E-READINESS FOR INTEGRATION OF E-LEARNING IN PUBLIC SECONDARY SCHOOLS IN TAITA TAVETA COUNTY, KENYA

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DECLARATION AND RECOMMENDATION

Declaration

I declare that this thesis is my original work and has not been presented to this or any other university for the award of a degree.

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Recommendation

This research thesis has been submitted for examination with our approval as the university supervