naivasha district to the implementation of digital schools?

(iii) What challenges are the schools facing in offering computer lessons in terms of hardware, software and liveware in relation to the Mc Connell e-readiness tool?

(iv) How can learning institutions sustain their digital schools to be able to provide information technology skills to the learners?

(v) What should constitute a model digital school?

1.5 Significance of the research

(i) The research unearths the main challenges affecting the implementation and maintenance of the digital schools. This can help institutions investing in the ICTs know how to handle the challenges as they come.

(ii) The research comes up with a model for implementing digital schools which can be applied in any set up in Kenya. Many digital schools have been noted to be developed without something to lean back to when challenges are experienced.
(iii) It also unearths the roles the digital schools can play in bringing services closer to people such as e-learning and e-communication. Many digital schools are not opened to the public. By rendering services to the public, the schools can generate income which can be used to sustain the project.

1.6 Assumptions

The research was based on the following assumptions:

i. Many schools invest in digital technologies to impart skills to the learners without considering the sustainability of such projects.

ii. Digital schools have not been utilized to the maximum by the learners, teachers and the community around the schools because of the absence of guidelines to follow in their utilization.

iii. Schools have not invested in computer technology because of the absence of e-leadership, physical infrastructure and ignorance.

1.7 Scope

The research was restricted to a single district, that is, Naivasha. Being a case study, the information got may not be a replica of other areas in Kenya.

1.8 Justification of the study

The Government of Kenya has for the last five years been laying ground for digital schools’ implementation through a number of ministries. This has been through:
i. Rural electrification projects for example through the stima loan project. This has made many areas in the country get electricity hence laying a good foundation for digitization;

ii. Introduction of computer studies as a teaching subject in secondary schools. The computer syllabus has been revised since inception incorporating the new trends in ICTs. This becomes a good base for schools to invest in computer technology. The primary schools that have computer lessons are forced to come up with their own syllabus;

iii. Creation of the ICT board under the office of the president. The board advises the government on all matters of ICTs in the country. It was established in 2007 as a state corporation under the State Corporations Act Cap. 446;

iv. Zero rating computer accessories and equipment and reduction of the taxes to 5% of the computer software in 2009/2010 Kenya’s budget. This means that many schools can afford computer equipment which learners can use to learn computer skills as well as use them to learn other subjects;

v. Ministries having websites where they put information. Important information which the public needs to know is put in these websites. They put downloads in form of reports and other e-publications which the public may be in need of;
vi. Many high and middle level colleges offering computer related courses. The KIE ensures that all the courses examined by the Kenya National Examinations Council (KNEC) have an ICT component. This acts as source of manpower to the digital schools.

Many countries in the west have already established digital schools to help in e-learning. This is a challenge to the developing countries Kenya inclusive. This then suggests that such as study is of benefit to the Kenya’s schools including the ones in the rural areas hence the issue of e-readiness becomes very crucial before the starting up digital schools at any place.

1.9 Definition of operational terms

**Digital school:** This is a school that has ICT equipment that are used in the provision of information and making e-learning a success. It may be a primary or a secondary school. They are points of Internet access for educational, research and other curriculum related online content.

**Digital village:** This is a cybercafé in the rural areas that offers services such as access to government services (e-government) and other business services.

**Digital:** This is the data which the computer understands and is normally in form of bits(Binary digits)
**e-banking:** is defined as the automated delivery of new and traditional banking products and services directly to customers through electronic, interactive communication channels

**e-business:** This conducting buying and selling products and services via the Internet

**e-government:** electronic government, also known as e-gov, digital government, online government or in a certain context transformational government refers to government’s use of information technology to exchange information and services with citizens, businesses, and other arms of government.

**e-learning:** Refers to computer-enhanced learning. It makes use of ICT equipment which are both online or offline.

**e-readiness:** Having the needed frame work for implementation of the digital villages and schools(physical, human and technical resources)

**ICT:** This means Information Communication and Technology. It means the usage computer related equipment and technologies in communication.

**Information:** This is knowledge and understanding that is usable to the recipient

**Internet:** is a global system of interconnected computer networks that interchange data by packet switching using the standardized Internet Protocol Suite

**Offline:** This is the opposite of online. It means that the computers are not connected to the Internet.
**Online:** This means connection of the computers to the Internet.

**Pedagogy:** This is the correct use of instructions or strategies or the process or act professional teaching.

**Syllabus:** This is an outline and a summary of topics to be covered in a certain subject.
CHAPTER TWO
LITERATURE REVIEW

2.0 Introduction
This chapter analyses literature about digital schools and the importance of e-readiness. It also discusses Mc Connell e-readiness tool which was the theoretical framework used in the research. It looks at the functions of the digital schools if established and also the factors that may hinder their establishment.

2.1 Theoretical framework
The implementation of digital schools requires that e-readiness is done if the project is to become successful. According to Mc Connel(2001), e-readiness is the measure of a nation to participate in a digital economy while according to Economist Intelligence Unit(2009) it is an evaluation of the quality of a country’s ICT infrastructure. It also looks at how the consumers are to benefit from it. This suggests that it focuses on the utilization of ICTs in place.

Ghavamifar, Beig and Montazer (2008) feel that the main problem with e-readiness assessments is the lack of a common standard assessment policy that would provide unified assessment measures, support relative analysis and comparisons, and help in diagnosing problems and deriving solutions. There are different available models for the assessment of national and international developments. This research used an e-
readiness tool by McConnell International (MI), a global technology policy and management consulting firm as its theoretical framework in assessing the e-readiness of the Naivasha district to the implementation of digital schools.

According to Ghavamifar, Beig and Montazer (2008), this tool measures status and progress on five interrelated attributes with sub-indicators as connectivity, e-leadership, information security, human capital and e-business climate.

The MI rates countries in five categories on a scale of one to three ("blue", "amber", "red") in which blue indicates that the majority of conditions are suitable to the conduct of e-business and e-government while amber indicates that some improvement is needed and red indicates substantial improvement is needed in the conditions necessary to support e-business and e-government.

McConnell International (MI) e-readiness tool is also supported by Digital Education Revolution (2008) which looks at four aspects that are crucial to a school starting digital education. These include:

**Leadership:** This ensures that schools have a coordinated plan for the provision of infrastructure, learning resources and teacher capability to address the educational challenges of the 21st Century.
**Infrastructure:** This helps in accessing digital teaching and learning resources and tools for processing information, building knowledge and for communication and collaboration.

**Learning Resources:** These stimulate, challenge and assist students in achieving desired learning outcomes. These include collaborative and interactive activities as well as instructional and reference materials.

**Teacher Capability:** Teachers have the skills and tools to design and deliver programs that meet students’ needs and harness the benefits and resources of the digital revolution.

Renu and Sameer (2002) note that on the basis of the objective and focus of a study any of the models can be adapted or evolved based on local needs. This study customized McConnell International (MI) e-readiness tool to rank Naivasha district. The tool breaks the factors to be used to assess ICTs in area which may be a country or even an institution into components that can be scaled and considers the role of the government in promoting ICTs in a country. Other available tools which may not easily be customized to a school setup include: CSPP, CID and APEC readiness guides.

To be able to rank an area using the tool, a thorough assessment based on the following is done:
(i) Connectivity

This is the interlink between computers in a network. KIE(2003) recommends that computers that are to be used in schools be networked. Mitchell (2011) notes that a Local Area Network(LAN) is useful for sharing resources like files, printers, games or other applications. LAN may connect to other LANs and eventually to the Internet. Connectivity also deals with power connection to run the systems. Gakuu et.al (2011) note that out of a sample of both primary and secondary schools drawn from Nairobi and Central Province, only 38% had internet connectivity for use in e-learning.

(ii) e-leadership

Burke (2011) notes that e-leadership is a modern way of bringing people, tools and resources together to solve problems by adopting modern technological developments in ICTs. For the digital schools to succeed, the school administrations must embrace and accept the e-world. It is through this that the skills will trickle to the learners. Gakuu et.al (2011:93) observe that: “the ICT skills of school managers are seen as a major success factor. In cases where the manager had ICT skills or had keen interest, a trickle down effect was observed”. The same is observed by Kidombo(2009).

(iii) information security

Crystal(2011) observes that information security is a process of protecting information availability, privacy and integrity. Security of data can be compromised especially in
a networked environment. The stakeholders need to be sensitised on how to keep information secure.

**(iv) human capital**

This deals with the people who are to impart the ICT skills to the learners. MOEST (2005) notes that in the evaluation of ICTs in education, there is a need to look at the ICT literacy of the people imparting the skills to the learners. It notes that the integration of ICTs in the operations of the schools will make digital schools become a success. This is also observed by Gakuu et.al (2011) and Kidombo (2009).

**(v) e-business**

According to Nelson (2000) it is the conduct of business on the Internet, not only buying and selling but also servicing customers and collaborating with business partners. Digital schools that have internet connection can sustain themselves by providing such a service to the community around. The amount of money they charge can help in sustaining these systems. This is by performing e-services such as e-banking and e-commerce. Gakuu et.al (2011) and Kidombo (2009) note that many schools (90%) in urban and semi urban areas have computer systems and 38% have internet connectivity. With such an infrastructure, the schools can venture into e-services hence making their projects sustainable.

In the Information age, countries without high levels of resources can hope to accelerate development if they are able to develop knowledge and information which,
combined with adequate ICT-related infrastructure, can allow successful integration into knowledge-based economies. This is what can help in reducing the digital divide experienced in the world now.

Economist Intelligence Unit (2009) also supports the McConnell International (MI) model of e-readiness by stressing on the importance of the ICTs developed being of importance to the consumers.

**Importance of e-readiness**

Renu and Sameer (2002) note that e-readiness assessment, when properly applied in a larger process of evaluation, is a first step towards converting good intentions into planned actions that bring real changes to people’s lives. E-readiness assessments are meant to guide development efforts by providing benchmarks for comparison and gauging progress. E-readiness assessment can also be a vital tool for judging the impact of ICT, to replace wild claims and anecdotal evidence about the role of ICT in development with concrete data for comparison. This then becomes the entry point to any digital school establishment.

MOEST (2005) suggests that for ICTs to be implemented in schools two forms of e-readiness should be done. These are access e-readiness and content e-readiness. All should be addressed at institutional, national and international levels.
Access e-readiness

(i) Institutional access e-readiness: This is what the school has in terms of power connectivity, security, computer systems, policies, LAN and WAN connectivity.

(ii) National access e-readiness: This is the telecommunication connectivity of a country though it is not a big issue with the entry of the wireless networks.

(iii) International access e-readiness: These are licensed groups to provide Internet backbone services for example UUNET, KDN among others.

Content e-readiness addresses the availability of suitable (relevant) content at the various levels of the learners and the teachers. Gakuu et.al (2011) notes that many schools in Nairobi and Central Kenya which have computer systems have ventured into a form of e-learning.

2.2 Definition of digital schools

Digital schools suggest cybercafes in schools. This phenomenon is mostly a reality in the international schools such as Greensted School in Nakuru, ISK or St Mary’s school in Nairobi. Most of the schools offering computer studies as a KCSE subject in the country only have computers which work offline meaning that the learners can not conduct online research by themselves from the Internet. The syllabus according to KIE (2003) provides a whole topic on the Internet to be taught which the teachers
ignore or ask the learners to research amongst themselves. KNEC (2007) observes that a question in the national exam which required the knowledge and application of the Internet was poorly performed because many schools do not have Internet connection. The learners using the Internet without guidance do not properly utilize this e-resource. Majority will go for computer internet games, email systems and social sites such as face book and fan book. Some end up getting to the pornographic sites or movies which lead to moral decay in the society.

According to IWBnet (2008), a digital school is one where the operations are predominantly digital. The availability of computers, TV sets, VCR, smart boards among others help in making services in schools highly digital.

According to Loertscher (2003), a digital school is the same thing as an online school or a virtual school where students and teachers may not meet face to face in the same location, but are connected by technology either synchronously or asynchronously. This definition stresses the need for communication though not face to face interaction between the teacher and the learner.

According to Greenleaf (2010) digital schools or virtual schools are educational facilities that are not a physical location, but rather are located on the Internet. The primary difference between a virtual school and a stand-alone brick and mortar school is the latter's physical interactions among teachers, staff and students. Virtual schools
offer programs and curriculum for all grade levels. This definition relates to online interaction between the learner and the teacher though should not be the case all the time.

DVN(2009) acknowledges the role the Government of Kenya is playing in making digital schools through policies and provision of the necessary infrastructure. The same sentiments are echoed by Ministry of Information and Broadcasting (2007). It appreciates the role they can play in facilitating e-learning. The provision of the infrastructure needs to be provided to both the urban and rural areas if digitization of schools is to become a successful phenomenon in Kenya.

IWB (2008) reports that many schools globally are close to leaving behind the paper paradigm and positioning themselves to take advantage of the largely untapped potential of a digital operational paradigm. It feels that such schools have positioned themselves to take advantage of the immense opportunities opened to give an even richer, more effective and efficient and more attractive education.

The Computer for Schools Kenya (CFSK), a non-profit making body is instrumental in making digital school a success in a number of institutions in the country. It strives to always get systems that are environmental friendly.

The body has the following as its objectives:
(i) to provide an assessment of the regional situation on e-waste tools to develop national policies for reuse, repair, refurbishment and recycling and capacity building to implement those policies,

(ii) to raise public awareness on the environmentally sound management of used and end-of-life electrical and electronic equipment (CFSK, 2008).

The CFSK has succeeded in making a number of schools get computer systems and also helped in ensuring that there is less or no e-wasting.

2.3 Initiatives to the implementation of the digital schools

2.3.1 Global initiatives

(a) NEPAD

NEPAD (2004) has been quite instrumental in Africa in the promotion of the usage of ICT through e-schools initiative. The specific objectives of the NEPAD e-schools initiative include:

(i) to provide ICT skills and knowledge to primary and secondary schools students that will enable them to function in the emerging information society and knowledge economy,

(ii) to provide teachers with ICT skills to enable them use ICT as tools to enhance teaching and learning,
(iii) to provide the schools managers with ICT skills so as to facilitate the efficient management of schools and

(iv) to make every learner health literate.

According to Evoh (2007) the aim of the initiative is to impart ICT skills to young Africans in primary and secondary schools as well as harness ICT to improve, enrich and expand education in African countries. Kenya has already signed this hence a beneficiary. It was part of the demonstration projects whose purpose was to accrue a body of knowledge, based on real-life experiences of implementing ICT schools across the African continent in order to inform the rollout of the NEPAD e-schools initiative. These included:

(i) investigating and reporting of the typical scenarios,

(ii) circumstances and requirements for implementation,

(iii) challenges in large scale implementation,

(iv) effectiveness of partnership and partnership models and

(v) benefits of the envisaged satellite based connectivity network.

The e-school initiative is seen as a good avenue for bridging the digital gap in Africa. Mikenga (2008) reports the South African former Deputy President while opening a NEPAD e-school stakeholders meeting in South Africa in 2007, saying that e-schools will play a major role in reducing the digital gap that exists especially in Africa.
Through the use of ICT, the levels of educational standards can be raised. This can help in reducing inequality, poverty and unemployment in our countries. This is because through ICTs, information which is a factor of production can be repackaged easily for consumption.

While underscoring the importance of people as stakeholders in ICT, she affirms that ICT skills development is not only about infrastructure, but rather it is about the interface between the infrastructure, connectivity, electronic content and people. She notes that this technology needs to be adopted to change the lives of the people in Africa.

(b) The World Bank

Malakata (2009) reports that the World Bank offers financial support to the African states to improve their ICT infrastructure. The World Bank announced a program to fund ICT African infrastructure development in 2007. He observes that the program was created after calls by various governments in the region requesting funding from the bank for telecom infrastructure. Many developing countries especially in Africa such as Rwanda, Zambia, Burundi and Nigeria have benefitted from this.

(c) International companies

NEPAD (2004) acknowledges the roles played by the international computer hardware and software companies in bridging the digital gap. These companies
include Demo AMD, Helwett Packard, Microsoft and Oracle. It notes that the e-
school initiative involves over six hundred thousand schools across Africa, Kenya
being among them. The participation of Helwett is also acknowledged by Wangui
(2007).
(d) School Net Africa
MOEST (2005) recognizes School Net Africa, an NGO playing a crucial role in
helping many schools in Africa be at par with others technologically. Since its
creation, Fall (2008) notes that it has been able to:

i. facilitate schools’ access to Internet and IT tools through the
campaign for One Million Computers for Youth,

ii. reinforce students’ and teachers’ capabilities relating to the
integration of ICT into teaching and creating areas for collaboration
and experience-sharing between teachers,

iii. develop educational material adapted to the daily lives of students,

iv. organize Mtandao Afrika, a website development contest for young
people, dedicated to stimulating the creativity of African youth, and
increasing their ability to lead collaborative projects and showcase
their talents,

v. organize campaigns to promote ICT usage and experiences at
different teaching levels and
vi. develop activities to bring together the educational community, local collectives, the private sector and developmental partners for more powerful support of initiatives to integrate ICT into schools.

Through its activities, the School Net Africa has been able to improve the levels of ICTs in many institutions.

2.3.2 National initiatives

The following have been active in promoting digital schools nationally in Kenya:

(a) Computer for Schools Kenya: Computers for Schools Kenya (CFSK) is a charitable non-governmental organization registered under the Kenya Non-Governmental Organizations Co-ordination Act. CFSK (2008) highlights some of the successes of the organization in promoting digital schools. These include:

i. sourcing, placement and support of over 18,000 computers in over 600 institutions,

ii. provision of generators to 21 schools,

iii. provision of Internet connectivity to 16 schools,

iv. development of intensive skills-based hands-on training programmes for school head teachers and ICT tutors,

v. development of an ICT Integration Pedagogy Course,

vi. development of a remotely-accessible eLearning Platform, already in use by the Kenya Medical Training Centres,
vii. quality hands-on skills based training of over 4000 persons,
viii. development of curricula for training – simple user proficiency to high level professional competence in ICT,
ix. development of local digital content for ICT in education,
x. development of model examinations, administered to over 10,000 students so far,
xi. a successful Volunteer and Internship Programme which has benefited over 200 young people so far,
xii. extension of ICT access to disadvantaged groups in society for example children’s homes, schools for the deaf, a rehabilitation centre for street children and a centre for girls with special needs,
xiii. defining standards for ICT integration in education many of which have subsequently been adopted by the Ministries of Education,
xiv. active participation in national policy formulation for the ICT sector, especially in training and education,
xv. establishment of an innovative e-Waste Management Centre which is the first in the region,
xvi. establishment of lasting and effective multi-stakeholder partnerships and
xvii. provision of ICT access to an estimated 750,000 young Kenyans and their communities.
This proves that CFSK is actively involved in e-readiness through the provision of human, technical and physical support to institutions especially in secondary schools.

(b) ICTVillage.com

ICTvillage.com is a business lobby for ICT innovation which seeks to make Kenya the ICT hub of Africa through the following ICT-focused initiatives in Kenya:

i. ICT Projects,

ii. ICT Portal,

iii. ICT Events for example exhibitions, tours and conferences and

iv. ICT Magazine – published once every three months.

ICTvillage.com is managed and marketed as a division of Idea Factory Limited - a privately owned technology business incubator based in Nairobi. All its activities are funded through revenues generated from various activities (ICTVillage.com, 2007).

(c) Institutions and companies

There are a number of institutions which have also been involved in donating ICT facilities to schools. CFSK (2008) acknowledges the following as being instrumental in helping the development of the digital schools in Kenya:
They donate the equipment as individual institutions or companies or they work through the Computer for Schools Kenya (CFSK). This acts as a proof that many organisations have been involved in the promotion of ICTs in schools. The level to which schools are e-ready is what is crucial in determining the success and sustainability of the projects.

2.4 Importance of the Digital schools

The digital schools if established will help in:

(i) **Creation of jobs**: The jobs created will be both direct and indirect as the Kenya’s Chairman ICT Board observes. This helps in improving the economy. Ministry of Information and Broadcasting (2007:6) in the foreword by a former Minister for Broadcasting and Communication observes that “Kenya has reached
a point where she must shift from depending on an agricultural base which is characterised by a relatively weak industrial foundation and embrace a knowledge economy”. He goes ahead to note that with ICT there are “potentials and prospects to generate additional jobs and employment opportunities for the growing youthful population”.

(ii) **Provision of information**: Loertscher (2003) notes that the digital schools will aid in information provision. This information will be used in making decisions regarding many issues affecting the society. Ministry of Information and Broadcasting (2007) observes that ICT applications have enabled countries make gigantic improvements in productivity and quality of services such as finance, trade, distribution, marketing, education and health. All these can help in the fight against poverty which is prevalent in the rural areas. The digital schools will become e-libraries which will be providing information to the people on the school compound in different fields of knowledge. Gitonga (2009) reports that with the installation of fiber optic cable across the country, life-enhancing disciplines such as educational, clinical and other scientific research, which depend on real-time sharing of data around the world, will also become more available for many African organisations. Kamau (2009) reports the permanent secretary in the Ministry of Information and Broadcasting lamenting that there is need to develop content about Africa. He notes that many people are willing to pay for information about Africa especially the researchers. He laments that the
negative publicity Kenya is having abroad is as a result of less information on the Internet about it. With Internet becoming cheaper, the concentration should be towards content development to market Kenya to the outside world.

(iii) **Communication:** Loertscher (2003) notes that through the digital schools, communication and social networking will be possible. The learners and their teachers will be able to share their religious and cultural beliefs. People will make friends from far and wide using services as the ones provided by fan box or face book and email systems. When the fiber optic cable becomes fully operational, Gitonga (2009) reports that the Internet will become relatively cheap. Kinyanjui (2009) also notes the same about the fiber optic. He reports that the cost of telephony and Internet connections is expected to drop by 80% in 24 months. The Kenya’s Permanent Secretary in Ministry of Information and Broadcasting notes that the infrastructure will serve as the pillar on which services will ride to support the demands of a modern economy. Mulanda (2009) observes that the arrival of the fiber optic will cut down the cost of communication and increase speeds replacing the satellite system, which is expensive and slow. ICT in Africa (2009) reports that the lack of a well developed fiber network is one of the major causes of high costs of bandwidth and poor access in many of the developing countries. Gakuu et.al (2011) notes that many teachers have email systems which they use for communication.
(iv) **Centres for computer literacy**: According to Loertscher (2003), digital schools can act as the centres of computer literacy classes. Ministry of Information and Broadcasting (2007) quotes the PS in the ministry noting that ICT can spur economic recovery. He observes that Kenya needs depth of relevant skills, good work ethos, managerial capabilities and entrepreneurial drive. These can be created by the digital villages and schools. When people have computer skills, it will be possible to create websites which can be used for the marketing of products and services and making programmes which can be used in e-learning. 

CCK (2008) notes that the Communication Commission of Kenya (CCK) has already been commissioned by the KIE to digitise eleven subjects in the secondary school curriculum. Through the usage of the computers to facilitate e-learning, the KIE director feels that learners will have access to quality education and according to the CCK director general lack of relevant content, facilities and skills continue to deny majority of the young access to ICT services. The partnership between the KIE and CCK will also according to him enhance the uptake of ICT services among the youths.

For the teachers to be able to use ICT in teaching, they will require to have many educational and didactical skills to deal with questions adequately. According to Jager and Lokman (1999), they will need skills such as creativity, flexibility,
logistic skills, skills for working in a project, administrative and organisational skills and collaborative skills as well.

(v) **Source of development**: Information has been observed as one of the factors of production in the modern economy. This has been noted by Wagacha (2007) and Kamar (2006). The digital schools will be sources of current information. This is possible especially with the access of Internet in the rural areas. Kinyanjui (2009) notes that much of the growth will come from the rural and home users since the services will be availed cheaply with the fiber optic connectivity becoming a reality. The director-general of the Communications Commission of Kenya (CCK) notes that with the infrastructure, service providers will be attracted to the remote and marginal areas at lower costs. More information will be provided unlike when satellite communication which carries less data is used. Loertscher (2003) observes that the digital schools will create intellectual freedom and a creative learner through information provision. Utilization of information by the learners and the teachers leads to development.

It is observed by Ministry of Information and Broadcasting (2007) that collaborative efforts between the government and all the stakeholders is quite crucial in making both the digital schools and villages a success.

On the issue of the ICT in schools Kareithi (2005:58) observes that for it to succeed:

(i) teachers must believe that the technology will provide students with learning opportunities that would not be available without it,
(ii) they must access to working with computer technology equipment,
(iii) they must access to basic computer skills,
(iv) teachers require training opportunities coupled with administrative support,
(v) time is required to prepare new learning environments that will allow the use of computer technology in the classroom activities and
(vi) refined institutional practices are required to utilise the full potential benefit of the integrated computer technology.

Kareithi (2005:60) notes that the teachers should be at the forefront in playing a central role in the implementation of the strategy. This then suggests that they should be included in all matters pertaining to the development of the digital schools.

The vision of the Ministry of Education ICT unit (2007) states that ICT is a universal tool in education and training. Its mission is to integrate ICT in education and training for improved access, learning and administration. This then suggests that the Ministry should be at the forefront assisting schools settle with the digital schools by providing direction. This has not been evident in the field. In some public schools, the people teaching the subject are not qualified to do so neither is there much assistance by the Ministry to help the institutions acquire ICT equipment.

NEPAD (2008) notes that these skills are the basic to survival in the 21st Century. The same is noted by Nderitu (2002:10) in a Newspaper article who laments about the
removal of the computer studies from the 8-4-4 curriculum in 2002 by the Minister for 
Education. Nderitu (2002) notes:

“Life is not imaginable nowadays without computer skills. They have become a basic 
requirement in our working environment. Whoever denies students these skills denies 
Kenya development”.

This then suggests that having digital schools especially in the rural areas will aid in 
making the users more knowledgeable, more informed hence contribute to the national 
and global development as prepared as that person in the urban areas.

For the digitals schools to be able to achieve the above roles, physical infrastructure, 
technical resources and skills become quite crucial which all constitute e-readiness.

2.5 Inhibiting factors to the digital schools establishment

2.5.1 Funds

The computers and their accessories are quite expensive as observed by Saleemi(2000; 
MOEST,2005; Cooper,2006 and Karamagi, 2009). They are the basic equipment 
needed in the digital schools. Their maintenance is also expensive. Saleemi (2000) 
divides the computer costs into initial and recurrent. In the initial cost, he considers the 
hardware, software, media, training and computer room which should be purposefully 
constructed as a computer laboratory. On the recurrent cost, he considers;
depreciation, wages of the staff, administration expenses such as telephone bills, insurance cover and consumable items.

The hardware that the computer operators need may be classified as:

(i) storage devices: These may include the optical disks, magnetic tapes, magnetic disks and flash memories,

(ii) output devices: These include printers, plotters and visual display units,

(iii) input devices: Example of these include keyboards, mice, scanners among others.

They should be provided together with extra ones just in case one of them fails. There is also the software part that is made up of the applications software and the systems software. All these software can be crashed by virus(es). This suggests that an extra cost of buying an anti-virus has to be incurred. A crash on a computer system is quite expensive.

Otieno (1999:5) observes that “Lack of funds hampers efforts to introduce I.T. in the school system”. This was a remark by a former permanent secretary in the Ministry of Education. He notes that lack of equipment and funds can really hamper the development of ICT.
Saleemi (2000:412) observes: “Sadly, access to computers is largely a privilege of the middle class in many societies and this fact tends to widen the gap between the rich and the poor”. This suggests that the technology might at the end benefit the rich and not the poor or the average.

Munene (1999:24) laments that “the high cost of computing technology favours wealthy schools and students”.

Gakuu et.al (2011) and Kodombo(2009) also note that most of the schools in Nairobi and Central Kenya have not set aside any funds to deal with repairs of the machines when they break down. This explains why in many schools one may get many e-wastes in form of dead screens, keyboards, printers, mice among other electronics

Viruses also make computer users to spend dearly when they strike a machine. On the issue of viruses, Patel (2003:22) observes that “updated anti-virus protection is still the best weapon for computer virus, whether new or old because the neuristics of the latest security software use generic identification covering a range of viruses and variants”. This though the best requires money to be ready all the time to have the anti – viruses updated. Kenya is now at a higher level even in the production of virus. Many computer laboratories and cybercafes are known to be the main sources of viruses found on storage devices of many computer users.
Internet is an important tool in the teaching profession especially in computer studies. But Anderson (2008:9) observes that “local ISPs need to invest in modern data centers comprising of ultra high quality connectivity, networking gear, climate control and security and power systems”. These are quite expensive to many of them and if they invest, the charges drip down to the common man either in a school environment or a cyber cafe.

A pupil in USA where a lot of ICT is used in e-learning is quoted by Latw (2008:5) commenting about a laptop computer saying that “it’s better than just looking in a text book to find answers”. They just click on different web pages to get the answers they want. E-learning becomes a reality if the digital schools are implemented.

The establishment of digital schools can only be practical with the involvement of the Kenyan government, NGOs and donors. The World Bank and the computer hardware and software giants are highly involved in this venture together with individuals who want to bring development by introducing ICT.

Kamar (2006:9) notes that the implementation of “ICT and related policies has been slowed down by the inadequate or inaccessible complementary infrastructure and services which include electricity, telephone, data services and financial services”. She
also observes that finances have been the biggest bottleneck to the establishment of a national information policy where digital schools may fall.

Cooper (2006) in a seminar presentation argues that the role played by computers at work place will continue to grow. He argues that the path to computer efficacy is more difficult for the poor, for ethnic minority and women. This is further supported by KNEC(2010) which reports low candidature among the girls in computer studies with a low mean and standard deviation compared to the boys. Gakuu et.al (2011) on the other hand notes a different trend, where there were more girls into computers than boys in the schools in Nairobi and Central provinces.

Karamagi (2009) notes that Internet connectivity in many of the districts (in Africa) is very limited or even non-existent. She continues to argue that most people in these rural areas do not even know how to use it leave alone how it can be applied to improve their livelihoods. She notes that computer technology is still perceived as white elephants meant for the literates.

2.5.2 Qualified personnel

Manpower is what makes a dream come true. Computer studies as a subject in the curriculum was introduced in schools without considering the people to impart the skills on a serious note.
Otieno (1999:5) notes that “the Ministry (Education) has not been able to provide required teachers due to financial constraints and the fact that such teachers are not available and that many of our teachers lack equipment and training”. Since 2003, many public and private universities have started offering Bachelor of Education degrees in computer studies. The unfortunate thing is that it is happening when the government is not giving the employment of teachers a priority. Some schools have been forced by circumstances to employ their own teachers who are not paid by the TSC. Gakuu et.al (2011) observes that at least 80% of the schools have qualified person to handle ICTs in schools though a large percentage is employed by BOGs. He laments that the situation is worse in primary schools where most parents are not ready to pay any money to hire a computer teacher.

Otieno (1999:5) reveals that “although the secondary schools curriculum on computer studies was in place, the Ministry of Education could not implement for lack of equipment, teachers among other pre-requisites”. Though the situation is changing, not all schools have qualified professional teachers imparting the skills to the learners. This then suggests that the digital schools may experience difficulties in picking up unless the government provides qualified manpower and the necessary infrastructure.

KNEC (2001, 2003, and 2007) observes that there is still very poor performance in computer studies paper (iii) (project). This can partly be explained by the fact that
most of those handling the subject are not properly trained. Many qualified teachers are always on the move to better pastures.

The issue of digitisation especially at Ministry of Education has gone a step higher through GIS (Geographic Information System) and EMIS (Education Management Information System). This according to MOEST (2005) is as a recognition of the role of ICT in the education sector. GIS is a system for capturing, storing, analysing and managing data and associated attributes which are spatially referenced. This can only be successful if there is enough support to create the digital schools.

According to MOEST (2005), EMIS main objective is to provide an effective and efficient framework for harmonised, timely, collection, processing, analysis and dissemination of educational data, shared and used in decision making by the Ministry management, development partners, researchers, NGOs, students and other stakeholders.

Kamar (2006) underscores the role which information professionals may play in bridging the digital divide. But on the other hand she notes that not only are they few but also, they are not motivated to work. These are the people who can make Kenyans know the role of information in development through the digital villages and schools to produce an information literate society where information is an important factor of production. It is sad to note that many of the professionals involved in the brain drain
to other countries have among them computer programmers, technicians, and systems administrators among other ICT professionals.

Kamau (2009) reports on the East African Standard that there is very little information or content about Kenya on the Internet. This may suggest that there are few marketers or human resource managers with web design skills which they can use to market their companies and products. There is a need to have portals that have information about Kenya like the one which was started by Access Kenya at a cost of 10 Million Kenya shillings in 2009. The Manager of Access@home portal is quoted saying that “it is frustrating when using a search engine to look for something Kenyan and out of the thousands of results; none is related to what one is searching for”.

2.5.3 Lack of supportive infrastructure

Computer technology investment is quite expensive as Saleemi (2000) and MOEST (2005) observe but as Nderitu(2002) notes : It is a pre-requisite especially these days to development.

Computers need power and security. This lacks in most parts of Naivasha though the Ministry of energy through rural electrification is quite active in the area. KenGen runs Africa’s biggest geothermal power station in Naivasha where it has many
geothermal systems. Naivasha has other potentials for geothermal power through Mt Longonot and Eburru mountains as Hartley (1985) observes, which are still untapped.

Power shortage is not only a problem in Kenya but also in most parts of Africa. ICT in Africa (2009) reports that countries in African seem to be waking up to the reality that electricity is actually a critical and necessary pre-requisite for development, especially if this development is to be achieved through industrialization and harnessing of ICTs. It puts the picture in more pessimistic way when it reports that in sub Saharan Africa, one can count only a handful of countries where there is no power load shedding today- and this excludes regular outages due to an inefficient generation, transmission and distribution system. The power problem is becoming a paradoxical one- with most countries now peaceful for the first time in decades, economic growth above 5% in many countries, the demand for power has never been greater and yet supply has never been lower. Electricity is one of the biggest challenges to investing on the continent. This suggests that many investors run away from these countries due to the unavailability of power to run systems.

ICT in Africa (2009) notes that there are many reasons why there is a severe and growing power shortage, but the biggest contributor to this problem seems to be sheer lack of planning on the part of the African governments. Several efforts are on at the national and regional levels, to increase power generation, increase efficiency of
transmission and distribution and improve reliability. This is also supported by Evoh (2007).

Ombok (2010) reports that Kenya is in the process of investing in geothermal power in Naivasha. This is because the demand for electricity keeps on rising while the supply is not enough. It is noted that less than 50% of Kenya’s population gets access to electricity.

Kenya’s Prime Minister is quoted by UNEP (2008) saying that millions of people depend directly and indirectly on the Mau Forests Complex. The article notes that Mau complex is an asset of national importance that supports key economic sectors in Rift Valley and Western Kenya, including energy, tourism, agriculture and water supply since it is the single most important water catchment in the Rift Valley and Western Kenya.

Otieno (1999:5) reveals that “many rural schools have no electrical power, computer equipment is expensive and many parents cannot afford basic teaching materials”. This means that such schools would tend to rely on solar energy that is also expensive and unreliable during some weather seasons.

KDN (2007) quotes the Permanent Secretary in the Ministry of Information and Broadcasting observing that tougher measures that need to be taken for the people who
as a result of the ignorance on what the fiber optic cable can do for them, end up vandalizing it. He laments that people need to realize the growth that can come with such connectivity if successfully laid down. To cater for the teaching materials which may be needed, the Internet though expensive, if used well can be a solution especially in supplementing traditional pedagogy (Kinyua, 2002).

MOEST (2005) decries the state of Kenya’s communication connectivity with the outside world as poor, but goes ahead to state that the current situation can be taken advantage of in promoting e-learning in the education sector if proper planning is done. When fiber optic connectivity becomes a reality in most parts of the country, things are bound to improve.

On the importance of Internet, Mutero (2001) notes that developing an Internet culture remains the only way of ensuring that our education sector is not left behind by the information gap.

But with the entry of wireless connections through Airtel, Orange and Safaricom modems among others has made Internet cheaper. This can be harnessed by the teachers for use in e-learning. It can also be used in e-government, e-commerce, e-agriculture among other e-services. If the culture to use the Internet is developed, coverage of the syllabus in depth and width would be possible. Gakuu et.al (2011)
observe that Internet as a tool is not properly harnessed in improving pedagogy with only 38% of schools having it in Nairobi and central Kenya.

**2.5.4 Effects of computer technology**

**2.5.4.1 Health**

Prolonged use of computers as Saleemi (2000) and Wanjohi and Musonye (2005) observe results to:

i. skeletal joint diseases,

ii. increased skin irritation and miscarriage,

iii. tampering with a woman menstrual cycle,

iv. general tiredness, irritability and depression,

v. eye ailment (eye strain and conjunctivitis) and

vi. Carpal Tunnel Syndrome (CTS).

Computers also cause technostress which has the following symptoms

i. aggravation,

ii. hostility towards humans,

iii. impatience and

iv. enervation.

Onunga (2000) notes that improper positioning of the keyboard and the monitor on the bench can cause a lot of ailments on the computer users. This suggests that detailed
knowledge is needed on the implementation of the computer technology. People have to be made aware of these problems and the possible precautions to take.

Most of the companies which aid in starting up the digital schools do donate the already obsolete hardware which have a lot of effects on the users’ health. They use that opportunity to dump their e-wastes from their countries as Nieuwoudt (2009) observes. The users need to be aware of the effects these have on their health. Most people are ignorant to change and unless convinced to see the role digital technology can play, then they may not appreciate it especially if they learn of the health effects computers bring to them.

2.5.4.2 Joblessness

Saleemi (2001) asserts that “people are creatures of habit and hence are afraid of change”. He further says that people usually associate the computer with loss of jobs.

Wanjohi and Musonye (2005), observe that on introducing IT, some jobs disappear while some are done in new ways. The learners will be able to study in the absence of a teacher. On the other hand when the people come to appreciate ICT in the digital schools, many people especially those doing some psychomotor jobs may lose them. The administrators will be left to handle tasks that require face-to-face communication hence will not be overburdened. Many people will be able to do their own jobs without assistance from experts unless the situation is complicated.
If the computers are going to render people jobless as observed by Wanjohi and Musonye (2005) and Chemwa and Mburu(2005), then their acceptance both in the rural and urban areas may not be a welcome.

2.5.4.3 Social communication

Saleemi (2000) laments that people who continuously work with computers expect other humans and human institutions to behave like computers, providing instant response, attention, and with an absence of emotion. This could be the reason why the ICT managers are always in problems with the top-level managers in many institutions. Gakuu et.al (2011) notes that poor communication between the head teacher can hamper the development of ICTs in school.

2.5.4.4 Retraining

Wanjohi and Musonye (2005) observe that technology has made people who were trained before their usage in work places to go back to school and acquire skills. The worst part of the technology is the rate at which it changes and also the unavailability of time to go for training.
Mutero (2001:17) notes that “the biggest complaints by teachers have been scarcity of resources to upgrade their knowledge and teaching skills especially these days when many professions have embraced computer technology”.

Arrington (2006) notes that many old people are scared of computers. As a result not many are comfortable going back to school to be taught by youngsters how to use computers and their accessories.

2.5.5 Government policy

Wanja (2009) notes that the government has improved in data exchange through better connectivity and Internet. She notes that most parts of Kenya are now having better connectivity than before. E-government Directorate (2009) notes that Information and Communication Technology (ICT) is a powerful tool for national, community and personal development. ICTs achieve this function by facilitating the accurate and rapid collection, storage, retrieval, analysis, synthesis and sharing of information. This enables both informed policy formulation and effective decision-making.

UNEP (1990) notes that the UN objective number 21 of Promotion of Education, Public Awareness and Training; is to promote broad public awareness as an essential part of a global education effort to strengthen attitudes, values and actions which are compatible with sustainable development. It stresses the principle of devolving
authority, accountability and resources to the most appropriate level with preference given to local responsibility and control over awareness-building activities. This can be done best through digital schools. The UN should be at the forefront in helping governments come up with policies to promote ICTs in their operations.

Evoh (2007) notes that the success of the NEPAD e-school initiative will depend on the policies the participating countries will put in place Kenya inclusive. Some of these policies he notes touch on legislation and infrastructure construction.

The government policies in Kenya are encouraging departments to computerise though a lot is still expected. Different ministries already have websites from where citizens get information. CCK (2008) notes that the Communication Commission of Kenya (CCK) has partnered with KIE to facilitate e-learning.

The Government of Kenya ought to have most of the services computerized to be seen serious. Tallying of votes should be computerized to avoid any rigging taking place. Makan (2008) reports some students of the Catholic University and University of Nairobi developing a software for vote tallying. Such talents should be enhanced by the Ministry of Science and Technology to make Kenya a software powerhouse in this economic region. These students do not understand why the ECK failed to use better
technology during the disputed presidential elections in December 2007. Such can be used practically in the digital schools during voting periods.

In recognition of the role ICT plays in the country’s economy, the 2009/2010 budget read by the Finance Minister lowered taxation for the software to 5% Kenyatta (2009). The government also provided some relief for those Kenyan operators and ISPs that were investing heavily in the purchase of capacity on the submarine cables that landed in Mombasa. The Minister also announced that ISPs will be able to offset against their taxable income the cost incurred in acquiring the rights to use the TEAMS and SEACOM submarine cables over a period of 20 years.

Gakuu et.al (2011) notes that lack of a unified school curriculum in the primary schools as a big let down by the education stakeholders. He notes that the delivery of the skills as a result is limited to the ICT teacher. The KIE has a curriculum for secondary schools though the number of students taking the subject at Form four KCSE examination is quite low. On the other hand, KIE has produced ICT curricula for all certificate and diploma courses that are assessed by the Kenya National Examinations Council.
2.5.6 Fear of Computer Viruses

Saleemi and Owino (2001) define a computer virus as a rogue software program that spreads rampantly through computer systems destroying data or causing the system to become congested and malfunctional.

Riaga (1995), Saleemi and Owino (2001) and Gakuu et.al (2011) note that it is a crime to produce a virus. They note that they are developed by unscrupulous computer experts with selfish motives. Gakuu et.al (2011) notes that viruses are a universal problem in most schools in Kenya.

Viruses can make the establishment of digital schools a nightmare. The 2007 saw a lot cyber war through the usage of viruses which were quite destructive. The Odinga Raila.gif virus and Kibaki Tosha Tena virus as reported by Security Stronghold (2007) which are believed to have been created by some Kenyan university students were quite destructive and even could make one to hate or love the individuals they are named after. The effects these viruses have had on people’s data and PCs can make one not to appreciate what the ICT can do.

Rigby (2009) reports on the East African Standard that many computer users fear computer viruses and worms. When people read such, they may end up becoming computer phobia making the implementation of ICT in many institutions become a
dream. The report suggests that most of victims are the Microsoft product unlike the open source software users.

2.5.7 Ignorance among the administrators

Most school administrators do not have any background in computer skills. MOEST (2005) observes that administrators need to be sensitized about the role of ICTs in the educational sector. There tends to be a lot of ignorance among the head teachers on matters pertaining to computer technology. On the other hand, the Ministry feels that they should be at the forefront in implementing ICT skills in schools. As a result, there is a need to have a person who can guide them on this technology. Makau (1999:17) observes that “the school needs someone to advise the management on what computers and equipment to buy. The success of any computer project depends entirely on the understanding by the computers teacher and the school management.” The Ministry and some NGOs organize workshops to help in ICT sensitization as observed by MOEST (2005) and CFSK (2008). A school would need an e-leader and an e-teacher to invest in the technology successfully.

Gakuu et.al(2011) observes that schools that have managers that are ICT trained or are ready to learn are more keen in investing in this technology more that those that are run by technophobia ones.
Computer for school Kenya and the government have been at the forefront in fighting this ignorance and lack of concern, not only among the administrators but also among the teachers in secondary and primary schools. According to CFSK (2008), the NGO does the following:

(i) provide training for the administrators and the teachers in schools,

(ii) provide computers to institutions,

(iii) has a curriculum which can be followed to teach ICT,

(iv) develop model computer exams,

(v) define the standards for computer laboratories, computer hardware, software, maintenance, curriculum, resource materials, evaluation and certification and

(vi) develop an organizational model for sustainable provision of ICTs to schools and related institutions.

Obura, et.al(2010) notes that Mwiciringiri, Naivasha girls, Naivasha Mixed and Naivasha Day schools as among the schools which have received computer systems from the CFSK in Naivasha district. These are some of the reasons why it was voted to win 2007 award for being the top civil society organization helping to bridge the digital divide in Africa with the use of limited resources.

A computer expert should explain to the administration the priorities when developing computer technology in a school or any institution to avoid the many frustrations
many CEOs face after implementing ICT systems. Saleemi and Owino (2001:269) note that “for the computer installation to succeed, the top management must be involved in the system running, right from take on and all the staff should be made to appreciate the aims and needs of the computer system for the overall co-operation at all levels”.

The government has been at the forefront sensitizing its workers on the need for adopting ICT skills. This is done to avoid many of them being left behind by the technological changes taking place. Most of these government employees may be in their age of 50’s and as Arrington (2006) observes, may be scared of computers hence not appreciate them.

2.6 Attitude of girls about the technology

A lot of research has been dedicated to women and girls and the role they play in the development of any country. Cooper (2006) argues that girls have not fared well in learning computer skills. He notes that women are underrepresented in their use and ownership of computers.

Other studies quoted by Cooper (2006) show the girls take fewer computers and IT lessons in secondary and high school. This makes the subject to be male dominated and also that they are unlikely to graduate in Computer science and IT related courses.
The studies note that boys get more attracted to computers than girls in primary schools, and at adolescence, girls react negatively towards computers while boys get attracted to them.

Cooper (2006) reports a broad spectrum of activities where girls and women feel that computers are not fun but a source of anxiety. The same situation is in most of Kenya’s secondary schools where many of the computer studies students are boys and in a mixed school set up, only about 30% of the number taking the subject are girls. But this does not mean that the boys perform better than girls. Overall, their performance is almost at par (KNEC, 2009).

Studies conducted in USA have shown that computers make girls lower their attitudes, lower performance, lower interest and have computer anxiety (Sanders, 2005). This suggests that the computer programs which are to be used with girls (Computer Assisted Learning) need to have beauty embedded in them and be as user friendly as possible for them to develop interest hence reduce the digital divide brought about by gender. This stereotype idea about computers and girls need to be overcome if the digital divide is to be reduced. This is one of the ways of making the world realise the Millennium Development Goals (MDG) and the Kenya’s Vision 2030 where ICT is the engine to its pillars.
Cooper (2006) concludes by lamenting that solving the problem of the gender digital divide will not be easy and that to allow the girls to benefit from the most important innovations of modern society, we must even the playing field and encourage girls and boys to partake of technology as a function of their gender. This could be the reason why Obura, et.al (2010) reports computer donations to schools by CFSK balanced between boys’ and girls’ schools.

KNEC reports indicate that the candidature in computer studies is less for girls than for boys with poor mean scores. This is shown in table 2.1.

**Table 2.1: Candidature and mean scores for boys and girls in Computer studies**

<table>
<thead>
<tr>
<th>Year</th>
<th>Candidates (Girls)</th>
<th>Mean score</th>
<th>Candidates (Boys)</th>
<th>Mean score</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>1708</td>
<td>51.37%</td>
<td>1696</td>
<td>57.33%</td>
</tr>
<tr>
<td>2006</td>
<td>1874</td>
<td>52.09%</td>
<td>2309</td>
<td>56.87%</td>
</tr>
<tr>
<td>2007</td>
<td>2151</td>
<td>51.66</td>
<td>2619</td>
<td>57.61</td>
</tr>
<tr>
<td>2008</td>
<td>2378</td>
<td>44.36%</td>
<td>3089</td>
<td>47.42%</td>
</tr>
</tbody>
</table>

This is an indicator that the boys perform better than the girls in the subject and there is an increment in enrolment which goes with motivation and attitude. The girls especially in the rural areas where there is less motivation to science and technical
subjects always take it to be a male subject. The girls fair in subjects such as CRE, Kiswahili, English, Music and Home science.

2.7 Resources needed for the success of digital schools

MOEST (2005) feels that every school needs to have a computer laboratory and 2-3 computers which should be incorporated into teaching and learning in classrooms.

DVN (2009) reports Adopt a School initiative encouraging people in Kenya to donate computer systems to make digital schools a success. It is a nonprofit making body just like CFSK out to promote digitization in schools.

The body identifies the following as the chief components of a digital school:

i. hardware; these are the computers and their peripherals,

ii. software; they include both the programs and the manuals,

iii. secure rooms; computer equipment are expensive hence need to be kept in a secure place,

iv. furniture; quality furniture for the computers and their accessories are needed,

v. power; may be provided by main supply or by solar batteries,

vi. Internet connectivity; needed to facilitate online teaching and learning,

vii. stationeries; these are needed for the production of hard copy outputs and

viii. human resources: these are the managers of the digital schools.
The above resources are also supported by KIE (2003) and MOEST (2005). Gakuu et.al (2011) notes that some schools in Kenya even have smart boards which they use to teach.

Ministry of Information and Broadcasting (2007) notes that the development of ICT requires infrastructure development, human resource development, stakeholder participation and appropriate policy and regulatory framework. It notes that the personnel working in the ICT sectors are prone to brain drain and hence recommends steps that would be used to avert such a situation. These include:

(i) develop a national ICT knowledge and skills strategic plan to ensure the availability of skills in the future;

(ii) help the employees to develop personal career plans and find ways to achieve goals;

(iii) support actions and initiatives to attract more people to work in the ICT sector, especially women;

(iv) support educational institutions in their efforts to introduce new ICT curricula, including offering financial support to education institutions to help defray expenses in piloting the development, design and testing a new curriculum;
(v) evaluate and anticipate supply and demand, monitor the uptake of new ICT curricula, and establish benchmarks for actions aimed at reducing the skills gap and shortage;

(vi) ICT companies will be encouraged to provide employees with opportunities to develop and enhance their skills as they work and

(vii) providing employees with the capacity and capability to make use of new innovations as they emerge and create innovations of their own.

A lot of awareness campaign needs to be done to remove ignorance among the education stakeholders on the need to adopt computer technology. This according to MOEST (2005) is currently going on through sensitization seminars and workshops. These stakeholders include: the teachers, the learners, boards of governors (BOG), parents teachers associations (PTA) and even the general public if the society is to be digitally compliant. They need to be aware of the items that the digital schools need to house and the care that accompanies them.

### 2.8 Conclusion

Chapter two discussed digital schools and provided initiatives that have been taken both nationally and globally in promoting them. Previous studies done on the area of ICT and pedagogy have concentrated on the utilization of e-resources by learners and teachers in schools but do not provide details on how students who have accessed ICTs fare in their nationally examinations. The studies also never looked at the e-
readiness that needed to be done before the implementation of the digital schools.

This review in chapter two analysed the situation of the digital schools in terms human capital, technical and physical factors which are classified by Mc Connell International e-readiness tool into connectivity, e-leadership, information security, human capital and e-business. The methodology which the study used to collect data in Naivasha district and the model used to design and develop the framework proposed is discussed in chapter three.
CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

Chapter three discusses Naivasha district where the research took place. It provides the population and the sampling that was done. It also discusses data collection tools that were used, their validity and reliability and the data collection procedures that were applied. The chapter as well discusses data presentation, analysis, interpretation and the research ethics that were observed. The model that was used to develop the framework is also discussed at the end of the chapter.

3.2 Research Design

A research design is a specific plan for studying a research problem. It is a process of meticulously selecting methods to be used to answer the research questions and solve the problem. According to Kothari (2004), the conceptual structure within which research is conducted, constitutes the blueprint for the collection, measurement and analysis of data.

This was a qualitative type of research. Shuttleworth(2008) observes that is a precursor to quantitative research, in that it is often used to generate possible leads and ideas and is probably the most flexible of the various experimental techniques,
encompassing a variety of accepted methods and structures. The research went for this type of research because the findings could not be generated using booleans such as “yes” and “no”. The data collected using this design can not easily be analyzed mathematically for example with the use of statistical software to bring relationships among different elements being considered.

The research used a case study approach where interview and observation data collection methods were used.

3.2.1 Study Location
Naivasha District, which is the area the research concentrated on is in Nakuru county of the Rift Valley province. It is a district which has many tourist attraction sites and agricultural activities. By January 2009, it had 150 registered primary schools and 53 secondary schools as shown in tables 3.1 and 3.2 page 67.

3.2.2 Research Method
The research made use of case study. Mugenda (2003) defines a case study as an in-depth investigation of an individual, group, institution or phenomenon. She notes that the purpose of a case study is to determine factors and relationships among the factors that have resulted in the behaviour under study where the investigation makes a detailed examination of a subject, group or phenomenon. The study used critical instance case study which according to Colorado State University (2011) looks at one
or more sites for the purpose of examining a situation of unique interest to call into question or challenge a highly generalized or universal assertion.

Best and Kahn (2006) note that data in a case study can be gathered by a variety of methods such as observation, interviews, questionnaires and document analysis. This research used observation and interview methods.

3.2.3 Advantages of using a case study

Cohen and Manion (1989) give the following as the advantages of using case studies:

(i) Case study data, paradoxically, is ‘strong in reality’. This method made it possible to come up with in depth data about Naivasha. The information gathered can be used in other areas.

(ii) Case studies allow generalisation either about an instance or form an instance to a class. Their peculiar strength lies in their attention to the subtlety and complexity of the case in its own right. Case study helped the research go deep into the characteristics and distinguishing features of samples of population.

(iii) Case studies recognise the complexity and ‘embeddedness’ of social truths. By carefully attending to social situations, case studies can represent something of the discrepancies or conflicts between the viewpoints held by participants. The best case studies are capable of offering some support to
alternative interpretations. It allowed the research to dig deeper using the interview method of data collection hence ending up with data that could be relied on. It helped bring forward the many relationships among the different elements under consideration based on Mc Connell e-readiness tool.

(iv) Case studies, considered as products, may form an archive of descriptive material sufficiently rich to admit subsequent reinterpretation. Given a variety and complexity of educational purposes and environments, there is the obvious value in having a data source for researchers and users whose purposes may be different. Through this research, detailed or in-depth data was collected that can be used in different aspects of development and covering complex situations that may be hard to come across if a case study approach is not applied. The data collected can be used by other researchers pursuing a different purpose other than the one this research had.

(v) Case studies are ‘a step to action’. They begin in a world of action and contribute to it. Their insights may be directly interpreted and put to use; for staff or individual self-development, for within institutional feedback; for formative evaluation; and in educational policy making. The data collected can easily be relied on for any policy making provided it is
touching on Naivasha district since it is detailed and has a higher element of reliability and validity.

3.3 Study Population

The study population comprised of the head teachers or their deputies and the computer teachers in the sampled schools. The area MP who constitutionally is a member of the Constituency Development Fund (CDF) was also interviewed. The study population also included a coordinator of some computer laboratories in Longonot and Maraigushu zones.

3.4 Sampling design

The research divided the schools into two major categories:

(i) Private schools: These are schools which are owned by companies, individuals and religious organizations. They are not entitled to government support.

(ii) Public schools. : These are schools that get government support.

The population was stratified sampled. According to Mugenda (2003) the goal of stratified sampling is to get a desired representation from the various subgroups in the population.

Mugenda (2003) identifies four steps to follow in doing stratified sampling which the research did. These included:
identify the population. The study population was obtained from the DEOs office. This acted as the sampling frame,

define the criteria for stratification. The research decided to stratify the study population into private and public schools since they have different characteristics. The public schools are supported by the government while the private schools are on business and strive to remain relevant to the market all the time. These schools were further stratified into primary and secondary schools,

list the population according to the defined strata or subgroups. The research put the identified schools respectively. These were private and public primary schools and private and public secondary schools as shown in the tables 3.1 and 3.2 respectively,

determine the required sample size and the appropriate representation of each stratum.

The area had the following number of schools divided in educational zones:
### Table 3.1: The primary schools in Naivasha district by January 2009

<table>
<thead>
<tr>
<th>Zone</th>
<th>Private schools</th>
<th>Public schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maella</td>
<td>8</td>
<td>20</td>
</tr>
<tr>
<td>Naivasha central</td>
<td>5</td>
<td>13</td>
</tr>
<tr>
<td>Karunga(Gilgil)</td>
<td>8</td>
<td>15</td>
</tr>
<tr>
<td>Mbaruk</td>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>Elemeitaita</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>Maraigushu</td>
<td>2</td>
<td>16</td>
</tr>
<tr>
<td>Longonot</td>
<td>4</td>
<td>13</td>
</tr>
<tr>
<td><strong>Total number of schools</strong></td>
<td><strong>33</strong></td>
<td><strong>117</strong></td>
</tr>
</tbody>
</table>

### Table 3.2: The secondary schools in Naivasha district by January 2009

<table>
<thead>
<tr>
<th>Zone</th>
<th>Private schools</th>
<th>Public schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maella</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Naivasha central</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Karunga(Gilgil)</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>Mbaruk</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Elemeitaita</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Maraigushu</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Longonot</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total number of schools</strong></td>
<td><strong>21</strong></td>
<td><strong>32</strong></td>
</tr>
</tbody>
</table>

The research was qualitative one. After stratified sampling, the researcher did purposive sampling which as Mugenda (2003) observes allows a researcher to use
cases that have the required information with respect to the objectives identified. This was based on the physical accessibility of the school and also the availability of computer systems. The staff at the DEO’s office helped the researcher to know more about the schools that were in the interior hence determine whether there was a need to visit them especially if they had similar characteristics with those that were accessible.

Purposive sampling ensured that relevant information was collected from the sample selected. With the assistance of the staff at the District Education Office (DEO), the research was able to choose the schools that qualified to be included in the survey. Each zone was represented in the sample as shown in the tables 3.3 and 3.4 below
Table 3.3: Public and Private secondary schools included in the sample

<table>
<thead>
<tr>
<th>Zones</th>
<th>Sampled private primary schools</th>
<th>Sampled public primary schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maella</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Naivasha Central</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Karunga</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Mbaruk</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Elementaita</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Longonot</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Maraigushu</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>8</strong></td>
<td><strong>13</strong></td>
</tr>
<tr>
<td><strong>Percentage Sampled</strong></td>
<td><strong>38%</strong></td>
<td><strong>40%</strong></td>
</tr>
</tbody>
</table>

The table above shows that 38% of the private schools and 40% of the public schools were included in the sample. Longonot and Maraigushu zones did not have a private secondary school.

The research considered on average 39% of the secondary schools in the area. Table 3.4 shows the private schools that were included in the sample.
Table 3.4: Private and public primary schools included in the sample

<table>
<thead>
<tr>
<th>Zones</th>
<th>Sampled private primary schools</th>
<th>Sampled public primary schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maella</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Naivasha Central</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Karunga</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Mbaruk</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Elementaita</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Longonot</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Maraigushu</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>12</strong></td>
<td><strong>27</strong></td>
</tr>
<tr>
<td><strong>Percentage Sampled</strong></td>
<td><strong>36</strong></td>
<td><strong>23</strong></td>
</tr>
</tbody>
</table>

All the zones were represented in the sample. The public schools considered in the sample are only 23% compared to private which is 36% because they are many and have similar characteristics such as understaffing, poor performance and generally the children who go to such schools come from poor economic backgrounds. The research learnt this after piloting in five public primary schools, one in Karunga and two in Longonot and Maraigushu zones.

The private schools were in the market and town centres hence quite accessible. On average the number of primary schools sampled was about 30% of the total study population.
3.5 Data collection tools

The research used the following data collection tools:

- interviews
- observation

3.5.1 Interviews

Data collection was done through face-to-face interviews. The reason why the research chose this method is because through such, it was possible to combine with other methods of data collection such as document analysis of charts and tables which are normally pinned on the walls of many offices. The method also combines well with observation data collection method.

The research was qualitative hence interviews as data collection tools became quite useful. Unstructured interviews were conducted. The researcher visited 21 secondary schools, 8 being private while 13 public where the principals or their deputies or the dean of studies were interviewed.

The research collected data from 39 primary schools, 27 public and 12 private schools where the head teachers or their deputies or the senior teachers were as well interviewed.
In 6 primary schools and 8 secondary schools, the researcher was directed to the ICT or the computer studies teachers or tutors. The interview questions for the secondary schools and the primary schools are found in appendix one and two respectively.

The area Member of Parliament and a coordinator of some digital schools in Longonot and Maraigushu zones were also interviewed. Telephone interview was used with the area MP for the research took place when there were many issues of national interest which were going on at that time concerning the Ministry of Agriculture which he was the chairman of the parliamentary select committee. The interview questions to the area MP and the coordinator of the digital schools in Longonot and Mai Mahiu areas are found in Appendix three and four respectively.

### 3.5.1.1 Advantages of using interview method

Mugenda (2003) outlines the reasons why a researcher may use interview method of data collection. These include:

(i) Provision in-depth data which is not possible with other data collection tools. The interview between the researcher and the area MP and also the coordinator of the digital schools in Longonot revealed a lot of in-depth information which was quite relevant to the study.

(ii) They help collect data required to meet specific objectives of the study. The questions were directed to answering a specific objective in the study.
(iii) They guard against confusing the questions since the interviewer can clarify the questions thereby helping the respondent give relevant responses. The research clarified many issues especially while interviewing the area MP who would occasionally view issues politically.

(iv) They were more flexible since the interviewer could adapt to the situation and get as much information as possible.

(v) Very sensitive and personal information can be extracted from the respondent by honest and personal interaction between the respondent and the interviewer. The interviewees would occasionally drift from the main issues especially while explaining why certain infrastructures were not found in a school.

(vi) The interviewer can clarify and elaborate the purpose of the research and effectively convince respondents about the importance of the research. This helped in getting more and honest information.

(vii) Through genuine interaction and conversation, it is possible to get the negative side of the topic. The research learnt about the politics behind some schools getting support from the leaders and others not.

(viii) The interviews yielded higher response rates because it is difficult for a subject to completely refuse to answer questions or ignore the interviewer. One principal was defiant at the beginning but on learning that the research
can propose a framework which can be used in different schools including his, became positive.

The researcher decided to go for the unstructured interviews to allow more probing to be done. Though there were chances of the interviewees going out of topic or spending a lot of time on an issue, more information was gathered. To ensure that the relevant data was collected, the researcher recorded the answers either manually or electronically. This ensured that no information was left out.

3.5.2 Observation

It was not possible to have every information captured through the interviews. As a result, the research used observation as the second tool for data collection.

The following were observed:

i. the absence or the presence of power and the type

ii. the types of computers if any the school had and their arrangements in the laboratory,

iii. the kind of laboratory the school had or was planning to set up,

iv. the presence or absence of a computer network as recommended by the KIE,

v. the location of the center or the computer laboratory or the one being planned,
vi. the presence or the absence of a police station nearby,

vii. the presence of the subject on the timetable,

viii. the performance of subjects as shown on the wall charts.

The type of observation the research used was the naturalistic one which Mugenda (2003) observes does not control or manipulate the subjects or the surrounding in any way. The purpose is to record and study behaviour as it normally occurs.

According to Wagner (2010) and Kothari (2004) the advantages of using the observation method are as follows:

(i) Subjective bias is eliminated. One observes features, events and objects as they are. The researcher observed ICT infrastructure in its natural setting hence the data collected was reliable.

(ii) Data collected relates to what is currently happening and may not relate to past behaviour or future attitudes and intentions. Using a checklist, it became possible to understand the infrastructure in the school.

(iii) It is independent of the subjects’ willingness to respond and is less demanding of any cooperation from them. Appearing in a school setup helped the research get some of the information required without necessarily talking to any person on the ground.
(iv) It is the best in situations where the subjects are quite busy and may not have time to go through all the questions which may be presented in an interview. In situations where the head teachers were busy, observation became the answer.

(v) It is free from response bias. This means that one will not have to rely on any response from the subjects. The researcher would observe either the presence or absence of a feature under study.

(vi) It is possible to record the natural behaviour of a group and obtain data not obtainable easily through other methods of data collection. The research observed that many schools that would claim to be teaching the subject had not put it on the main timetable.

The observation checklist used in the research is in appendix eight.

3.5 Data validity and reliability

The research ensured there was data validity and reliability through the following ways:

(i) The same interview questions were used for the head teachers, their deputies or the dean of studies or the senior teacher in case of the primary schools. This helped in ensuring content validity
(ii) The research made questions clear in situations where the interviewers had difficulties understanding them. This helped in ensuring reliability of the responses.

(iii) More than one observer was used in some schools where data was collected. This means that the information which one observer missed out was got by the second one and also that the second one helped in confirming what the first one observed.

3.6 Data Collection procedures

The research collected data using interviews and observation methods. The sampled centres were informed of the purpose of the research via mobile phones. The phone numbers were got from the DEOs office Naivasha. On visiting the schools, the questions appearing on appendix one and two were used depending on whether the centre was a primary school or a secondary school. The questions worked as the guides to the conduction of the interviews. The observation checklist (appendix eight) was filled in at the centre during or after the interview. For the area MP, a telephone interview was conducted between 8:00pm and 9:00pm after booking an appointment with him. The digital school coordinator was interviewed at Village market in Nairobi on a Saturday also after booking an appointment. The recording was done as the interviewee answered the questions.
3.7 Data Presentation, analysis and Interpretation

Data was analysed after collection. Mugenda (2003) notes that data collection goes hand in hand with data analysis. Data analysis in qualitative research seeks to make general statements on how categories or themes of data are related. The data collected was in form of photographs, text, tables and maps which described events and occurrences.

Data analysis was done in steps. These steps have been observed by Mugenda (2003) as:

(i) Data organisation

(ii) Creation of categories, themes and patterns. The objectives of the research were used to put the themes together.

(iii) Analysing and interpreting information. This also followed the objectives of the research.

(iv) Writing a report.

The report written is of narrative form with words that are analytical and interpretative.

The research findings will be made available to the public through the following avenues:

(i) Publications on the newspapers(The researcher intends to be writing parts of the findings on the digital schools in the local dailies)
(ii) Thesis will be available in the libraries and other information centres which may be in need of it.

(iii) The research findings will also get published with both print and e-journals when an opportunity is provided. Already two items have been published in EcoDigest and AEAA journals.

(iv) Workshops, seminars and conferences in information and communication technology related areas for example at the KIE or in the Universities. Some of the research work was presented at Strathmore University ICT workshop on 4th September 2010.

The study led to the designing of a framework that can be used in the implementation of a digital school in any part of the Kenya. This model is presented in webpage formats as found in the appendix 19 to 25.

3.8 Model used for systems development

The research was to come up with a framework to be used in the development of digital schools. Spiral model of systems development was adopted. This model is also referred to "Boehm’s Model". The model was developed in 1986 by Barry Boehm in his 1988 article A Spiral Model of Software Development and Enhancement. This model was not the first model to discuss iterative development, but it was the first model to explain why the iteration matters. User requirements are not easy to
determine and as a result, iterative approach of spiral method uses prototype to mitigate this risk posed by unclear requirements.

According to Parekh (2011), there are four phases in the Spiral Model. They include: planning, evaluation, risk analysis and engineering. He notes that the four phases are to follow one another iteratively to eliminate all the problems, which were faced in the Waterfall Model. The spiral model is iterative. The first iteration is considered to be most important, as it is through it that almost all possible risk factors, constraints, requirements are identified and in the next iterations all known strategies are used to bring up a complete software system.

Though the Spiral Model combines the waterfall and the prototyping models hence achieving more advantages, is it worth noting that highly skilled people in the area of planning, risk analysis management and mitigation, development and customer relations are required. It may also be expensive in terms of money and time.

The main problems associated with the waterfall model were:

i. Real projects rarely followed the sequential flow that the model proposed. The model provided for the development of the software in a linear way.

ii. Most projects had a level of uncertainty about requirements and goals during the initial stages. As a result it was difficult for customers to identify these criteria on a detailed level.
iii. Developing a system using the Waterfall Model can be a long, tedious process that may not yield a working system until late in the process.

iv. There was no formal means of exercising management control and risk management Blum(1997).

3.8.1 The four stages of spiral model include:

**Planning:** This phase determines the objectives, alternatives and constraints of the project. The objectives and other specifications are fixed in order to settle on which strategies or approaches to follow during the project life cycle. The main objective of the research was to come up with a framework that schools could use to come up with digital schools that were sustainable. Information about Naivasha’s primary and secondary schools was first collected using interview and observation methods. It was then analysed to find out the challenges that the schools were facing in introducing or handling or maintaining their ICTs. This was to work as the baseline to develop the framework.

**Risk Analysis:** This phase is the most crucial part of the Spiral Model. All possible and available alternatives, which can assist in developing a cost effective project are analyzed. This phase is added specially in order to identify all the possible risks in the system or project development. If the risks indicate some form of uncertainty in requirements, prototyping may be used to carry on with the available data. Prototyping
is coming up with a blue print of the system to be developed. A prototype is built, tested, and then reviewed as necessary until an acceptable one is finally achieved from which the complete system or product can now be developed.

The research looked at the possible alternatives to solving user requirements identified at the planning stage of the systems development. The alternatives were discussed with a systems developer, before finally arriving at a conclusion that a web based system that is available both online and offline would be the most appropriate. An offline system would be of importance to schools that have difficulties getting Internet connectivity, while an online system would be made available on the internet hence interactive to the users. This would be the best since schools would be able to communicate with the researcher and updates would be made often. The research came up with a number of prototypes. Through discussions with a systems developer and four computer teachers teaching in secondary schools, a conclusion to adopt one that would cut across primary and secondary schools was adopted.

**Engineering:** This is the actual development of the project or the system. The output of the engineering phase is passed through all the phases iteratively in order to achieve improvements in the same. This is meant to help in coming up with a good product in form of a software or system as the end product. The research used the following software to come up with the system:
(i) **MYSQL**: This was used to develop the database to hold the content of the framework. This content was developed into different modules.

(ii) **Dreamweaver**: This was used to design the structure and develop codes for the web pages.

(iii) **Mozilla Firefox**: This was used to preview the web pages that were developed.

(iv) **Wampserver**: This was to create a local webserver to enable local hosting of the system.

**Customer Evaluation**: In this phase, the developed system or software is passed on to the customer who is the end user to receive his or her comments and suggestions which can help in identifying and resolving potential errors in the system or the project developed. This phase is very much similar to testing phase where the system may be tested using normal, extreme and abnormal data.

The essence of prototyping is to come up with an acceptable system. In the development of the system, the research ensured that comments were gotten from the end users after every stage. Four secondary school teachers and a principal provided valuable comments on what needed to be available on the framework. The principal would give information on what the BOGs needed to know about the digital schools while the computer teachers would comment on the design and the usability of the framework.
Diagram 3.1 shows the stages that are involved in the development of a system using the Spiral Model.

**Diagram 3.1: A diagram showing the stages involved in spiral model**


Diagram 3.1 emphasizes prototyping in the development of the software or a system. The model is quite comprehensive all aimed at producing a working system acceptable by the end users. The prototype that was used in the development of the framework is the usability type. This type is used to define, refine, and demonstrate user interface, design usability, accessibility, look and feel.
Wilson et.al (2011) notes that prototyping in software development leads to:

i. Fast cycles, with little or no code development: The initial plan of coming up with a system or a software requires one to come up with the end product before its development. A prototype is a blueprint to work with. The research come up with the modules that were to be in the framework and discussed with a systems developer and some teachers.

ii. Early visualization of the product: The research could visualise the framework before its production. The details that were to be input into the system were in the minds of the systems developer and the researcher.

iii. Crisp definition of requirements: Prototyping helps one have the requirements of software, hardware and the cost in mind before systems development starts. The systems developer informed the research of the software and their utilities that would be crucial. MYSQL, Dreamweaver, Mozilla firefox and Wampserver were all crucial for the system development.

iv. Early user testing: With many interactions with the end users of the system developed, the research was able to test it for many times to ensure that the best in form of a framework was developed. The teachers would test the system as coding went on and occasionally would provide constructive suggestions.
v. Enhanced feedback to users: This was feedback from the end users. The four computer teachers developed interest in what the research was developing and would make valuable contributions especially on the design and the content to be posted.

3.9 Ethical issues to consider

Vayana (2006) and Trochim (2006) identify a number of ethical issues to be considered in a research. In view of what they observe, the research:

(i) avoided questions which could embarrass the respondents especially after the general elections in December 2007 which were characterised by animosity among different communities in Kenya,

(ii) assured the confidentiality to the respondents so that they could feel free to divulge the information which the research needed

(iii) avoided leading questions,

(iv) made the respondents to relax so that they could provide the information without feeling tensed and

(v) quoted and acknowledged all the sources of information.

By observing the ethical issues, the research collected valid and reliable information.
3.10 Conclusion

Chapter three discussed research design, study location, research method, study population and also the data collection tools used in the research. It also discussed data validity and reliability, data collection and procedures, presentation and analysis and also the model that was used to come up with the framework for the development of the digital schools. The ethical issues that were considered in the process of data collection and development of the system were also highlighted. The data collected was used as the baseline to the development of the system that would consider McConnell e-readiness tool for the development of the digital schools. The findings of the study are discussed in chapter four.
CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND INTERPRETATION

4.0 Introduction

This chapter looks at the data collected through interviews and observation. It presents, analyses and interprets the data. The results of the research are presented through themes and statements while others are presented in tabular and graphical forms.

4.1 Schools offering computer studies

Out of the 12 private primary schools in the sample, 8 had computers systems. This is equivalent to 67% of all the private schools sampled in the area. This is shown in the table 4.1.

Table 4.1: Private schools with computer systems in Naivasha District

<table>
<thead>
<tr>
<th>Zones</th>
<th>Private primary schools with computers (X)</th>
<th>Sampled Private primary schools(Y)</th>
<th>Percentage of schools with computers X/Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maella</td>
<td>2</td>
<td>2</td>
<td>100</td>
</tr>
<tr>
<td>Naivasha Central</td>
<td>2</td>
<td>2</td>
<td>100</td>
</tr>
<tr>
<td>Karunga</td>
<td>2</td>
<td>2</td>
<td>100</td>
</tr>
<tr>
<td>Mbaruk</td>
<td>1</td>
<td>2</td>
<td>50</td>
</tr>
<tr>
<td>Elementaita</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Longonot</td>
<td>1</td>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>Maraigushu</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>TOTAL</td>
<td>8</td>
<td>12</td>
<td>67</td>
</tr>
</tbody>
</table>

Percentage of private primary schools with Computer systems 67
This shows that most of the private schools (67%) have computer systems which they use to teach the learners and also to market the schools. All the primary schools in the market centres sampled had computer systems. This is because such centres have power connection, there is a bigger catchment for pupils, people around those areas are economically strong and there is better security provided. Power connectivity, security and availability of users are crucial to the establishment of digital schools.

Table 4.2 shows the public primary schools that had computer systems. About 40% of these computers were laptops while the rest were desktops.

Table 4.2: Public primary schools with computers in Naivasha District

<table>
<thead>
<tr>
<th>Zones</th>
<th>Public primary schools with computers (X)</th>
<th>Sampled public primary schools(Y)</th>
<th>Percentage of schools with computers X/Y)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maella</td>
<td>3</td>
<td>5</td>
<td>60</td>
</tr>
<tr>
<td>Naivasha Central</td>
<td>1</td>
<td>3</td>
<td>33</td>
</tr>
<tr>
<td>Karunga</td>
<td>1</td>
<td>4</td>
<td>25</td>
</tr>
<tr>
<td>Mbaruk</td>
<td>0</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Elementaita</td>
<td>0</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Longonot</td>
<td>4</td>
<td>4</td>
<td>100</td>
</tr>
<tr>
<td>Maragushu</td>
<td>2</td>
<td>3</td>
<td>67</td>
</tr>
<tr>
<td>TOTAL</td>
<td>11</td>
<td>27</td>
<td>41</td>
</tr>
<tr>
<td>Percentage of public primary schools with Computer systems</td>
<td>41</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The public primary schools had a lower investment in the computer systems that is 41% compared to 67% among the private schools. Of the 41% above, over 90% had gotten them as donations either from the Steve Peifer computer project in the area or from the flower farms around Lake Naivasha. It is only in one centre where the PTA had a hand in their acquisition. This was a public boarding primary school located in Naivasha town.

Computer studies as a subject is given more seriousness in secondary schools compared to the primary schools. This is as shown from the tables below representing the secondary schools sampled.

**Table 4.3: Private secondary schools with computers in Naivasha District**

<table>
<thead>
<tr>
<th>Zones</th>
<th>Sampled secondary schools with computers (X)</th>
<th>Sampled private secondary schools(Y)</th>
<th>Percentage of schools with computers X/Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maella</td>
<td>1</td>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>Naivasha Central</td>
<td>2</td>
<td>2</td>
<td>100</td>
</tr>
<tr>
<td>Karunga</td>
<td>2</td>
<td>3</td>
<td>67</td>
</tr>
<tr>
<td>Mbaruk</td>
<td>1</td>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>Elementaita</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Longonot</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Maraigushu</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>6</strong></td>
<td><strong>8</strong></td>
<td><strong>75</strong></td>
</tr>
<tr>
<td>Percentage of private secondary schools with Computer systems</td>
<td></td>
<td></td>
<td><strong>75</strong></td>
</tr>
</tbody>
</table>
Out of the private secondary schools considered in the sample, 75% had computer systems. Three of these schools have contributed to the 1.65% of the total candidature at KCSE in 2009 and 1.98% in 2010 though the performance was not good in the subject. Others were hoping to present candidates in the years to come. The study learnt that the qualifications of the teachers teaching the subject in the private schools had only the technical skills in ICT and no pedagogical skills compared to the ones in the public schools who had both skills. This means that the government plays a critical role in the establishment of digital schools. It helps in the provision of manpower, security and policies which constitute to e-readiness.

Table 4.4: Public secondary schools with computers in Naivasha District

<table>
<thead>
<tr>
<th>Zones</th>
<th>Sampled secondary schools with computers (X)</th>
<th>Sampled public secondary schools(Y)</th>
<th>Percentage of schools with computers X/Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maella</td>
<td>1</td>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>Naivasha Central</td>
<td>1</td>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>Karunga</td>
<td>1</td>
<td>2</td>
<td>50</td>
</tr>
<tr>
<td>Mbaruk</td>
<td>2</td>
<td>2</td>
<td>100</td>
</tr>
<tr>
<td>Elementaita</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Longonot</td>
<td>3</td>
<td>2</td>
<td>67</td>
</tr>
<tr>
<td>Maraigushu</td>
<td>3</td>
<td>3</td>
<td>100</td>
</tr>
<tr>
<td>TOTAL</td>
<td>11</td>
<td>13</td>
<td></td>
</tr>
</tbody>
</table>

Percentage of public secondary schools with Computer systems 85
The above shows that 85% of the sampled public schools had computer systems. Three of the public schools, Koelel, Naivasha girls and Utumishi academy had even presented candidates in KCSE examination with good performance. They had recorded better performance compared to the private schools in the area.

The study found out that the schools had computers of different capabilities. The schools sponsored by Steve Peifer’s digitization project had laptops all having the same programs in terms of application and systems software. The other schools had Pentiums 1 to 4 while some even had old 486 desktops. The study discovered that over 50% of the computers did not have anti-virus software which is very dangerous especially in this era where the production of computer viruses is fun among many computer students in the middle level colleges and universities. The fear of viruses has been noted as a factor that has made many administrators in schools not to invest in this technology. They need to be informed on the precautions to take or how to handle them when they strike a machine, instead of hiding in their fears.

Only about 30% of schools had purposively built computer laboratories. Majority could not accommodate all the computers and their accessories plus the clients. The average capacity of the laboratories of the schools sampled in the research was fifteen students/pupils. This forced the computer teachers especially in the public primary schools to divide the learners into groups hence affecting the content that could be
learnt per time. The teachers had difficulties planning for the lessons. This was made worse by the absence of a curriculum and the absence of the subject on the timetable. The schools which had computers from Steve Peifer project had a curriculum that did not give the learners good mastery of the keyboard during the introduction stages as compared to the secondary school curriculum.

The Computer for Schools Kenya has assisted many schools get computers, teachers and the technical support. Only four schools in the district had benefitted from them in the area. These were Mwiciringiri, Naivasha girls, Naivasha Mixed and Naivasha Day schools. Even with its support, Mwiciringiri, Naivasha Mixed and Naivasha day schools had not presented candidates for KCSE computer studies by 2010. The notion that girls can not perform well in the subject is demystified in the schools above. The girls had a better performance than the boys in the 2009 and 2010 KCSE computer studies examination in the district while the candidature was almost equal.

Some schools in the district had also benefitted with the computers donated by the area MP who was also the chairperson, Computer for Schools Kenya (CFSK). He informed the research that he was motivated by the Bill Clinton administration (former USA president). It was only secondary schools which had benefitted from his donations. He complained that many schools take his ideas about computers and the role they can play in the improvement of students’ lives but were always complaining
about initial and the maintenance costs involved. He said that he was dedicating more
time in the future to acquisition of the computers for the schools in his area through CFSK. If the schools knew how they were to make money with the technology, then the issue of initial and maintenance costs being high would not arise. The schools need to think about sustainability of the computer projects through opening up to the public who may need some e-services.

The MP felt that lives for the people of Naivasha district can drastically improve if ICT is employed in all that they do. He informed the researcher that schools should adopt e-resources way of learning so that all the schools in the country regardless of whether they are in the rural areas can be at par. This is only possible if the e-content to be shared through computer networks was made available.

At Longonot secondary school, the young pupils of the adjacent primary school, Longonot Township use the facility comfortably for their computer lessons just like their counterparts in the secondary section. This was quite opposite in Kinungi. The students in Kinungi secondary school were not willing to go to the nearby primary school to share the facility with the young boys and girls. The principal of Kinungi secondary school observed that majority of the students had schooled there for their primary school education and felt belittled going back to their old school for some education regardless of its importance.
The study revealed that computer studies were taken seriously in the secondary schools unlike in primary schools because of the following reasons:

i. there is a curriculum to follow,

ii. there is a KCSE computer studies exam,

iii. the TSC in public secondary schools provides teachers if the head teacher makes requests and

iv. the teenagers in the schools know what they can do with the computers unlike many children in the primary schools.

On average, most schools have computer systems which can be used for a number of purposes. This shows that was an element of e-readiness on the ground. These computers are used to perform certain functions in the schools and at least they were found in a laboratory or a certain room.

4.2 Challenges facing ICT

4.2.1 Power connectivity

The researcher visited schools in the town centres notably Naivasha, Mai Mahiu and Gilgil areas and also those in the interior of the district. About 31% of all the sampled schools in the towns had no power connections. 69% had power for use in the science laboratories and for lighting during evening and morning preps especially among the boarding schools. The schools which did not have power connections complained of
the high costs of installing it while others complained that the BOGs had not give
them the go ahead to implement the project.

Over 60% of rural schools complained of lack of enough resources to even think of
applying for power from the Kenya Power. Two public secondary schools were over
20KMs away from the transformer hence it would have been uneconomical to apply
for power connection. Asked about installing solar power as was the case with most
schools in Longonot area, the administrators lamented that it was still expensive and
that there was a high level of insecurity. Eight primary schools in the area had solar
panels to run the computers which they got as a donation through a project by the
Africa Inland Mission. The project is coordinated by a CNN award winner of 2007
Steve Peifer whose dream is to have quality education to help eradicate poverty in the
area.

The research found out that the schools in the area which had power would use it for
the following purposes:

i. lighting,

ii. running computer systems,

iii. preserving science materials especially in biology and

iv. operating electrical equipment in the workshops.
This then suggests that the schools that did not have power connection of any type did not either have any of the above or had to seek assistance from the institutions around especially the secondary schools. The schools with the lighting systems were observed to perform better than those without. This could be the reason why schools like Naivasha Girls, Koelel, and Utumishi Academy among others are academic giants in the area while many others continue to remain unknown nationally in the KCSE performance. The KCPE schools nationally known in the area include: Naivasha Boarding and Gilgil Hills.

Tables 4.5, 4.6, 4.7 and 4.8 show the percentage of the schools with power connection among the ones sampled by the research:

**Table 4.5: Private secondary schools with power connection**

<table>
<thead>
<tr>
<th>Zones</th>
<th>Sampled private schools</th>
<th>Schools with power connection</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maella</td>
<td>1</td>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>Naivasha Central</td>
<td>2</td>
<td>2</td>
<td>100</td>
</tr>
<tr>
<td>Karunga</td>
<td>3</td>
<td>3</td>
<td>100</td>
</tr>
<tr>
<td>Mbaruk</td>
<td>1</td>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>Elementaita</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Longonot</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Maraigushu</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>8</strong></td>
<td><strong>7</strong></td>
<td></td>
</tr>
</tbody>
</table>

Percentage of private secondary schools with power connection **88**
The table above shows that 88% of the private secondary schools have power connection all from the Kenya Power. This sometimes is unpredictable especially during the dry spells due to power rationing.

Table 4.6: Public secondary schools with power connection

<table>
<thead>
<tr>
<th>Zones</th>
<th>Sampled public schools</th>
<th>Schools with power connection</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maella</td>
<td>1</td>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>Naivasha Central</td>
<td>1</td>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>Karunga</td>
<td>2</td>
<td>1</td>
<td>50</td>
</tr>
<tr>
<td>Mbaruk</td>
<td>2</td>
<td>2</td>
<td>100</td>
</tr>
<tr>
<td>Elementaita</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Longonot</td>
<td>2</td>
<td>2</td>
<td>100</td>
</tr>
<tr>
<td>Maraigushu</td>
<td>3</td>
<td>3</td>
<td>100</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>13</strong></td>
<td><strong>10</strong></td>
<td></td>
</tr>
</tbody>
</table>

This shows that 77% of all the public secondary schools sampled had a form of power connection. 50% relied on power connection from solar panels while the other 50% was from the Kenya Power. The solar energy was mostly used to power the computer systems and not for lighting purposes.
Table 4.7: Private primary schools with power connection

<table>
<thead>
<tr>
<th>Zones</th>
<th>Sampled private schools</th>
<th>Schools with power connection</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maella</td>
<td>2</td>
<td>2</td>
<td>100</td>
</tr>
<tr>
<td>Naivasha Central</td>
<td>2</td>
<td>2</td>
<td>100</td>
</tr>
<tr>
<td>Karunga</td>
<td>2</td>
<td>2</td>
<td>100</td>
</tr>
<tr>
<td>Mbaruk</td>
<td>2</td>
<td>1</td>
<td>50</td>
</tr>
<tr>
<td>Elementaita</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Longonot</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Maraigushu</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>12</strong></td>
<td><strong>7</strong></td>
<td><strong>58</strong></td>
</tr>
</tbody>
</table>

The 50% of the private primary schools shown above were getting their power from the Kenya Power and none from solar energy. The Steve Peifer project funds public schools only.
Table 4.8: Public primary schools with power connection

<table>
<thead>
<tr>
<th>Zones</th>
<th>Sampled public schools</th>
<th>Schools with power connections</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maella</td>
<td>5</td>
<td>3</td>
<td>60</td>
</tr>
<tr>
<td>Naivasha Central</td>
<td>3</td>
<td>1</td>
<td>33</td>
</tr>
<tr>
<td>Karunga</td>
<td>4</td>
<td>3</td>
<td>75</td>
</tr>
<tr>
<td>Mbaruk</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Elementaita</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Longonot</td>
<td>4</td>
<td>3</td>
<td>75</td>
</tr>
<tr>
<td>Maraigushu</td>
<td>3</td>
<td>2</td>
<td>67</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>27</strong></td>
<td><strong>12</strong></td>
<td><strong>44</strong></td>
</tr>
</tbody>
</table>

44% of the public primary schools had power connection while the private schools were 58%.

42% of these schools in the sample were getting their power from solar batteries to power their computer systems.

This explains why the same percentage had computer systems in their schools. A few poorly performing public secondary schools (23%) did not have any plans for power installation. Most of these were waiting for the CDF (Constituency Development
Fund) and rural electrification project to sort them out. The worst hit area in as far as power connectivity was concerned was Elementaita.

At Mwiciringiri Secondary school, the principal informed the research that power connection was their main out doing since the school had over twenty PCs which they purchased through the assistance of the area MP and the Computer for Schools Kenya (CFSK). They relied on a generator which was expensive to run. This means that the computers are of no use most of the time. He also complained that the solar panels they had were unreliable to run the machines. The principal of Kinungi secondary complained that the power cables had been on the ground for sometime and nothing tangible seemed to be going on hence the school did not have plans of introducing the subject. A computer teacher at Kinungi primary informed the research that she had difficulties with power from the solar panels making some machines she uses to teach the pupils not to be used during some lessons.

Most of the primary schools with power connections (67%) were the private ones while only a few public in the market centres had power from the Kenya Power. The rest got their power from solar panels which they had got as donations through Steve Peifer’s project especially in the Maraigushu and Longonot zones. The research found out that if solar power was well tapped, it could be used for lighting purposes.
About 77% of the public secondary schools and 88% of the private ones with power connection used it for lighting and running the computers. The study discovered that 60% of the schools with power connection from the Kenya Power had computers either for use in teaching or for administrative tasks. The ones with solar panels (35%) use the power generated to run the computers for teaching purposes and not for lighting.

At St Francis Xavier Girls School, the principal lamented that the power supply was not stable all the time. This is coupled with the problem of the unavailability of Uninterruptible Power Supply (UPS) which helps in stabilising power getting into the computer system and also providing an opportunity for the computer users to save their work.

There was a higher level of e-readiness in power connectivity. But it would have been better if the schools had invested in different forms of power to ensure that the machines could run at any single time. The different forms of power can help in supplementing one another. The schools need to realise the importance of using green energy instead of relying on the energy which they have no control over like the Kenya Power one.
4.2.2 Human Capital

The study revealed that there were qualified computer teachers in 80% of all the secondary schools that had computer studies taught. However, there were only two that had been hired by the Teachers Service Commission (TSC) as computer studies teacher. The primary schools that had computers especially in the Longonot and Maraigushu zones have computer experts who had not taken education as a course in their training. Sometimes such teachers do face difficulties in class for they may not know how to deal with young pupils. According to Steve Peifer, the primary school heads determine who can teach and only forwards the names of the ones chosen to him so that he may organize for their salaries. The head teachers may not be in a position to know whether the ones they choose are under or overqualified. In one of the centres the researcher visited, it was observed that the teacher was not so social with the others in the system and majority did not have an idea of what went on in the centre. This may explain why they had not taken the subject seriously.

This is quite opposite of other schools where the computer teachers who are educationists happen to be quite popular and social. The other workers in the system learn many skills which they make use of from the computer teachers. Some primary schools had qualified teachers especially the ones who had completed Teachers Training Colleges (TTCs) from 2007, for it is part of the curriculum, but were not willing to take up the challenge for fear of being overworked by their head teachers.
One of the senior teachers in Loldia Primary in Naivasha Central zone informed the researcher that in the colleges there are three hours per week for ICT lessons and that the course is up to date. The research established that it had been in place for the last four years.

The study discovered that it was only six secondary schools in the district which had presented candidates in the form four KCSE. These were: Naivasha Girls, Shiners Girls, Gilgil High, Koelel, Lady Anne Dalemere and Utumishi Academy. The schools recorded average grades in the subject compared to the other subjects. A close look at the performance of computer studies in other schools in the country proved that the subject helps in boosting performance among the candidates. A computer teacher noted that the 8-4-4 syllabus is so comprehensive in coverage, both in theory and practical work that the candidates can comfortably work in any computer related environment. The syllabus is well structured to give a candidate most skills that are needed in the market.
Tables 4.9, 4.10, 4.11 and 4.12 below show the distribution of manpower in the sample per zone:

Table 4.9: Private secondary schools with qualified manpower

<table>
<thead>
<tr>
<th>Zones</th>
<th>Sampled schools</th>
<th>Private schools</th>
<th>Schools with qualified ICT manpower</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maella</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>Naivasha Central</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>100</td>
</tr>
<tr>
<td>Karunga</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>67</td>
</tr>
<tr>
<td>Mbaruk</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Elementaita</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Longonot</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Maraigushu</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>8</strong></td>
<td><strong>5</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The above shows that only 63% of the private schools had qualified manpower. The study noted that the teachers teaching the subject had a high turnover compared to other subjects. This is because there are many job opportunities for ICT teachers. They do have an option of teaching in secondary schools or tertiary institutions.
Table 4.10: Public secondary schools with qualified manpower

<table>
<thead>
<tr>
<th>Zones</th>
<th>Sampled Public schools</th>
<th>Schools with qualified ICT manpower</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maella</td>
<td>1</td>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>Naivasha</td>
<td>1</td>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>Central</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Karunga</td>
<td>2</td>
<td>1</td>
<td>50</td>
</tr>
<tr>
<td>Mbaruk</td>
<td>2</td>
<td>1</td>
<td>50</td>
</tr>
<tr>
<td>Elementaita</td>
<td>2</td>
<td>2</td>
<td>100</td>
</tr>
<tr>
<td>Longonot</td>
<td>2</td>
<td>2</td>
<td>100</td>
</tr>
<tr>
<td>Maraigushu</td>
<td>3</td>
<td>3</td>
<td>100</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>13</strong></td>
<td><strong>11</strong></td>
<td><strong>85</strong></td>
</tr>
</tbody>
</table>

The above is due to the fact that the TSC employs teachers if the head teacher makes a request. Most teachers teaching in these public schools have had an experience in ICT and did not mind teaching the students even if not for national assessment at KCSE. Majority had not done teaching method in computer studies at college but had other teaching methods in physics and mathematics which relate well with the subject.
Table 4.11: Private primary schools with qualified manpower

<table>
<thead>
<tr>
<th>Zones</th>
<th>Sampled schools</th>
<th>Private schools</th>
<th>Schools with qualified ICT manpower</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maella</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>100</td>
</tr>
<tr>
<td>Naivasha</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>100</td>
</tr>
<tr>
<td>Central</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Karunga</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>100</td>
</tr>
<tr>
<td>Mbaruk</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Elementaita</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Longonot</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Maraigushu</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>12</strong></td>
<td><strong>6</strong></td>
<td></td>
<td><strong>50</strong></td>
</tr>
</tbody>
</table>

The computers in these schools were used to attract pupils and parents. They were used as marketing tools to the parents. The main task of these schools is to maintain a good average in KCPE so that they can make a name nationally. The computer teachers were certificate and diploma holders from the Teachers’ Training Colleges (TTC).
Table 4.12: Public primary schools with qualified manpower

<table>
<thead>
<tr>
<th>Zones</th>
<th>Sampled schools</th>
<th>Public schools</th>
<th>Schools with qualified manpower</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maella</td>
<td>5</td>
<td>2</td>
<td>2</td>
<td>40</td>
</tr>
<tr>
<td>Naivasha Central</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>33</td>
</tr>
<tr>
<td>Karunga</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>25</td>
</tr>
<tr>
<td>Mbaruk</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>25</td>
</tr>
<tr>
<td>Elementaita</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Longonot</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>100</td>
</tr>
<tr>
<td>Maraigushu</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>67</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>27</strong></td>
<td><strong>11</strong></td>
<td></td>
<td><strong>41</strong></td>
</tr>
</tbody>
</table>

Percentage of public primary schools with qualified manpower

In Longonot and Maraigushu zones, these teachers had been provided by the AIC Mission through Steve Peifer otherwise the situation would be different. The public schools were busy struggling with understaffing hence they prioritised teachers to teach the examinable subjects. Even the schools which had computers donated to them or had bought them spent most of their energies on the KCPE subjects, hence the computers and the computer teacher ended up being underutilized. They did not realise that a computer system can be a good teaching tool that can avert the problem of understaffing through the adoption of e-learning.
The head teacher of Kamuyu Primary which is in Longonot zone admitted that it was only the young teachers who were in their 20’s who had interest in computers and even dedicated their time to learning new ICT skills. The research also got a positive correlation in performance between the primary schools with computers and those without. A primary school like Longonot Township or Loldia were found to perform quite well in KCPE with some pupils getting over 400 marks. Those without were found not to perform well in the exam. This can be attributed to the fact that computers make one a fast thinker either through typing or playing computer games. If more time was dedicated to computer usage by the students, then it was possible to get better results from the primary schools in the area.

On average, 58% of all the schools in Naivasha had a computer teacher. This is shown in the graph 4.1 below:
Over 70% of the public primary schools visited were understaffed by a big margin. This contributed to poor performance at KCPE. This had forced the parents to contribute some money to hire extra teachers. In some schools, the research learnt that a class could have an enrolment of over one hundred pupils.

According to the Head teacher of Kamuyu Primary and Deputy Head teacher of Moi Ndabi, understaffing had led to:

(i) Poor performance.
(ii) Indiscipline among the learners.

(iii) Poor class control: The classes had very high numbers for the teacher to control professionally. This also contributed to poor performance in examinations for the teachers hardly got the time they needed to mark the assignments they gave the learners.

(iv) Inability to complete the syllabus.

(v) Many parents taking their children to private schools for they felt that very little went on in the public schools.

(vi) Lack of enthusiasm among teachers: Many teachers felt that the government was punishing them by not employing others. They also complained of low remuneration.

Many head teachers were quite positive about the Free Primary Education (FPE) for it had made many children who otherwise would have gone into waste due to lack of school fees charged, get their primary education and now secondary education.

The issue of understaffing was such a serious one that Longonot Township had 16 teachers 9 being TSC while 7 hired by the BOG. The study learnt that at one time Ereri Primary had 2 teachers making teaching practically impossible for the eight classes.
The secondary schools did not have problems with staffing since the teachers had manageable loads on their timetables. However, the following were the reasons noted which made secondary schools not to present candidates for computer studies at KCSE examination:

(i) **Insufficient funds**: The administrators said that they were aware that the subject is expensive in the purchase of hardware and software. The 8-4-4 syllabus has a list of application software needed for teaching of the subject which comes in a suite meaning that one or two compact disks hold all of them. The research found out that a number of schools did not have an anti-virus while others had outdated ones. The computer teachers complained that it took a lot of time before an item in the ICT department is approved by the BOG to be bought. Many teachers confessed that they were using pirated software to safe guard the machines against viruses and worms. A TSC staffing officer based at the DEOs office underscored the importance of the skills but felt that very little had been done by the Ministry of Education in promoting the subject. He observed that the first priority is to employ teachers to teach the compulsory subjects since even the government has financial constraints. The issue of lacking funds has also been observed by the area MP. Talking to an executive accounts officer with Kenya Data Network(KDN), the cost of implementing the fiber optic cable is high as a distance of about 500metres may cost institutions about
half a million Kenyan shillings. Many BOGs can not approve such an amount. The Government policy that form 1 and 2 need to have one computer shared among four students and form 3 and 4 need one between two also made many schools not to invest in the technology for examination purposes.

(ii) **Ignorance by the E-leadership:** About 80% of the schools which had the computers had principals who were themselves computer literate. The study established that about 85% of the principals and teachers interviewed had not attended any of the ICT courses offered by the Ministry of Education despite the fact that they are charged cheaply and are distributed throughout the country and taught over the holidays. It is through such courses that they may appreciate the role played by ICT and can even have grounds to convince the BOGs and the PTAs to have the subject introduced regardless of the funds which may be used. In one of the schools visited, the computers did not have UPS connection and an antivirus software thus lowering the lifespan of the machines while on the other hand the proprietor would see it as an unnecessary cost. If e-leadership is well informed about the technology, many of the ICT basics like anti-virus software or UPS that were found to miss in many digital schools would be an issue.
(iii) **Lack of supportive infrastructure**: This was quite clear in the areas which did not have electricity by the Kenya Power. This power is relatively cheap and reliable for it is to a larger extent never affected by weather like the solar power. The Kenya Power also provides good services in case of a problem experienced like a spoilt transformer or a fallen power post or cable. The rural schools did not have good security hence many schools did not want to risk investing in such systems. Over 60% of the secondary schools did not have landline telephone connections. This is needed for Internet connection though with wireless communication, it is not a must. A TSC staffing officer observes that the World Bank and the Government of Kenya are working in collaboration in making the ICT dream a reality but there is a lot that needs to be done.

(iv) **High rate of turn over of the human capital**: Majority of the qualified computer teachers prefer teaching in the middle level colleges. In such institutions, they are able to do other part time jobs hence getting more money than they would get from secondary and primary schools.
The study also looked into the qualifications of the teachers by gender. This is shown in graphs 4.2 and 4.3

**Graph 4.2:**

A Graph showing the qualifications of the teachers teaching Computer skills

The graph shows that majority of the teachers have the required skills to handle the imparting of skills. All those with certificates and 50% of those with diplomas are in the primary schools while the rest were teaching in the secondary schools.
Majority of the teachers in the sampled schools were females though with diplomas and certificates. This is evidence that ICT and computer studies are not a domain for men only. This can be used to motivate girls to take the subject positively right from the primary schools to the university and also help in demystifying the subject as a male dominant one.

The above shows that human capital is available in most of the schools that had computer systems. There is manpower to handle the subject. E-leadership is also available only that it needs to be sensitized to issues of ICTs so that there can be more investment in it. E-leadership helps in giving direction to the digital schools in what is to be acquired, repaired, donated and what needs to be taught and by who. Also helps
in the promotion of the ICTs and encouraging the learners. Lack of e-leadership leads to the collapse of the digital schools.

4.2.3 Internet connectivity

Internet connectivity allows the teachers to fully explore the potentials of ICT. The 8-4-4 syllabus has a whole section on Internet and the topics that are covered are highly relevant to a growing economy like Kenya. The research found out that only a few schools especially the renowned and the best performing institutions had Internet. The students and teachers in these schools had limited time to browse or surf and majority only concentrated on emails. The schools that had presented candidates in the subject at KCSE lamented that the students did not have ample time to explore the Internet because there was only one server which was also used by the administration. In all these schools, the Internet was only switched on to the students on request from the computer teachers.

There was no school in the sample which used the computer systems for e-learning. 50% of the teachers interviewed had no idea how a computer can be used to facilitate learning to enhance the retention rate among the learners. 60% of computer teachers admitted that using the computers to facilitate teaching and learning would lead to poor performance for the learners would hardly concentrate in class.
The secretaries in these schools only used the internet connection for communication on rare occasions since most of the communications to other schools and the government departments was still in paper form. The schools they communicated with for sports, debates, drama and club activities also did not have internet connection. This meant that the computer as tool to enhance communication was under-utilised as well.

The study found out that none of the schools had a website. The principals never seemed to know what they could do with it. One principal admitted that he had been challenged by old students to have a website but never saw it as a priority. They take it as a facility which was only relevant to the international schools and high academic institutions such as universities and colleges. Tables 4.13, 4.14, 4.15 and 4.16 below show Internet connection among the different categories of schools in the sample. Majority of the private schools (62%) had no Internet connection meaning that they could not take advantage of the many e-resources available on it.
Table 4.13: Public secondary schools with Internet connection

<table>
<thead>
<tr>
<th>Zones</th>
<th>Sampled schools</th>
<th>public schools</th>
<th>Schools with Internet connection</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maella</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Naivasha Central</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>Karunga</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>50</td>
</tr>
<tr>
<td>Mbaruk</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>50</td>
</tr>
<tr>
<td>Elementaita</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Longonot</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Maraigushu</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>13</strong></td>
<td><strong>3</strong></td>
<td></td>
<td><strong>23</strong></td>
</tr>
</tbody>
</table>

Percentage of public secondary schools with Internet connection

Table 4.14: Private secondary schools with Internet connection

<table>
<thead>
<tr>
<th>Zones</th>
<th>Sampled schools</th>
<th>Private schools</th>
<th>Schools with Internet connection</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maella</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Naivasha Central</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>50</td>
</tr>
<tr>
<td>Karunga</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>67</td>
</tr>
<tr>
<td>Mbaruk</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Elementaita</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Longonot</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Maraigushu</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>8</strong></td>
<td><strong>3</strong></td>
<td></td>
<td><strong>38</strong></td>
</tr>
</tbody>
</table>
Of the six schools offering candidates at KCSE level in the subject, only three had Internet connection which was not available to the students anytime they needed it. This suggests that the Internet as a topic in the curriculum was not taught as it should. Most of the work was done theoretically. The candidates had to struggle by themselves by visiting the cyber cafes in major towns in and around Naivasha area to learn more about the Internet. This can be dangerous since in the cybercafés, there is no one to control the content they visit on the Internet.

Table 4.15: Private primary schools with Internet connection

<table>
<thead>
<tr>
<th>Zones</th>
<th>Sampled private schools</th>
<th>Schools with Internet connection</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maella</td>
<td>2</td>
<td>1</td>
<td>50</td>
</tr>
<tr>
<td>Naivasha Central</td>
<td>2</td>
<td>2</td>
<td>100</td>
</tr>
<tr>
<td>Karunga</td>
<td>2</td>
<td>1</td>
<td>50</td>
</tr>
<tr>
<td>Mbaruk</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Elementaita</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Longonot</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Maraigushu</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>TOTAL</td>
<td>12</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Percentage of private primary schools with Internet connection</td>
<td>25</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The 25% of the schools with Internet connection used it for communication with parents since majority of them were well up and computer literate and knew the efficiency of relying on emails for communication. The teachers hardly used it as a teaching aid in other subjects.

### Table 4.16: Public primary schools with Internet connection

<table>
<thead>
<tr>
<th>Zones</th>
<th>Sampled Public schools</th>
<th>Public Schools with Internet connection</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maella</td>
<td>5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Naivasha Central</td>
<td>3</td>
<td>1</td>
<td>33</td>
</tr>
<tr>
<td>Karunga</td>
<td>4</td>
<td>1</td>
<td>24</td>
</tr>
<tr>
<td>Mbaruk</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Elementaita</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Longonot</td>
<td>4</td>
<td>1</td>
<td>25</td>
</tr>
<tr>
<td>Maraigushu</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>27</strong></td>
<td><strong>3</strong></td>
<td><strong>11</strong></td>
</tr>
</tbody>
</table>

Only 11% of the public primary schools had Internet connection. This could be attributed to the fact that many schools may not know what to do with it bearing in mind that they also do not have a lot of use for the computers especially due to the absence of a curriculum and many of them concentrate on the examinable subjects.
Overall, only 25% of all the schools in the sample had Internet connection while 75% had none. 60% of the schools with Internet connection relied on either Safaricom, airtel or orange modems.

The research learnt that the lack of Internet connectivity was as a result of the following factors:

i. Schools knew very little on what they could do with it.

ii. The head teachers feared that the students and the teachers could misuse it.

iii. Ignorance by the head teachers and the BOG of its importance in schools.

At Mwiciringiri secondary school, the principal lamented that in spite of having a trained computer teacher in the subject and also having informed him that he had bought a safaricom modem to connect to the Internet, the teacher had not turned up to show the students what Internet was and its importance in this era. This could have been as a result of the following:

i. Bureaucracy in getting the modem from the principal

ii. The teacher endearing other subjects compared to computer studies

iii. He did not know how to use the modem.
Internet connectivity as a form of e-readiness for digital schools’ establishment is quite poor in Naivasha district. But with mobile phones now being able to access Internet and the cost of communication going down, it is bound to change with time. Internet in schools can really help schools cope with the issue of understaffing which was a common phenomenon in most of the schools in the district. This is through e-learning platforms. The internet is an important element in the overall educational experience of many teenagers. Through networks, the students and the teachers can share information while assignments can be marked online. The learners will also be able to learn at their own pace and consult when a need arises. From the web portals, the teachers can upload notes which the learners can access anytime.

4.2.4 Accessibility to the computer laboratory

The study found out that there were 15 schools especially in Longonot and parts of Maraigushu areas which have received sponsorship from Steve Peifer’s work. Some schools did share this facility especially where a primary school was next to a secondary school. This was found to be the situation in Longonot, Kiambogo and Kinungi schools.

This posed a number of challenges such as:

(i) **Fewer lessons for the learners**: The study found out that some students had only one lesson per month because the computer teacher was forced to
put them into groups in a bid to provide the skills to all of them. The teacher faced difficulties in ensuring the continuity of the topics covered. This made some of the learners especially in the secondary schools to give up and concentrate on the examinable subjects.

(ii) **Less time to use the computer**: A teacher from Kinungi secondary complained that he could hardly get time to use the computers in Kinungi primary school since the laboratory was ever busy with young boys and girls practising. Teachers using the computers can help in motivating the young children to like the technology. He suggested that there should not be sharing of computers if possible between the schools for sometimes led to enemity among the learners and the teachers. The principal of the school argued that they felt demeaned to share the same laboratory and with the majority of the students having been in the same primary school complicated the issues for the teenagers. Situations where the learners shared the computers sometimes led to molestation of the young ones unless drastic measures were taken to ensure such occurrences did not happen.

A teacher at Naivasha Girls noted that despite the fact that the students got access to the computer laboratory, it was not as they would have liked. This suggests that the learners including the computer studies candidates did not get ample time as they
would wish. The study also noted that the accessibility to the Internet was very limited in many schools including the ones studying the subject for KCSE.

Three secondary schools did not have the subject on the time table yet it was supposed to be taught and get tested every end of the term. The teacher was supposed to make his/her own arrangements on how and where the subject is to be taught. Two secondary and four primary schools even undermined the subject by giving it one or two lessons per week at the expense of the compulsory subjects.

The research also noticed that eight of the computer laboratories visited were too small to accommodate the learners. The size of the laboratories can be risky in case of a fire outbreak for the users would not have time and space for escaping. Most of the laboratories visited had only one exit and never had a fire extinguisher as recommended by the Ministry of Education.

The Naivasha MP felt that the number of computers in the schools was quite low to support proper learning as would be expected. Through the CFSK, he intended to get P2, P3 and P4 computers to donate to the schools which did not have and for those with, to have the number increased.
The schools needed to have planned carefully before acquiring computers to ensure that learners got enough access to the machines to practice and get skills. This is a proof that thorough e-readiness was never done before the acquisition of the computer systems. If the learners were to have a better accessibility to the digital than the research discovered, then there would be a lot of innovations. The more they have access to the laboratory should never be mistaken to mean they may be out to waste time.

4.2.5 Finances to run the computer projects

Private schools rely on fees charged to the parents or guardians to run the schools. The money collected is never enough in some situations to manage even the very basic operations. The investment in the computers comes as an afterthought and are never on most of the schools’ main priorities. The computer teachers in the public schools have to use a lot of persuasion to have a certain computer hardware or software bought. The research noted that the science based principals were easily convinced to buy a computer part compared to art based ones. The schools ought to think of ways of utilising the computers to make money to run the projects and also to ensure their sustainability. According to Steve Peifer, It takes about Ksh. 1.3 Million to put together a solar computer laboratory like the ones in Longonot and Maraigushu zones.
4.2.6 Breakdowns

The research noted that there was a lot of breakdown of hardware in the schools that had computers. The head teacher of Loldia observed that a lot of money would go to the repair of the ICT equipment. The 8-4-4 syllabus has one of its topics dealing with Dos and Don’ts while in a computer laboratory. This to some extent helps the students to become more careful when handling the equipment. But there was no formal curriculum to teach the pupils in the primary schools. Four computer teachers explained to the researcher the pains they go through explaining to the principals and head teachers whenever there are breakdowns. Hiring technicians to sort out breakdowns and corruption of software is expensive despite the fact that they may be simple ones. Many of them take advantage of the ignorance among the administrators to ICT related issues and end up overcharging them. In one of the centres visited which uses solar energy, the computer teacher explained the difficulties they had faced with solar batteries which could not charge from the solar panels.

The schools also need to put aside some finances to run the digital schools. This was never the case with most schools. To be e-ready means that some finances are available to repair or buy electronic devices when a need arises. A policy is also crucial in schools so that the issues of hardware and software breakdown and corruption may be addressed. There is also a need to empower the computer teacher with skills in repair and maintenance to avoid schools incurring a lot of money
whenever breakdowns occur. E-readiness becomes well tackled when the school personnel is empowered to handle repairs and maintenance than when a technician is to be hired from outside. Hiring a person from outside sometimes exposes secrets.

4.2.7 Information and equipment security

ICT related equipment are expensive to acquire and maintain. Many areas were observed not to have proper security to guard them. The computers donated by the Steve Peifer project were put in a small metallic room whose outside was made of hard metals providing good security. In one instance some people had tried to cut the hard metal but because of the sound it produced and the hardness of the metal, they never managed to get to the computers and their accessories. It is only through carrying the metal container or an inside job within the school that the equipment may be stolen as witnessed at Karima High School.

E-readiness is not only concerned with physical security but also logical security. None of the computers which the students were using had UPS. They got their power direct from the source. In case of power loss, information not saved would get lost and occasionally the software would get corrupted. Naivasha then did not score well with the information security issue as addressed by the Mc Connell e-readiness tool.
Relying on watchmen to guard the facility is not enough. There is need to have burglar alarms, biometric systems and even CCTV to enhance security.

4.2.8 Students not appreciating computers

It was quite unfortunate that the students and pupils in four secondary schools did not appreciate the facility. This was observed at Arch Bishop Ndingi, Kinungi, Mwiciringiri and Longonot Township secondary schools. The study attributed this to a number of factors such as:

i. The teachers not promoting the subject positively

ii. The administration not buying the needed hardware and software

iii. The extra fee charged to the parents/guardians to have the students learn the subject

iv. The learners having computers at home hence can learn at their own pace

v. The subject not timetabled like the other subjects

vi. Influence from home by the parents that the subject is making them not to revise well for their KCSE examination.

It is easier to build an ICT culture when learners come to appreciate technology. Such a culture helps in promoting e-readiness in the school, district and even the country.
4.2.9 Sustainability and Lack of e-business initiatives

The biggest challenge facing the Steve Peifer’s computer project in Longonot and Maraigushu areas was sustainability. He said that he was worried about the project’s sustainability given that the pupils of the schools he was assisting were faced with diseases, hunger, poverty, lack of exposure and ignorance.

A project that is not sustainable may not yield the objectives it was intended. If the digital schools were to open to the public, they would be sustainable since most people even in the rural areas have interest in ICT skills. This would be better if Internet connection was available as e-services would become a reality. With the acceptance of mobile phone technologies, the demand for e-services through computer systems has gone a notch higher.

4.3 The uses of computers in the digital schools

The research found out that the computers were used for a variety of applications. The pupils/students used them for:

(i) Learning what was on the syllabus such as word processing, programming, database systems, spreadsheets, desktop publishing (DTP) and operating systems. Some learnt for the sake of the exams while others wanted to be computer literate.
(ii) Playing computer games: This was very common with the learners in the primary schools and a few students in the secondary schools who were not to sit for KCSE computer studies examination.

The study learnt that only about 25% of the teachers in both primary and secondary schools were keen users of the computers. Those who made use of the computers used them in the following ways:

(i) Word processing where they typed their examinations and prepared notes.

(ii) Communication through emails

(iii) Surfing for general information in different fields of knowledge

(iv) Playing computer games

(v) Listening to music or watching DVDs and VCDs

(vi) Exams analysis: One of the principals interviewed informed the researcher that they used the computers to analyse their KCPE results. He admitted that majority of the teachers in the school are young hence had learnt ICT in the colleges. The usage of the computer systems to analyse examinations was also a very common practise in all the secondary schools.
The computers provided by the Steve Peifer project were meant to help the learners get skills which may eventually lead to employment. The aim of the project is to provide basic skills to the learners in word processing, desk top publishing, database management, spreadsheets and basic operations of the computers which may eventually lead to the advancement in the skills and even employment. He believed that anybody who has done database management system could become a good programmer and eventually enter any field in computer technology.

The research found some teachers in both primary and secondary schools who were not users of the computer systems despite the fact that the machines were on the school compound. This was attributed to the following:

(i) Were not computer literate and were afraid and shy of going back to computer schools to learn the skills where they may be challenged.

(ii) Complained that they did not have time for they were busy teaching and examining students.

(iii) Ignorance: They thought that the technology was for the young.

(iv) Expensive in terms of time and money: They dedicated their time and money doing other things they felt were economically viable like starting businesses.
By teachers appreciating the technology, it would go far in motivating the learners. This can greatly help the country much in this era of e-services. It would also help improve technological innovations among the learners which constitute e-readiness. The teachers are supposed to provide e-leadership. If they have no interest in ICT applications, then e-leadership to ICT issues to the learners will be doomed.

### 4.4 Equipment and facilities in the digital schools

The research found the following equipment in the digital schools:

1. **Computer systems:** The centres in Longonot and Maraigushu areas under the sponsorship of Steve Peifer project had laptop computers while the other centres sampled had desktop computers. Some school offices also had laptops either privately owned or as school property.

2. **Printers:** Most schools had laser jet printers. Some of the primary schools were also in the process of acquiring one through the money they get from the free primary education kitty.

3. **Scanners:** Only one centre had a scanner.

4. **UPS:** They were only found in the offices and not computer laboratories

5. **Modems:** They were used for Internet connection
vi. TV sets: All the private schools had TV sets just like most of the secondary schools. They were used to show movies, academic documentaries, news and games.

vii. Digital camera: Only one centre had a digital camera for taking photos to communicate with the sponsors of the project. Some computer teachers also had personal digital cameras for use either at school or for business.

viii. Internet connection: Only 25% of the schools had Internet facility which was under-utilised.

The equipment was of different capabilities and makes. Only the centres which were presenting candidates for the KCSE computer studies had most of above hardware.

The e-leadership determines the type of equipment that will be found in a digital school and the type of e-business that may be conducted.

Graph 4.4 shows the different types of personal computers that were available in the schools that were sampled:
The laptops were about 100 of them while the desktops were about 220. The PCs were of different Pentiums as shown in graph 4.5:
Most of the computers were either branded or clones. A number of centres had some e-wastes in their laboratories either the devices that were difficult or expensive to repair or machines which were donated by failed to work. It is very important that guidelines be developed nationally for equipment that is donated to digital schools so that e-wastes are blocked from getting into the country. Some developed countries dump their technological donations to many developing countries in the name of bridging the digital divide in the form of e-wastes.
4.5 Conclusion

This chapter presented the findings, analysis and interpretations of the study. The human, technical and physical factors which constitute Mc Connell International e-readiness tool were critically analyzed and interpreted. It is from this that a conclusion on where Naivasha falls in terms of amber, blue and red scales will be made in the next chapter and recommendations made on the way forward.
CHAPTER FIVE
SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.0 Introduction
The following chapter presents a summary of the findings, ranks Naivasha District on the bases of e-readiness as advanced by the McConnell International (MI) and finally comes up with a recommendation on the sort of framework which can be adopted to develop and sustain digital schools.

5.1 Summary
5.1.1 Power connection
Most of the schools do not have reliable power connections. The supply from the Kenya Power is not always reliable just like the solar one. There is a need to have more than two sources of power for the schools if the digital schools are to succeed.

5.1.2 Availability of the computers
Most of the schools rely on computers that have been donated. These computers vary from laptops to desktops. They also varied in speeds, memory and makes. They were used in teaching, entertainment and administrative tasks. The usage of the computers depended on the number, peripherals available and Internet connectivity.

5.1.3 Human Capital
Almost all the public secondary schools had more qualified computer teachers compared to the primary schools. Qualified teachers can easily motivate the learners to
appreciate the technology for they have learnt psychology in colleges hence know how to approach issues while teaching.

5.1.4 Internet connection

The schools with the Internet connection were very few despite the role it plays in facilitating e-learning and communication. Those with the Internet connection complained of the high cost of acquiring and maintaining it. Most of the schools have not realized the potential that lies with Internet connectivity.

5.1.5 Accessibility to the computer laboratory

The research found out that there was limited accessibility by the learners and even teachers to the computer laboratory. ICT applications have not been given the necessary support by the school e-leadership as is required. While majority of the learners want to have maximum utilization of the computer laboratory, the Ministry of Education directives on the choosing of the subjects, lack of funds to buy the needed equipment and even get the needed human capital to work in the laboratory acted as the biggest challenges to the success of the digital schools in the area in spite of the efforts put by individuals like Steve Peifer, the area MP, donors and schools committees.
5.1.6 Others challenges facing digital schools establishment

i. Sustainability

ii. Pupils/students not appreciating computers

iii. Security

iv. Finances to run the computer projects

v. Breakdowns

5.2 Conclusion

The research found that there were a number of schools with the computer equipment which are relatively made use of in teaching and learning process and also in the administrative work. This research used McConnell International (MI), a global technology policy and management consulting firm as its theoretical framework in assessing e-readiness of Naivasha district. The tool measures status and progress on five interrelated attributes with sub-indicators as connectivity, e-leadership, information security, human capital and e-business climate.

The MI rates countries in five categories on a scale of one to three ("blue", "amber", "red") in which blue indicates that majority of conditions are suitable to the conduct of e-business, e-government and e-learning, amber indicates improvement needed and red indicates substantial improvement is needed.
Considering connectivity using McConnell International e-readiness tool, the study puts Naivasha at amber for power connections. On average 69% of the schools in the area had power connection. The study felt that more improvements needed to be done such as:

i. Schools to install reliable power from Kenya Power

ii. Schools to have alternative sources of power such as generator and solar energy. These can be used during rationing which has become a common phenomenon in the area despite the fact that Olkaria Power Station is located in the area.

On average 25% of the schools had Internet connectivity and as a result the study puts Naivasha at red meaning that substantial improvement is needed. This is because of the following factors:

i. E-registration after being piloted by KNEC in 2010 is now compulsory for all schools presenting candidates for national examinations such as KCPE and KCSE. The schools need to buy computers and modems if they are to avoid incurring a lot expenses during e-registration.

ii. The cost of modems has gone down to as little as Ksh 3000 and on loading airtime, it is possible to buy a bandwidth that can help download e-resources which can be used in teaching. The schools can use their share of the FPE funds to purchase modems.
iii. There are many services that can be used to generate income to the schools if there is Internet connection such as e-learning, e-banking, communication among others. This can be an avenue to make digital schools become sustainable.

On e-leadership and human capital, the study puts Naivasha at amber. About 58% of the schools had qualified manpower and some principals were positive on digital schools. But there are some improvements that need to be done. These include:

i. The head teachers need to be attending the sensitization sessions which are organized by the Ministry of Education so that they can be aware of the trends in ICT.

ii. The school administration needs to think of ways of making digital schools sustainable by opening services to the outsiders.

iii. There is a need to develop a policy on matters such as servicing of computers and their usage by the students and members of the staff. Such a policy is what has made the usage of computers to be at a higher level in the international schools in Kenya.

On information security, the study puts Naivasha at red because of the following reasons:
i. Security of software was not guaranteed due to the absence of UPS. Power instability is a major cause of software corruption and data and information loss in digital schools.

ii. The physical security that was in most digital schools did not prevent computer systems from being stolen. In the course of the research, two of the digital schools that is Kiambogo and Karima were vandalized. The employment of watchmen to guard these centres is not enough. The schools need to think of both physical and logical security.

iii. Breakdowns were on a higher side especially in primary schools. The schools need to improvise the curriculum to include safety precautions so that the young learners can know how to handle the hardware.

On e-business, the study puts Naivasha at red. This is related to connectivity. With good Internet connectivity, the digital schools can open to the outside and make money which can be used in making them sustainable. Connectivity helps in promoting e-business climate. With 66% of the schools with computers and only 25% with Internet connectivity, the climate for e-business and e-learning becomes doomed bearing in mind again that most of the computers are donations which come with strict instructions on their usage.
5.3 Recommendations

5.3.1 Requirements of a digital school

The study recommends that the following should be in a computer laboratory or a digital school:

(i) **Uninterruptible Power Supply (UPS):** They will help in ensuring that the supply of power to the computer systems is stable hence the electronic components of the system safe. The UPS will also give the computer users a chance to save their work and safely shut down their computers in an event of power loss. This should be the responsibility of the school administration. They need to be purchased together with the computers. The administrator needs to work in consultation with the computer technician and the teacher.

(ii) **Stable power supply:** This is important for the security of data and programs. It also ensures that the systems do not crash. The source of power should be reliable whether is from solar panels, batteries, generators or mains supply from the Kenya Power. This is the responsibility of the school administration to make consultation with the suppliers of power.

(iii) **Antivirus:** This is utility software which should be installed in the computer system to help in detecting, scanning and cleaning computer viruses (destructive programs) from the computer. It should be updated all the time for the information superhighway has on many occasions a virus leading on the
way. Updating can be online or through purchases of compact disks with the utility. The administration should consult the computer experts before acquiring antivirus software. The task of updating the software should be the work of the computer technician.

(iv) **Proper ventilation:** Good ventilation helps to remove the hard air which may be in the computer laboratory. This air is brought about by the burning wires in the system units, the breathing out of the clients and also by heat which is produced by the computers as they process data to become information. The hard air may make the users uncomfortable and can also reduce the durability of the computers and other peripherals. The constructor of the digital school should ensure that this is accomplished before handing it over to the school management.

(v) **Security:** Computer systems and their accessories are expensive hence need a lot of security. The security provided may be either physical or virtual through software systems. Physical security includes the provision of burglar alarms, locks, security personnel, setting the digital school at a strategic position among others. Virtual security is through authentication which is by the use of user names and passwords. Access to a computer system may be restricted through the use of cards or biometrics such as retina and finger prints. It may also be reinforced through data encryption especially when networks are
involved. There is also a need to have a policy on security of the hardware, software and data. Physical security of the digital school is the work of the school administrator while the implementation of the logical security is the work of the computer technician and the teacher.

(vi) Application software: The 8-4-4 syllabus teaches the following application software and hence need to be provided in the digital centre; word processors, spreadsheets, databases, desktop publishing, Internet and e-mail and at least a programming language and any other software which the schools may feel is good for the learners such as simulation, presentation, games, typing tutor, training tutors which are part of the computer aided learning (CAL) among others. The school management should purchase the software which are licensed and those which come with a guarantee.

(vii) Personnel: The digital schools should have trained computer personnel to provide services to the clients. There should be computer teachers and technicians whose number depends on the size of the centres. The teachers should be involved in imparting knowledge to the learners while the computer technicians help in the repair of the hardware and the software. The secondary school digital schools should have teachers with diploma or degrees in Information Technology or computer science. Many public universities in Kenya like Maseno, Kenyatta and Egerton offer degrees in Education which
have the subject as one of them. Private universities like Catholic and Mt Kenya Universities also provide the same. Those to help the pupils in the primary schools should be trained teachers as well. All the teachers training colleges (TTCs) have produced teachers who can teach the subject as from 2007. The technicians need to have courses such as CICT, MCSE, A+ or even diplomas in Information Technology or Computer science. The centre should also have a watchman to provide security. The BOG should interview and recruit a qualified person to handle the learners. The personnel should oversee the implementation of the digital school.

(viii) **Syllabus**: The secondary part of the 8-4-4 system has a formal syllabus which is detailed enough. If it is followed as it is, the students will have knowledge which is applicable even in other subjects especially the search for information. Internet and email as topics in the Form 2 syllabus are very crucial in making e-learning a success. It has been observed that the Internet is the key to making e-learning a success. The school administration should buy the syllabus from the KIE.

(ix) **Standard furniture**: The furniture should be able to accommodate all the hardware and the clients. They need to be stable and ergonomically designed so that the users can make use of the systems comfortably. This is the responsibility of the school administration.
(x) **Protection against fire:** The digital school should have fire extinguishers to put off any fire outbreak. Smoke detectors should also be there to help in detecting anything which could be burning in and around the digital school. Fire may be caused by inflammable materials or chemicals or smoking in the laboratory. It may also be caused by burning wires in the computer systems. This is again the responsibility of the school administration.

(xi) **Lighting:** A computer laboratory should have proper lighting system to avoid eyestrains which eventually may lead to headaches, stress and fatigue. The clients should be advised to change the settings of the computer monitor to make them comfortable. It is important that the monitor should have anti-glare screens to make the clients work in a cool environment. This is the responsibility of a qualified electrician.

(xii) **Cabling:** All power cables in the computer room must always be properly insulated and laid away from the walkways in the room. Exposing cables to the clients may lead to power interruptions and electric shocks and worse when the computer systems are in use. This is the responsibility of the computer technician.

(xiii) **A policy:** The schools should have a policy pertaining to the establishment and the management of the digital centre. A policy acts as a guideline to the development of the centre and should touch on all aspects of the digital
school. It should deal with the hardware, software and the liveware to work in these centres. The policy should also spell out clearly issues on funding and sustainability of the digital schools. It was observed that many digital schools fail because they do not have a guideline on how they should be managed. This is the responsibility of the school administration.

All the above should be fully done before any teaching can start taking place. It is always better to take precautions with digital schools than to cure a mess that could have been avoided during the implementation.

5.3.2 Suggested steps to follow in setting up a digital school

(i) A systems analyst should carry feasibility study to understand the ground where the project is to be implemented. Ground work needs to be done through a feasibility study done by a qualified systems analyst hired by the school(s) to find out what is there and what is not. The systems analyst should come up with a detailed report on the way forward for a digital school. The funds to finance the feasibility study can come from a donor or from the school(s). The BOG has to authorise the expenditure. The systems analyst will come up with the aims and objectives of the project which have to be discussed with the school board to see its workability. The roles to be played by each stakeholder should be in the report.
Inform all the stakeholders in the school. These include:

a) Parents Teachers Association (PTA): They are the representatives of the parents and the teachers. They play a crucial role in the marketing of the school to the outside. The teachers are to use the facilities to effect e-learning. They as well help the learners while choosing their careers. They can influence the direction the project takes.

b) Board of Governors (BOG): They are the managers of the schools. The head teachers are always the secretaries to the board for they are in touch with all that happens in the schools. They decide what happens and when in a school including money allocations to different sections.

c) Political and administration leaders: Through them security and sustainability of the project may be guaranteed.

d) Constructor: He/she will receive instructions from the BOG on how the digital school is to be constructed. The digital schools should be purposely built taking into consideration issues such as: security, ventilation, dampness, power supply, furniture, floor, fire outbreaks, lighting, and cabling and laboratory layout as provided for by the 8-4-4 Volume Four syllabus.
e) Learners: These are the chief beneficiaries of the digital schools. They are the ones to learn the skills either for examination purposes or for their application in the job market.

All the above should be sensitised on the roles they are to play in the project. They can be met individually or as groups to ensure that they appreciate one another as stakeholders in the success of the project. It is also possible to organise trips to where such projects have been successful so that they may have something to benchmark with.

By involving the above, the digital schools can be acceptable by the community making the learners to benefit to the maximum from them.

(iii) The BOG advertises tender for the supply of the equipment that will be in the digital schools. These will be dictated by the demand of the syllabus. The factors to consider in the choice of the software are in Appendix 22 while for the choice of topology are in Appendix 21. The resources that a digital school may need are in Appendix 20.

The number and the type to buy will depend on the availability of funds and the population of the school.
(iv) Creating awareness of the digital schools to all the stakeholders: This should be done before implementation is done so that they have in mind what to expect. This can be done through a number of ways:

- Visiting institutions having and using digital schools
- Visiting computer exhibitions
- Inviting speakers to talk on ICT related issues.

(v) Implementing the system.

The research recommends that the implementation to be done to depend on what is on the ground. The schools which have not invested at all in ICT will need direct implementation while those that have something on the ground may need either parallel running or phased implementation. Piloting may not be necessary for the schools that already have the systems which are running.

Direct implementation has the following advantages:

(i) There will be rapid implementation of the systems. If all that is needed is there then with direct implementation it will be very fast to implement

(ii) There is less confusion since there is nothing to compare the system with.

If the owners of the schools prefer to use the phased introduction method, the following merits will be realized:
(i) It is very structured; each phase can be fully evaluated before moving to the next one.

(ii) Lower risk since there is controlled introduction to the computer systems. It is possible to exchange ideas after the first phase becomes successful. There has to be a well-planned implementation timetable which needs to be evaluated after every phase.

(iii) It is easy to train staff by letting them learn new skills on each phase. This is one of the ways of ensuring that the systems are not rejected by the end users. It is wise to train the stakeholders on the ground especially the teachers for they have a lot of influence on the learners.

Parallel implementation involves running of the new and the old systems. This will be done where there are already digital schools on the ground. This is expensive but has the following advantages over the other two methods of implementation:

(i) If there is a problem with the new system, then the users can turn to the old system. This means that at no time will operations of the system come to a halt since there is one to be turned to.

(ii) Both systems can easily be compared to in terms of performance hence decide on what may be done at that time or in the future

(iii) Easy to train staff by letting them learn new skills on the parallel system. This makes the staff accept the system.
(iv) Easy to evaluate because the new and old systems are both running. Evaluation will involve checking whether the intended goals of the system were achieved or not.

Their success depends on a total overhaul on the way the traditional teacher and school approach educational and management issues. The benefits of ICTs can only be realized through proper planning, staying focused on educational objectives and understanding the limitations of their capabilities. This is what necessitates e-readiness to be done before venturing into digital schools’ implementation.

5.3.3 Further research

This study is not exhaustive as it comes at the time when Kenya is slowly embracing ICT in its operations. Despite the fact that the curriculum to teach computer studies in the 8-4-4 system secondary section has been there for over ten years, not many schools have been able to present candidates in form four KCSE examination. The teachers have not been able to fully embrace the technology in teaching, creating an avenue for further research in areas such as: The Impact of ICT usage in Kenya’s educational curriculum; A comparative study between teaching of ICT in primary schools and secondary schools in Kenya; The role of ICT in the promotion of education among the disadvantaged in Kenya, among others. These will be interesting areas to be looked into now that laying of the fiber optic is going on and by the time this research is
completed, many of the areas in Kenya will have Internet connectivity. Also, as we move towards Kenya’s Vision 2030, where ICT has been described as the engine to the social, political and economic development, the Government of Kenya will have invested in a great deal in the technology to be able to realise this noble dream.

5.4 Suggested Framework

5.4.1 Importance of the framework

The framework will remove the internal biases that come from personal feelings especially of the administrators. It will provide details that are required in the starting up of digital schools.

Computer frameworks provide an avenue for communication with the end users. This is very important especially for the schools that have Internet connection. Through this, the schools will be able to get advice on matters pertaining to digital schools establishment.

The framework will help one make informed decisions. There are many instances where the computer teachers and technicians can not relate well with the school administration because of issues pertaining to certain software or hardware. With a framework that is up-to-date, such issues may not arise.
The framework will act as a portal for notes and question papers. The usage of an efficient web portal can add immensely to the overall productivity of an institution. This will be a big advantage to a new computer teacher and also computer students.

5.4.2 Framework Design
This stage was meant to come up with a system structure in terms of database design, interface design and a process flow that is reflective of a systematically organized sequence. This activity was succeeded by a program design that facilitated data entry, processing and subsequent storage in the format that would ensure uniformity and maximum accuracy of entries. Database interface and program design was done to show the system’s flow of information. The requirements of the digital school were used to create the basis for the system. The main objective was to design a system which delivers the functions required by the users to provide the information that the digital school was to communicate.

5.4.3 Process modeling
The proposed system is object oriented. Unified Modelling Language was used to provide a comprehensive notation for communicating the requirements, architecture, implementation, deployment, and states of the system. The use case diagram below
shows the different modules that were made in the digital school system. Each module encapsulates a number of functions in it.

**Fig 5.1: Use case diagram for digital school system**

![Use case diagram for digital school system](image)

### 5.4.4 Component diagram

The component diagram's main purpose is to show the structural relationships between the components of the digital school system. In addition, component diagrams are useful communication tools for various groups of users of the system who in this case are ICT professionals, students and pupils among others. The diagrams can be presented to key project stakeholders and implementation staff. While component diagrams are generally geared towards a system's implementation staff, they can generally be used to put stakeholders at ease because they present an early understanding of the overall system that is being built.
It provided systems developers with a high-level, architectural view of the system that was built, which helps one to begin formalizing a roadmap for the implementation, and make decisions about task assignments and/or needed skill enhancements. The diagram below shows the component diagram that was used to develop the digital school system.

**Fig 5.2: The Component Diagram for the Digital school developed**

![Diagram](image)

**5.4.5 Activity diagram**

Activity diagrams illustrate the flow of functionality in a system. They may be used in requirements gathering to illustrate the flow of events through a use case. They define where the workflow starts, where it ends, what activities occur during the workflow,
and in what order the activities occur. An activity is a task that is performed during the workflow for example updating a database and navigating through the system.

Fig 5.3 : Diagram showing activity diagram of the digital school designed

5.4.6 Class diagram

The class diagram is a static diagram. It represents the static view of an application. Class diagram is not only used for visualizing, describing and documenting different
aspects of a system but also for constructing executable code of the software application.

The purpose of the class diagram is to model the static view of an application. The coding was done using Dreamweaver and MYSQL software. The diagram below shows the class diagram that was used.

**Fig 5.4: Diagram showing the Class diagram used in design**
5.4.7 Deployment diagram

A deployment diagram in the Unified Modeling Language models the physical deployment of artifacts on nodes. The diagram shows what hardware components or nodes exist, what software components or artifacts run on each node for example web application or database, and how the different pieces are connected.

The nodes appear as boxes, and the artifacts allocated to each node appear as rectangles within the boxes.

Fig 5.5: A diagram showing the deployment diagram used in the design
The suggested framework for the implementation of the digital schools is presented in form of Webpages. The development of the model followed the Spiral Model template where there is a lot of prototyping and iteration. Important information that digital school systems should provide is taken care of. Communication with the stakeholders in digital schools is also taken care of through feedbacks and news updates.

The printouts are available as appendices 19 to 25 while the codes used are in appendix 17 while the user manual is Appendix 18
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Appendix 1

Questions to the Head teachers or Deputies or Deans of studies or the computer studies teachers in secondary schools

I am a Masters student from Moi University in the Faculty of Information Sciences. I am undertaking a research on developing a framework for e-readiness and implementation of digital schools in rural areas: A case study of Naivasha District of Rift Valley Province in Kenya. Please answer the following questions. The answers you will provide will be treated with strict confidence.

1. When was this institution started?
2. How many students does it currently have?
3. How many teachers does it have?
4. How many of your members of staff are computer literate?
5. What are their academic qualifications?
6. Does your school have power connections?
7. If yes what do you use the power for?
8. If no are there plans to have power installed and by when?
9. Does the school have a library? If yes what type of collection do you house in it? Also where do you get them from?
10. If no, are there plans to have a library in the future?
11. Does your school have computers?
12. If yes what do you use them for?
13. How many computers do you have?
14. What type of computers are they?
15. Is there Internet connection in your school?
16. Do the teachers know how to use the Internet?
17. How do the teachers use the computers?
18. What challenges do you encounter in offering computer lessons?
19. How do you handle these challenges when they occur?
20. How is computer studies taught to the students from form one to four?
21. Have you presented candidates in KCSE computer studies?
22. If yes, how was the performance compared to other subjects?
23. If no to question 21, why?
24. Have you ever attended the courses offered by the Ministry of Education on the role of ICTs in school management?
25. If yes, did you benefit from the course and how?
26. If no, how come you have never attended?
For those with no computers in the schools
27. Are there plans to have computers installed and by when?
28. If you had computers, what would you use them for?
29. How would you rate the security situation in this area around the school?
30. How do you ensure that there is security in your school?
31. Any other information you feel this research needs to know?

Thanks for your cooperation.
Appendix 2

Questions to the Head teachers or Deputies or senior teachers or the computer studies teachers in Primary schools

I am a Masters student from Moi University in the Faculty of Information Sciences. I am undertaking a research on developing a framework for e-readiness and implementation of digital schools in rural areas: A case study of Naivasha District of Rift Valley Province in Kenya. Please answer the following questions. The answers you will provide will be treated with strict confidence.

1. When was this institution started?
2. How many pupils does it currently have?
3. How many teachers does it have?
4. How many of your members of staff are computer literate?
5. What are their academic qualifications?
6. Does your school have power connections?
7. If yes what do you use the power for?
8. If no are there plans to have power installed and by when?
9. Does the school have a library? If yes what type of collection do you house in it? Also where do you get them from?
10. If no, are there plans to have a library in the future?
11. Does your school have computers?
12. If yes what do you use them for?
13. How many computers do you have?
14. What type of computers does your school have?
15. Is there Internet connection in the school?
16. Do the teachers know how to use the Internet?
17. How do they use the computers?
18. Is computer studies taught to the pupils?
19. If yes, how is it taught?
20. What challenges do you encounter in offering computer lessons?
21. How do you handle these challenges when they occur?
22. Have you ever attended the courses offered by the Ministry of Education on the role of ICTs in school management?
23. If yes, did you benefit from the course and how?
24. If no, how come you have never attended?

For those with no computers in the schools
25. Are there plans to have computers installed and by when?
26. If you had computers, what would you use them for?
27. How would you rate the security situation in this area around the school?
28. How do you ensure that there is security in your school?
29. Any other information you feel this research needs to know?

Thanks for your cooperation.
Appendix 3

Questions to the Mr Steve Peifer, the coordinator of the digital schools in Longonot and Maraigushu areas of Naivasha District.

I am a Masters student from Moi University in the Faculty of Information Sciences. I am undertaking a research on developing a framework for e-readiness and implementation of digital schools in rural areas: A case study of Naivasha District of Rift Valley Province in Kenya.

Please answer the following questions. The answers you will provide will be treated with strict confidence.

1. When did this project start?
2. What drove you to starting this project in this area and not any other area?
3. Did you do any ground work before the project started?
4. What type of ground work did you do?
5. What factors do you consider before you donate the machines to a school?
6. What challenges do you encounter in the implementation of the project in the area?
7. How many schools have benefitted from this project so far?
8. What is the sustainability of the project?
9. In your view do you think the computers are being used in the right way by the students and teachers?
10. Are the teachers included in the project in learning the computer skills?
11. How are the teachers teaching the subject hired by the schools?
12. Is the community around allowed to learn skills?
13. Is there a syllabus which is followed in the primary schools? If not, what do the teachers use to impart skills to the learners?
14. How do you intend to bridge the digital gap that exists in the schools?
15. What other plans do you have about this project?
16. Any other information which you would like to provide to this research?

Thanks for your cooperation.
Appendix 4

Questions to the Naivasha Area MP Hon John Mututho,

I am a Masters student from Moi University in the Faculty of Information Sciences. I am undertaking a research on developing a framework for e-readiness and implementation of digital schools in rural areas: A case study of Naivasha District of Rift Valley Province in Kenya.

The answers you will provide will be treated with strict confidence.

1. For how long have you been the area MP?
2. Have you made any contributions towards the following and in each explain how?
   - Education
   - Health
   - Security
   - Employment
   - Computer installation
   - Power installation
3. What problems do you see facing the schools in your constituency?
4. How can such problems be solved and who will do it?
5. What is your take on computers in schools? Do you think they are important and is your constituency ready for them now that the fiber optic cable has become real in Kenya
6. Any other information which you would like to provide to this research?

Thanks for your cooperation.
Appendix 5

SEACOM Route Layout showing Sub-Marine Fiber Optic Connectivity which links up Africa to Asia and Europe

Source: Kenya Data Network
Appendix 6

BUDGET FOR THE RESEARCH

<table>
<thead>
<tr>
<th>Activity</th>
<th>Cost in Ksh</th>
</tr>
</thead>
<tbody>
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<td>Travelling</td>
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</tr>
<tr>
<td>Communication and postage</td>
<td>20,000</td>
</tr>
<tr>
<td>Stationery</td>
<td>30,000</td>
</tr>
<tr>
<td>2 research assistants</td>
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<tr>
<td>Printing and binding</td>
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<tr>
<td>Others</td>
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Appendix 7

The work plan

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### Appendix 8

**Observation checklist used in the research**

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Appendix 9

The Proposed Fiber Route Network in Kenya

Appendix 10

Schools in Karunga zone sampled in the research

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**Key**

1-Available

0-Not available
Appendix 11

Schools in Longonot zone sampled in the research

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**Key**

1-Available

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Appendix 12

Schools in Maella zone sampled in the research

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**Key**

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Appendix 13

Schools in Mbaruk zone sampled in the research

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Schools in Maraigushu zone sampled in the research

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Public primary schools

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Public Secondary Schools

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Private primary schools

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Key

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**Key**

1-Available

0-Not available
Appendix 16

Schools in Elemeitaita zone sampled in the research

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**Key**

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0-Not available
Appendix 17 Codes that were used to code the system

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<meta http-equiv="Content-Type" content="text/html; charset=iso-8859-1" />
<title>Digital School Development</title>
<link href="mystyle.css" rel="stylesheet" type="text/css" />
<link rel="stylesheet" type="text/css" href="chrometheme/chromestyle.css" />
<script type="text/javascript" src="chromejs/chrome.js">
	
/**********************************************
* Chrome CSS Drop Down Menu- (c) Dynamic Drive DHTML code library (www.dynamicdrive.com)
* This notice MUST stay intact for legal use
* Visit Dynamic Drive at http://www.dynamicdrive.com/ for full source code
*********************************************/
</script>
<script type="text/javascript" src="transitionshow.js">
	
/**********************************************
* Random Transitions Slideshow- by JavaScript Kit (www.javascriptkit.com)
* This notice must stay intact for usage
* Visit JavaScript Kit at http://www.javascriptkit.com/ for full source code
***********************************************/
</script>
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#Layer1 {
    position:absolute;
    left:0px;
    top:0px;
    width:950px;
    height:250px;
    z-index:101;
}
.style2 {
    color: #FFFFFF;
    font-weight: bold;
}
.style3 {
    color: #331257;
    font-size: 18px;
}
font-weight: bold;
}

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</style>
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<!--DWLayoutTable-->
<tr>
<td width="950" height="404" valign="top"><table width="900" border="0" cellpadding="0" cellspacing="0" bgcolor="#FFFFFF">
<!--DWLayoutTable-->
<tr>
<td width="950" height="120" valign="top"><table width="100%" border="0" cellpadding="0" cellspacing="0" bgcolor="#EDEDED">
<!--DWLayoutTable-->
<tr>
<td width="356" height="120" valign="top"><table width="100%" border="0" cellpadding="0" cellspacing="0">
<!--DWLayoutTable-->
<tr>
<td width="352" height="120" align="left" valign="middle"><img src="images/logo.jpg" width="344" height="49" /></td>
</tr>
</table></td>
<td width="11">&nbsp;</td>
<td width="583" valign="top"><table width="100%" border="0" cellpadding="0" cellspacing="0">
<!--DWLayoutTable-->
<tr>
<td width="575" height="120" align="left" valign="middle"><div class="top"><a href="scheduleappointment.php" class">Schedule an Appointment</a> &nbsp;| &nbsp;<a href="postajob.php">Employers: Post a job</a> &nbsp;| &nbsp;<a href="jointeam.php">Join Our Team</a>&nbsp;| &nbsp;<a href="index.php">Home</a></div></td>
</tr>
</table></td>
</tr></table></td></tr>
<tr></tr>
</table></center>

</table>
</body>
var flashyshow=new flashyslideshow({ //create instance of slideshow
  wrapperid: "myslideshow", //unique ID for this slideshow
  wrapperclass: "flashclass", //desired CSS class for this slideshow
  imagearray: [
    ["slide/lab.jpg"],
    ["slide/lab2.jpg"],
    ["slide/lab3.jpg"],
    ["slide/lab4.jpg"],
    ["slide/lab5.jpg"]
  ],
  pause: 3000, //pause between content change (millisecond)
  transduration: 2000 //duration of transition (affects only IE users)
<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### DIGITAL SCHOOL REQUIREMENTS

1. What you need to know

- [supercategory.php?main=1](supercategory.php?main=1) - What you need to know
<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Computer Lab Layout</td>
</tr>
<tr>
<td>2</td>
<td>Hardware Choice</td>
</tr>
<tr>
<td>3</td>
<td>Software Choice</td>
</tr>
<tr>
<td>4</td>
<td>Hardware requirements</td>
</tr>
<tr>
<td>5</td>
<td>Software Needed</td>
</tr>
<tr>
<td>6</td>
<td>Computer Laboratory Network</td>
</tr>
<tr>
<td>7</td>
<td>Topology to use</td>
</tr>
</tbody>
</table>

</table>
<table width="100%" border="0" cellpadding="0" cellspacing="0" bgcolor="#4C90E5">

<table>
<thead>
<tr>
<th>QUICK CONTACTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>+254 (723) 988746</td>
</tr>
<tr>
<td><a href="mailto:jimndegwa@yahoo.com">jimndegwa@yahoo.com</a></td>
</tr>
<tr>
<td><a href="mailto:jimndegwa@gmail.com">jimndegwa@gmail.com</a></td>
</tr>
<tr>
<td>MESVI</td>
</tr>
<tr>
<td>P.O BOX 867-00605</td>
</tr>
<tr>
<td>UTHIRU</td>
</tr>
<tr>
<td>KENYA, EAST AFRICA</td>
</tr>
</tbody>
</table>

| MESS |
| P.O BOX 867-00605 |
| UTHIRU |
| KENYA, EAST AFRICA |

<table>
<thead>
<tr>
<th>QUICK CONTACTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>+254 (723) 988746</td>
</tr>
<tr>
<td><a href="mailto:jimndegwa@yahoo.com">jimndegwa@yahoo.com</a></td>
</tr>
<tr>
<td><a href="mailto:jimndegwa@gmail.com">jimndegwa@gmail.com</a></td>
</tr>
<tr>
<td>MESVI</td>
</tr>
<tr>
<td>P.O BOX 867-00605</td>
</tr>
<tr>
<td>UTHIRU</td>
</tr>
<tr>
<td>KENYA, EAST AFRICA</td>
</tr>
</tbody>
</table>

<p>| MESS |
| P.O BOX 867-00605 |
| UTHIRU |
| KENYA, EAST AFRICA |</p>
<table>
<thead>
<tr>
<th>Date</th>
<th>News Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011-09-09</td>
<td>The International Baccalaureate is advertising for marking</td>
</tr>
<tr>
<td>2011-01-01</td>
<td>The KIE has already digitised the number of curricula and now appear in DVDs.</td>
</tr>
</tbody>
</table>

.. code-block:: html

    <table style="width:100%; border:0; cellpadding=0; cellspacing=0; bgcolor="#F4F5F7" class="allborder">
        <tr>
            <td width="10" height="19" align="center" valign="middle"><strong>&rsaquo;</strong></td>
            <td width="190" align="left" valign="top" class="news"><b><u><a href="news.php?newsid=18">2011-09-09</a></u></b></td>
        </tr>
        <tr>
            <td height="1"></td>
            <td></td>
        </tr>
        <tr>
            <td height="18"></td>
            <td align="left" valign="top">The International Baccalaureate is advertising for marking</td>
        </tr>
        <tr>
            <td width="10" height="19" align="center" valign="middle"><strong>&rsaquo;</strong></td>
            <td width="190" align="left" valign="top" class="news"><b><u><a href="news.php?newsid=17">2011-01-01</a></u></b></td>
        </tr>
        <tr>
            <td height="1"></td>
            <td></td>
        </tr>
        <tr>
            <td height="18"></td>
            <td align="left" valign="top">The KIE has already digitised the number of curricula and now appear in DVDs. This was a success</td>
        </tr>
    </table>
<table>
<thead>
<tr>
<th>Projects</th>
<th>News Window</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;iframe id=&quot;NewsWindow&quot; src=&quot;news_win.php&quot; width=&quot;196&quot; height=&quot;100&quot; marginwidth=&quot;0&quot; marginheight=&quot;0&quot; frameborder=&quot;0&quot; scrolling=&quot;no&quot; style=&quot;border:#CCCCCC 1px solid;&quot; /&gt;</td>
</tr>
</tbody>
</table>

For more information, please visit [our website](http://www.example.com).
This is a company that advises schools and institutions on the procedures to follow in setting up digital schools or computer laboratories. Our working definition of a digital school is one where the teaching resources and the administration and communications systems are predominantly digital. It implies the usage of ICTs in most of the operations in the school i.e. in administration...
Careers Module codes

```php
<?php

function left($string, $count)
{
    return substr($string, 0, $count);
}

$title1="";
?

<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN" "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">
<head>
<meta http-equiv="Content-Type" content="text/html; charset=iso-8859-1" />
<link href="mystyle.css" rel="stylesheet" type="text/css" />
<link rel="stylesheet" type="text/css" href="chrometheme/chromestyle.css" />
<script type="text/javascript" src="chromejs/chrome.js">

/*********************************************************/

* Chrome CSS Drop Down Menu- (c) Dynamic Drive DHTML code library (www.dynamicdrive.com)

* This notice MUST stay intact for legal use

* Visit Dynamic Drive at http://www.dynamicdrive.com/ for full source code

/*********************************************************/
```
<script type="text/javascript" src="transitions.js">/

/*Random Transitions Slideshow- by JavaScript Kit (www.javascriptkit.com)
* This notice must stay intact for usage
* Visit JavaScript Kit at http://www.javascriptkit.com/ for full source code

*/

</script>

<style type="text/css">
<!-
#Layer1 {
    position:absolute;
    left:0px;
    top:0px;
    width:950px;
    height:250px;
    z-index:101;
}

.style2 {
    color: #FFFFFF;
    font-weight: bold;
}
<table>
<thead>
<tr>
<th>Width</th>
<th>Height</th>
<th>Valign</th>
<th>Background Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>950</td>
<td>404</td>
<td>top</td>
<td>#FFFFFF</td>
</tr>
<tr>
<td>200</td>
<td>175</td>
<td>top</td>
<td></td>
</tr>
<tr>
<td>200</td>
<td>175</td>
<td>top</td>
<td></td>
</tr>
</tbody>
</table>

<?php include("top.php") ?>

<?php include("leftlinks.php") ?>
```php
<?php include("dbconnect.php");
    $contents="";
    $query = "select * from pages where title='COMPUTER CAREERS'";
    $result = mysql_query($query);
```
while($row=mysql_fetch_array($result))
{

    $contents=$row["contents"];  
    echo "$contents";
}

<p>  <div> <B><u>COMPUTER JOBS AVAILABLE</u></B> </div></p>

<div><div style="line-height:18px; text-align:justify;"><?php include("dbconnect.php");
    $contents="";
    $query = "select * from jobs ";
    $result = mysql_query($query);
    while($row=mysql_fetch_array($result))
    {
        $title=$row["title"];  
        $details=$row["details"];  
        ?></div>  
        <div style="border-bottom:solid 2px #999999;">
            <b><?php echo $title; ?></b><br />
            <?php echo $details; ?></div>  
    </div>
</div>
```html
<table>
<tr>
<td width="13">&nbsp;</td>
<td width="200" rowspan="2" valign="top"><?php include("right.php") ?></td>
</tr>
<tr>
<td height="62">&nbsp;</td>
<td>&nbsp;</td>
<td>&nbsp;</td>
</tr>
</table>
```
Contact us

```php
function left($string, $count)
{
    return substr($string, 0, $count);
}
```

```html
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN" "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">
<head>
<meta http-equiv="Content-Type" content="text/html; charset=iso-8859-1" />
<title>Digital School Development - Contact Us</title>
<link href="mystyle.css" rel="stylesheet" type="text/css" />
<link rel="stylesheet" type="text/css" href="chrometheme/chromestyle.css" />

<script type="text/javascript" src="chromejs/chrome.js">

/*****************************/

* Chrome CSS Drop Down Menu- (c) Dynamic Drive DHTML code library (www.dynamicdrive.com)

* This notice MUST stay intact for legal use

* Visit Dynamic Drive at http://www.dynamicdrive.com/ for full source code

/*****************************/
Random Transitions Slideshow - by JavaScript Kit (www.javascriptkit.com)

* This notice must stay intact for usage

* Visit JavaScript Kit at http://www.javascriptkit.com/ for full source code

******************************************************************************

Layer1 {
    position:absolute;
    left:0px;
    top:0px;
    width:950px;
    height:250px;
    z-index:101;
}

.style2 {
    color: #FFFFFF;
    font-weight: bold;
}
<body>
<center>
<table width="950" border="0" cellpadding="0" cellspacing="0">
<tr>
<td width="950" height="404" valign="top">
<?php include("top.php") ?></td>
</tr>
<tr>
<td height="6"></td>
</tr>
<tr>
<td height="269" valign="top">
<table width="100%" border="0" cellpadding="0" cellspacing="0" bgcolor="#FFFFFF">
</td>
</tr>
<tr>
<td width="200" height="175" valign="top">
<?php include("leftlinks.php") ?></td>
</tr>
</table>
</center>
</body>
</tr>

</table></td>

<td width="13">&nbsp;</td>

<td width="524" rowspan="3" valign="top"><table width="100%" border="0" cellpadding="0" cellspacing="0">
<tr>
<td height="24" valign="top"><table width="100%" border="0" cellpadding="0" cellspacing="0" bgcolor="#331257">
<tr>
<td width="524" height="24" align="left" valign="middle"><div style="color:#FFFFFF; font-weight:600;">OUR CONTACTS</div></td>
</tr>
</table></td>
</tr>
<tr>
<td height="245" valign="top"><table width="100%" border="0" cellpadding="0" cellspacing="0">
<tr>
<td height="245" valign="top"><div style="line-height:18px; text-align:justify;"><?php include("dbconnect.php");
(contents="";
$query = "select * from pages where title='CONTACTS' ";
$result = mysql_query($query);

</div></td>
</tr>
</table></td>
</tr>
</table>
</td>
</tr>
while($row=mysql_fetch_array($result))
{
    $contents=$row["contents"]; 
}

echo "$contents";
?>

</div>

<p><b>FILL IN THE FORM BELOW FOR ANY ENQUIRIES</b></p>

<form id="form1" name="form1" method="post" action="send.php">
</form>

<?php

$ipi = getenv("REMOTE_ADDR");

$httprefi = getenv ("HTTP_REFERER");

$httpagenti = getenv ("HTTP_USER_AGENT");

<?php

<input type="hidden" name="ip" value="<?php echo $ipi ?>" />

<input type="hidden" name="httpref" value="<?php echo $httprefi ?>" />

<input type="hidden" name="httpagent" value="<?php echo $httpagenti ?>" />

<input type="hidden" name="attn" value="Digital School Development" />

<center> <table width="545" height="158" border="0">
<!--DWLayoutTable-->
<tr>
<td width="539" height="234" align="left" valign="top"><p>Name<br />
<p>
<input name="name" type="text" id="name" size="50" />
<br />
Telephone<br />
<input name="tel" type="text" id="tel" size="50" />
<br />
E-mail<br />
<input name="email" type="text" id="email" size="50" />
<br />
Subject<br />
<input name="subject" type="text" id="subject" size="40" />
</p>
<p>Notes<br />
<textarea name="notes" cols="50" rows="10" id="notes"></textarea>
<br />
<br />
</p></td>
</tr>
<tr height="43" align="left" valign="middle"><input type="submit" name="Submit" value="Submit" />
<input type="reset" name="Submit2" value="Reset" /></td>
</tr>
</table>
</center>
<form></form>
<tr>
  <td height="5" /></td>
</tr>

<tr>
  <td height="46" valign="top">
<?php include("bottom.php") ?></td>
</tr>
</table></center></body></html>
Gallery codes

<?php

function left($string, $count)
{
    return substr($string, 0, $count);
}

?>

<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN" "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">
<head>
<meta http-equiv="Content-Type" content="text/html; charset=iso-8859-1" />
<title>Digital School Development - Photogallery</title>
<link href="mystyle.css" rel="stylesheet" type="text/css" />
<link rel="stylesheet" type="text/css" href="chrometheme/chromestyle.css" />
<link rel="stylesheet" href="lightbox.css" type="text/css" media="screen" />
<script type="text/javascript" src="lightbox.js"></script>
<script type="text/javascript" src="chromejs/chrome.js">
/*****************************/
* Chrome CSS Drop Down Menu- (c) Dynamic Drive DHTML code library (www.dynamicdrive.com)
* This notice MUST stay intact for legal use
* Visit Dynamic Drive at http://www.dynamicdrive.com/ for full source code
Random Transitions Slideshow - by JavaScript Kit (www.javascriptkit.com)

This notice must stay intact for usage

Visit JavaScript Kit at http://www.javascriptkit.com/ for full source code

---

#Layer1 {
    position:absolute;
    left:0px;
    top:0px;
    width:950px;
    height:250px;
    z-index:101;
}

.style2 {
    color: #FFFFFF;
    font-weight: bold;
}
<body>

<center><table width="924" border="0" cellpadding="0" cellspacing="0">
</center>

</table>
</center>

</body>
<table border="0" cellspacing="0" cellpadding="0">
<tr>
<td width="200" height="175" valign="top"><!--leftlinks.php--> </td>
</tr>
</table></td>
</td>
<td width="14" height="162"></td>
<td width="708" valign="top"><table width="100%" border="0" cellspacing="0" cellpadding="0" bgcolor="#331257">
<tr>
<td width="708" height="24" align="left" valign="middle"><div style="color:#FFFFFF; font-weight:600;">PHOTOGALLERY</div></td>
</tr>
</table></td>
</tr>
<tr>
<td width="708" height="138" valign="top"><table width="100%" border="0" cellspacing="0" cellpadding="0">
<tr>
<td height="138" valign="top"><table width="100%" border="0" cellspacing="0" cellpadding="0">
<tr>
<td width="708" height="138" valign="top"><table width="100%" border="0" cellspacing="0" cellpadding="0">
<tr>
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<tr>
<td width="708" height="138" valign="top"><table width="100%" border="0" cellspacing="0" cellpadding="0">
<tr>
<td width="708" height="138" valign="top"><table width="100%" border="0" cellspacing="0" cellpadding="0">
<tr>
<?php include("dbconnect.php");

$query = "select id, image, description from gallery";

//echo $query;return;

$result = mysql_query($query);

$i=0;

while($row=mysql_fetch_array($result))
{
    $i=$i+1;

    $image=$row["image"];
    $desc=$row["description"];
    $id=$row["id"];

    if($i==1){ echo"<tr>";}

    ?
    
    <td width="160" height="136" align="center" valign="top"
    class="allborder"><p><a href="gallery/<?php echo $image?>"
    rel="lightbox" title="<?php echo $desc ?>"&gt;&lt;img src="gallery/<?php echo $image?>" width="132" border="0"
    height="99"&gt;&lt;/a&gt;&lt;/p&gt;

    <div style="font-size:11px; line-height:normal; width:160px; padding:2px
    8px 0 0;"&gt;&lt;?php echo $desc?&gt;&lt;/div&gt;&lt;/td&gt;

    <td width="31" valign="top"&gt;&lt;img src="spacer.gif" alt="" width="30"
    border="0" height="1"&gt;&lt;/td&gt;

    <td width="508">&nbsp;&lt;/td&gt;
<?php

if($i!=3)
{
?>

<?php

}

elseif($i==3)
{

$i=0;
/* echo "<td width='90'>&nbsp;</td>
<td width='23'>&nbsp;</td>
<td width='80'>&nbsp;</td>
<td width='23'>&nbsp;</td>
<td width='70'>&nbsp;</td>
<td width='3'>&nbsp;</td>
</tr> <tr>";
*/

echo "</tr> <tr>";

echo "<td> &nbsp; </td> </tr></tr>";
}

}//While
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
<tr>
    <td height="46" colspan="2" valign="top"><?php include("bottom.php") ?></td>
</tr>
</table>
</center>
</body>
</html>
Resources codes

<?php

function left($string, $count)
{
    return substr($string, 0, $count);
}

?>

<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
"http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">
<head>
<meta http-equiv="Content-Type" content="text/html; charset=iso-8859-1" />
<title>Digital School Development - Photogallery</title>
<link href="mystyle.css" rel="stylesheet" type="text/css" />
<link rel="stylesheet" type="text/css" href="chrometheme/chromestyle.css" />
<link rel="stylesheet" href="lightbox.css" type="text/css" media="screen" />
<script type="text/javascript" src="lightbox.js"></script>
<script type="text/javascript" src="chromejs/chrome.js">

/**********************************************
* Chrome CSS Drop Down Menu- (c) Dynamic Drive DHTML code library
(www.dynamicdrive.com)
* This notice MUST stay intact for legal use
* Visit Dynamic Drive at http://www.dynamicdrive.com/ for full source code
Random Transitions Slideshow - by JavaScript Kit (www.javascriptkit.com)

This notice must stay intact for usage

Visit JavaScript Kit at http://www.javascriptkit.com/ for full source code
<center><table width="924" border="0" cellpadding="0" cellspacing="0">
    <tr><td width="922" height="407" valign="top"><?php include("top.php") ?></td><td width="2"></td></tr>
    <tr><td height="6"></td><td></td></tr>
    <tr><td height="175" valign="top"><table width="100%" border="0" cellpadding="0" cellspacing="0" bgcolor="#FFFFFF">
        <tr><td width="200" rowspan="2" valign="top"><?php include("top.php") ?></td></tr>
        <tr><td width="200" rowspan="2" valign="top"><table width="100%" border="0" cellpadding="0" cellspacing="0" bgcolor="#FFFFFF"></td></tr>
    </table></td><td width="2"></td></tr>
</table></center>
<tr>
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</tr>
</table></td>
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<table width="100%" border="0" cellpadding="0" cellspacing="0">
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<table width="100%" border="0" cellpadding="0" cellspacing="0" bgcolor="#331257">
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<tr>
<td width="708" height="24" align="left" valign="middle"><div style="color:#FFFFFF; font-weight:600;">PHOTOGALLERY</div></td>
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</tr>
</table>
<?php include("dbconnect.php");

$query = "select id, image, description from gallery";
//echo $query;return;

$result = mysql_query($query);
$i=0;
while($row=mysql_fetch_array($result))
{
    $i=$i+1;

    $image=$row["image"];  
    $desc=$row["description"];     
    $id=$row["id"];  

    if($i==1){ echo"<tr>";}
    if($i==1){ echo"<tr>";}

    <td width="160" height="136" align="center" valign="top"
    class="allborder"><p><a href="gallery/<?php echo $image?>" rel="lightbox" title="<?php echo $desc ?>"  
    <img src="gallery/<?php echo $image?>"  width="132" border="0" height="99"></a></p>

</td>
</div style="font-size:11px; line-height:normal; width:160px; padding:2px 8px 0 0;"><?php echo $desc>"</div></td>

</td width="31" valign="top"><img src="spacer.gif" alt="" width="30" border="0" height="1"></td>
```php
if($i!=3)
{
?
}
elseif($i==3)
{
$i=0;
/* echo "<td width='90'>&nbsp;</td>
 <td width='23'>&nbsp;</td>
 <td width='80'>&nbsp;</td>
 <td width='23'>&nbsp;</td>
 <td width='70'>&nbsp;</td>
 <td width='3'>&nbsp;</td>
</tr> <tr>*/
\necho "</tr> <tr>";
/*
 echo "</tr> <tr>";
 echo "<td> &nbsp; </td> </tr></tr>;
}
```
```html
} // While

</tr>
</table>
</td>
</tr>
</table>
</td>
</tr>
</table>
</td>
</tr>
<tr>
<td height="13"></td>
<td></td>
</tr>
<tr>
<td height="2"></td>
<td></td>
</tr>
<tr>
<td height="46" colspan="2" valign="top"><?php include("bottom.php") ?></td>
</tr>
</table>
</center></body></html>
```
Database connection codes

/*Table structure for table `articles` */

DROP TABLE IF EXISTS `articles`;

CREATE TABLE `articles` (  
    `ar_id` int(11) NOT NULL AUTO_INCREMENT,  
    `title` varchar(100) DEFAULT NULL,  
    `article` varchar(100) DEFAULT NULL,  
    PRIMARY KEY (`ar_id`)  
) ENGINE=MyISAM DEFAULT CHARSET=latin1;

/*Data for the table `articles` */

/*Table structure for table `gallery` */

DROP TABLE IF EXISTS `gallery`;

CREATE TABLE `gallery` (  
    `id` int(11) NOT NULL AUTO_INCREMENT,  
    `image` varchar(200) DEFAULT NULL,  
    `description` varchar(500) DEFAULT NULL,  
    PRIMARY KEY (`id`)  
) ENGINE=MyISAM AUTO_INCREMENT=17 DEFAULT CHARSET=latin1

/*Data for the table `gallery` */

insert into `gallery` values  
(1,'photos 237.jpg','A computer teacher with pupils at Kinungi Primary school'), (2,'photos 238.jpg','A laptop in a computer laboratory in Kinungi primary school'), (3,'photos 239.jpg','A teaching aid at Kinungi Primary school Comp laboratory'), (4,'photos 240.jpg','A computer teacher with pupils at Kinungi Primary school'), (5,'photos 241.jpg','Pupils using laptops at Kinungi primary school'), (6,'photos 242.jpg','The back view of a computer lab at Kinungi Primary school'), (7,'photos 243.jpg','The inside of computer lab at Kinungi Primary school'), (8,'photos 244.jpg','A safe where in a Computer lab where the laptops are kept'), (9,'photos 245.jpg','A teaching aid at Munyu Primary school Comp laboratory'), (10,'photos 246.jpg','A teaching aid at Munyu Primary school Comp laboratory'), (11,'photos 247.jpg','Solar Battery power connection in a comp lab'), (12,'photos 248.jpg','Teaching aid in a primary school computer laboratory'), (13,'photos 249.jpg','Sample of a Digital school in Kinungi Primary school'), (14,'photos 250.jpg','Such satellites to make mobile phone Modems help in Internet connections'), (15,'photos 251.jpg','Sign post of one of the schools in Naivasha with Computers gotten thro CFSK'), (16,'photos 252.jpg','Power connection. This is needed to make digital schools a success');

/*Table structure for table `jobs` */

DROP TABLE IF EXISTS `jobs`;

CREATE TABLE `jobs` (  
    `id` int(11) NOT NULL AUTO_INCREMENT,  
    `details` varchar(100) DEFAULT NULL,  
    PRIMARY KEY (`id`)  
) ENGINE=MyISAM DEFAULT CHARSET=latin1;

/*Data for the table `jobs` */

insert into `jobs` values  
(1,'photos 237.jpg','A computer teacher with pupils at Kinungi Primary school'), (2,'photos 238.jpg','A laptop in a computer laboratory in Kinungi primary school'), (3,'photos 239.jpg','A teaching aid at Kinungi Primary school Comp laboratory'), (4,'photos 240.jpg','A computer teacher with pupils at Kinungi Primary school'), (5,'photos 241.jpg','Pupils using laptops at Kinungi primary school'), (6,'photos 242.jpg','The back view of a computer lab at Kinungi Primary school'), (7,'photos 243.jpg','The inside of computer lab at Kinungi Primary school'), (8,'photos 244.jpg','A safe where in a Computer lab where the laptops are kept'), (9,'photos 245.jpg','A teaching aid at Munyu Primary school Comp laboratory'), (10,'photos 246.jpg','A teaching aid at Munyu Primary school Comp laboratory'), (11,'photos 247.jpg','Solar Battery power connection in a comp lab'), (12,'photos 248.jpg','Teaching aid in a primary school computer laboratory'), (13,'photos 249.jpg','Sample of a Digital school in Kinungi Primary school'), (14,'photos 250.jpg','Such satellites to make mobile phone Modems help in Internet connections'), (15,'photos 251.jpg','Sign post of one of the schools in Naivasha with Computers gotten thro CFSK'), (16,'photos 252.jpg','Power connection. This is needed to make digital schools a success');
`title` varchar(100) DEFAULT NULL,
`details` blob,
PRIMARY KEY (`id`)
) ENGINE=MyISAM AUTO_INCREMENT=7 DEFAULT CHARSET=latin1;

/*Data for the table `jobs` */

insert into `jobs` values  (1,'COMPUTER CAREERS','<p>Organizations have demanded greater use of newer technologies in recent years to stay competitive. Important issues involving the use of electronic or online commerce include when and how a company incorporates these new technologies. Information and Computer systems managers are essential in planning an organization’s future, maintaining Internet support, and supervising security operations.</p>',2,3), (2,'Computer Operator','<p>Computer operators operate and manage the use of hardware systems, mainframes, networks, minicomputers, and other types of systems. They should be proficient at solving technical problems.</p>',3,5), (3,'Computer Programming','<p>Computer programmers develop the instructions and languages computers use to operate. They also resolve computer problems and logical tests within the system. The roles of programmers and programs have evolved with technical advancements in language and computing. The responsibilities and backgrounds of engineers vary depending on the company or agency.</p>',4,6), (4,'Programmer','

/*Table structure for table `news` */

DROP TABLE IF EXISTS `news`;

CREATE TABLE `news` (
  `id` int(11) NOT NULL AUTO_INCREMENT,
  `title` varchar(50) DEFAULT NULL,
  `content` blob,
  `newsdate` date DEFAULT NULL,
  PRIMARY KEY (`id`)
) ENGINE=MyISAM AUTO_INCREMENT=15 DEFAULT CHARSET=latin1;

/*Data for the table `news` */

insert into `news` values  (1,'Digital divide','<p>The Ministry of Information and broadcasting is busy bridging the digital divide in Kenya.</p>',2011-01-10), (2,'E learning','<p>The Ministry of Education is encouraging schools to take e learning serious especially in this era of teacher shortage in many primary and secondary schools.</p>',2011-02-25);

/*Table structure for table `pages` */

DROP TABLE IF EXISTS `pages`;
CREATE TABLE `pages` (  
`id` int(11) NOT NULL AUTO_INCREMENT,  
`contents` blob,  
`title` varchar(300) DEFAULT NULL,  
PRIMARY KEY (`id`)  
) ENGINE=InnoDB AUTO_INCREMENT=10 DEFAULT CHARSET=latin1;

/*Data for the table `pages` */

insert into `pages` values  
(1,'<P>This is a company that advises schools and institutions on the procedures to follow in setting up digital schools or computer laboratories.&nbsp; Our working definition of a digital school is one where the teaching resources and the administration and communications systems are predominantly digital. It implies the usage of ICTs in most of the operations in the school i.e. in administration, elearning etc</P>','home'),  
(2,'<p>This is a company that advises schools and institutions on the procedures to follow in setting up digital schools or computer laboratories.&nbsp; Our working definition of a digital school is one where the teaching resources and the administration and communications systems are predominantly digital. It implies the usage of ICTs in most of the operations in the school i.e. in administration and teaching.</p> <p>A digital school is the same thing as an online school or a virtual school where students and teachers do not meet face to face in the same location, but are connected by technology either synchronously or asynchronously. This definition stresses the need for communication though not face to face interaction between the teacher and the learner.</p> <p>The primary difference between a virtual school and a stand-alone brick and mortar school is the latter's physical interactions among teachers, staff and students. Virtual schools offer programs and curriculum for all grade levels. This definition relates to online interaction between the learner and the teacher. This should not be the case all the time.</p> <p>The growth of digital schools since the advent of the micro computers has been rising steadily in many countries. Most of the developed countries have fully gone digital in the provision of education. In most of the countries in Africa, only the schools offering the international curriculum have digital systems to conduct teaching and learning. The rest still hold to the traditional way of pedagogy.</p> <p>Our company strives to provide institution with advice for setting up computer laboratories or in modern terms virtual or digital schools.</p>','ABOUT US'),  
(3,'<P>This section is designed to help you find reliable and relevant information on variety of computer careers. Whether you're looking for a fast track into computer programming or simply want to find out more about a career in technology management, you'll find what you're looking for here. Make your selection from the list of computer specialties and careers below and you'll find detailed information on job opportunities, earnings, career training requirements and much more. Take your time to read through all of the material we provide and find the computer career that is right for you. </P>','COMPUTER CAREERS'),  
(4,'+254 (723) 988746','CONTACTS'),  
(5,'Schedule an appointment','appointment'),  
(7,'<P>Join our Team</P> <p>You are assured of quality services!!!!!!!!!!!!!!!</p>','jointeam'),  
(8,'+254 (723) 988746','quickcontacts'),  
(9,'All Rights Reserved','bottom');
DROP TABLE IF EXISTS `projects`;

CREATE TABLE `projects` (  
  `projectid` int(11) NOT NULL AUTO_INCREMENT,  
  `title` varchar(100) DEFAULT NULL,  
  `contents` blob,  
  `image` varchar(50) DEFAULT NULL,  
  PRIMARY KEY (`projectid`)  
) ENGINE=MyISAM AUTO_INCREMENT=7 DEFAULT CHARSET=latin1;

/*Data for the table `projects`*/

insert into `projects` values  
(1,'E Learning',  
  '<P>We support schools that are intending to start elearning. We help them get software, hardware and manpower.</P>',  
  'project1.jpg'),  
(2,'Framework to starting digital schools',  
  '<P>We provide a framework on how to start digital schools. This is both in Primary and secondary schools.</P>',  
  'project1.jpg'),  
(3,'Ministry of Education',  
  '<P>The Ministry of Education through KIE is in the process of coming up with a syllabus for Primary schools. This will help the many schools that have invested in ICT for learners but have difficulties deciding the content to be taught.</P>',  
  'photos 241.jpg'),  
(4,'Green computing',  
  '<P>We need to strive to use green computing to be able to deal with global warming.</P>',  
  '[From www.metacafe.com] 281518.2077347.1.jpg'),  
(5,'KNEC Conference',  
  '<P>Conference theme: Best practices in Educational Assessment for regional intergration</P>',  
  '<P>From 1st to 5th Aug 2011</P>',  
  '<P>For details visit <A href="http://www.aeeafrica.org">www.aeeafrica.org</A></P>'),  
(6,'','''Untitled - 6.jpg');

/*Table structure for table `resources`*/

DROP TABLE IF EXISTS `resources`;

CREATE TABLE `resources` (  
  `id` int(11) NOT NULL AUTO_INCREMENT,  
  `maintitle` varchar(200) DEFAULT NULL,  
  `description` blob,  
  `files` varchar(100) DEFAULT NULL,  
  PRIMARY KEY (`id`)  
) ENGINE=MyISAM AUTO_INCREMENT=9 DEFAULT CHARSET=latin1;

/*Data for the table `resources`*/

insert into `resources` values  
(1,'Draft SNE policy 12 May 08',  
  'The Government of Kenya recognizes the importance of Special Needs Education as an important sector for accelerating the attainment of Education for All (EFA) and the Millenium Development Goals (MDGs)','Draft.doc'),  
(2,'Convention on the Rights of Persons with Disabilities',  
  'Guidelines on treaty-specific document to be submitted by states parties under article 35, paragraph 1, of the Convention on the Rights of Persons with Disabilities','ICRPD_Reporting.pdf'),  
(3,'Kenya National Survey for Persons with Disabilities',  
  'According to the World Health Organization (WHO), disability affects 10% of every population. An estimated 650 million people worldwide, of whom 200 million are children, experience some form of disability.','KNSPWD_front.pdf'),  
(4,'Kenya National Survey for Persons with Disabilities',  
  'National Coordinating Agency for Population and Development (NCAPD) and Kenya

/* Table structure for table `samples` */

DROP TABLE IF EXISTS `samples`;

CREATE TABLE `samples` (
  `sampleid` int(11) NOT NULL AUTO_INCREMENT,
  `title` varchar(100) DEFAULT NULL,
  `description` blob,
  PRIMARY KEY (`sampleid`)
) ENGINE=MyISAM DEFAULT CHARSET=latin1;

/* Data for the table `samples` */

/* Table structure for table `supercategory` */

DROP TABLE IF EXISTS `supercategory`;

CREATE TABLE `supercategory` (
  `supercategory_id` int(11) NOT NULL AUTO_INCREMENT,
  `supercategoryname` varchar(100) DEFAULT NULL,
  `description` blob,
  PRIMARY KEY (`supercategory_id`)
) ENGINE=MyISAM AUTO_INCREMENT=8 DEFAULT CHARSET=latin1;

/* Data for the table `supercategory` */

insert into `supercategory` values (1, 'What you need to know', '<p><strong>What You Need to Know When Setting Up a Computer Lab</strong></p>

<p>Efficiency, safety and ergonomics should drive the design of any computer lab. Your setup must facilitate a variety of instructional techniques and teaching scenarios. The instructor and assistants need to observe each person's monitor and provide assistance without encountering obstacles. Users also need easy access to shared resources, like printers, without disrupting the lab. </p>

<p>Measure the room to determine how many computers you can install. When you use tables, provide at least three feet of space for the computer and the user. If you purchase self-contained workstations or carrels, allow room for space between them. </p>

<p>Identify the location of the power outlets in the lab. This can affect the capacity of the lab and your design. For safety, avoid running long extension cords across the floor in the workspace. </p>

<p>Find
out the total amperage of the room before you install equipment. Do not overload the electrical system
with more computers and accessories than it can handle safely. This could result in constant power
problems that cause data loss or even cause a fire.<p>

Store the computer tables or workstation in an open square, circle as close to walls as possible. This design makes
monitoring and assistance more efficient than computers in long rows.<p>

Plug surge protectors into the wall outlets. Do not daisy chain surge protectors. Instead, move your
computers closer or use a heavy-duty extension cord to make it possible to place the surge protector near the computers safely.<p>

Leave space for shared resources, like printers, between every three or four computers. Users should not have to cross the entire room and disturb others to retrieve documents.<p>

Install the computers, peripherals and accessories. Position the equipment and furniture in the instructor’s work
area so that the entire lab is visible. Check your setup for user comfort, ease of instruction and
documenting.<p>

Run electrical cords inside of the lab’s work area under carpeting or heavy plastic runners. You can use duct tape or cord channels if necessary. If you used extension cords from the wall to the rear of your workstations or tables, they will not be in the path of normal travel, but taping them down increases lab safety.<p>

A computer lab needs to have good air circulation for two reasons. The first reason is to keep the electronic components in the computers from overheating. If the air is not flowing properly throughout the room, then your computer components will get hot and damage your computers. The other reason for good air circulation is the comfort of the lab users. Several computers in the same room all operating at the same time can generate heat. Without good air flow it may be difficult for anyone to use the lab for extended periods of time. According to PC Guide, a good room temperature to use ranges from 60 to 75 degrees Fahrenheit.

The classic classroom computer lab design serves as the default layout in many High School and Colleges. However, it does have two major advantages. First, it serves as a great instruction room where students learn computer topics from an instructor at the front of the room. With everyone facing the same direction, it allows instructors to see the faces of the students with which to read non-verbal cues as to whether students are learning the material or need more help. Second, it is similar to the layout of other classroom environments emphasizing that the students are there to learn.<p>

One disadvantage of the classroom layout is the need to disturb other students along the rows of computers as students enter and exit the lab. For labs where students are coming and going, the classroom layout is not ideal. In addition, the classroom layout is not conducive to team work. It is difficult for students to work together, especially on collective projects and in peer-assist teaching models.<p>

The four-leaf clover design offers the most privacy for students and reduces to a minimum the possibility of cheating during tests or exercises. It also eliminates the need for students to disturb others when entering and exiting the lab and allows instructors to go from student to student to address individual problems and concerns.<p>

One disadvantage of the four-leaf clover design has to do with attention spans. When students are sitting at their own computers, instructors will not be able to see what each student is doing at his/her workstation. Students may not be paying attention to lessons or may be surfing to inappropriate websites in labs equipped with Internet access.
Computer Lab Designs</strong> <div><strong class="style3">Inverted U-Shaped Computer Lab</strong> Layouts</div> <div><strong class="style3">U-shaped Computer lab layout encourages engagement between instructors and students. Instructors can enter the U and engage with students one-on-one. This design also serves as the most conducive layout for computer maintenance as technicians do not have to disturb others to gain access to the computers. In addition, students will not interfere with other students' work while entering and exiting the lab. <p>Unfortunately, the U-shaped design offers little opportunity for instructors to monitor what students are doing and looking at on their monitors. This design is not compatible with test taking and requires many assistants to monitor students. Furthermore, this design often takes up more space than other layouts.</p></div> <div>Conclusion</div> <div>FACCTORS TO CONSIDER WHEN CHOOSING HARDWARE</div> <div><ul><li>HARDWARE</li><li>Portability</li><li>Compatibility</li><li>Cost</li><li>Upgradability</li><li>User needs</li><li>Warranty</li><li>Availability</li><li>Government policy</li><li>Success of the software elsewhere</li><li>Hardware requirements</li></ul></div> <div> Shooting</div> <div>Facilities</div> <div>Applications</div> <div>Operating systems</div> <div>Software utilities</div>
Examples of software utilities include:

- Copy
- Merge
- Calculator
- Anti virus
- Defragmentor
- Compressor
- Recovery
- Sort
- Graphics editor
- Text Editors

/* Table structure for table `users` */

DROP TABLE IF EXISTS `users`;

CREATE TABLE `users` (  
`id` int(11) NOT NULL AUTO_INCREMENT,  
`username` varchar(100) DEFAULT NULL,  
`password` varchar(100) DEFAULT NULL,  
PRIMARY KEY (`id`)  
) ENGINE=MyISAM AUTO_INCREMENT=3 DEFAULT CHARSET=latin1;

/* Data for the table `users` */

    insert into `users` values (2,'digital','just2011');
Appendix 18 User Manual

The following are the steps that need to be followed to successfully make use of the digital schools system:

1. In order for the digital school framework to run on the client computer (stand-alone installation) the following applications need to be installed:
   
i. Wamp Server
   
ii. SQLyog

2. Activate the two programs

3. Open browser program and from the address bar type the URL for the local host as http://localhost.

4. From the local host window click on the digital school as shown by the arrow navigating.
5. The following will then appear as your homepage from where you start navigating
(iv) Appendix 19

The homepage

(v) The homepage has photos that animate to look attractive to those who visit the site to gather information on how to start digital schools.
Appendix 20
Recommended resources for a DS

RECOMMENDED RESOURCES FOR A DIGITAL SCHOOL

1. Stable power supply
2. Recommended Hardware
3. Recommended Software
4. Antivirus
5. Proper ventilation
6. Security
7. Application software
8. Personnel
9. Syllabus
10. Standard furniture
11. Protection against fire
12. Lighting
13. Cabling
14. A policy

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Appendix 21

A screenshot showing the factors to consider in choosing a Topology for the LAN network

<table>
<thead>
<tr>
<th>DIGITAL SCHOOL REQUIREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>What you need to know</td>
</tr>
<tr>
<td>Computer Lab Layout</td>
</tr>
<tr>
<td>Hardware Choice</td>
</tr>
<tr>
<td>Software Choice</td>
</tr>
<tr>
<td>Hardware requirements</td>
</tr>
<tr>
<td>Software Needed</td>
</tr>
<tr>
<td>Computer laboratory Network</td>
</tr>
<tr>
<td>Topology to use</td>
</tr>
</tbody>
</table>

Topologies to use

- The physical topology of a network refers to the configuration of cables, computers, and other peripherals. Physical topology should not be confused with logical topology which is the method used to pass information between workstations.

Considerations When Choosing a Topology:

- **Money.** A linear bus network may be the least expensive way to install a network; you do not have to purchase concentrators.

- **Length of cable needed.** The linear bus network uses shorter lengths of cable.

- **Future growth.** With a star topology, expanding a network is easily done by adding another concentrator.
**Appendix 2**

A screenshot showing the factors to consider in choosing software for a DS

<table>
<thead>
<tr>
<th>DIGITAL SCHOOL REQUIREMENTS</th>
<th>Software Choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>What you need to know</td>
<td><strong>Factors to consider when selecting a software</strong></td>
</tr>
<tr>
<td>Computer Lab Layout</td>
<td>(i) <strong>Authenticity</strong>: This refers to the genuineness or originality of a software. When acquiring a software one should go for the original ones which are supported by the developer. Authentic software is licensed and protected by the law. Software piracy is the copying and distribution of a program without the permission of the developer. It is a computer because it denies software developers a chance to reap from their sweat.</td>
</tr>
<tr>
<td>Hardware Choice</td>
<td></td>
</tr>
<tr>
<td>Software Choice</td>
<td>(ii) <strong>User needs</strong>: This means the kind of services that a certain software is expected to perform. It depends on the requirements of the users. Under such circumstances, a bespoke programme (a programme written specifically to meet user requirements) may be developed. Such software are normally expensive. They are mostly made use of in library management, accounting, supermarkets, hospitals among other places. They are normally developed targeting a certain</td>
</tr>
<tr>
<td>Hardware requirements</td>
<td></td>
</tr>
<tr>
<td>Software Needed</td>
<td></td>
</tr>
<tr>
<td>Computer laboratory Network</td>
<td></td>
</tr>
<tr>
<td>Topology to use</td>
<td></td>
</tr>
</tbody>
</table>

**QUICK CONTACTS**

+254 (723) 988746  
jimndegwa@yahoo.com  
jimndegwa@gmail.com  
MESVI  
P.O BOX 867-00605  
UTHIRU  
KENYA, EAST AFRICA

**NEWS AND UPDATES**

2011-09-09  
The International Baccalaurette is advertising for marking.

2011-01-01  
The KIE has already digitised a number of curricula and now appear in DVDs. This was a succ
Appendix 23

A screenshot showing the interactive section of the framework

Through the designed framework, it will be possible to keep in touch with the users. They will be able to ask any question on ICTs hence creating a forum for discussions with them. Through authentication by the use of a password and a username, the framework owner will be able to determine what will be in the system as shown below:

Notice: Undefined index: Submitlogin in C:\wamp\www\digitalschool\Admin\index.php on line 93

Admin Login:

Username: 
Password: 
Appendix 24: A screenshot showing samples of digital schools

The website also has a section for updates where the users will be getting news on what is happening in the world of ICTs. This will mostly benefit the users who will be online.
### Appendix 25: A Screenshot of the Photo gallery.

The photos were taken from two digital schools in Maraigushu zone in Naivasha.

#### DIGITAL SCHOOL REQUIREMENTS

<table>
<thead>
<tr>
<th>What you need to know</th>
<th>Hardware Choice</th>
<th>Software Choice</th>
<th>Hardware requirements</th>
<th>Software Needed</th>
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<tbody>
<tr>
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<td></td>
</tr>
</tbody>
</table>

#### QUICK CONTACTS

- **+254 (723) 988746**
- jimndegwa@yahoo.com
- jimndegwa@gmail.com

#### MESVI

- **P.O BOX 867-00605**

#### UTHIRU

- **KENYA, EAST AFRICA**

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A laptop in a computer laboratory in Kinungi primary school

A computer teacher with pupils at Kinungi Primary school

A teaching aid at Kinungi Primary school Comp laboratory

A teaching aid at Munyu Primary school Comp laboratory

The inside of computer lab at Kinungi Primary school

A safe where in a Computer lab where the laptops are kept

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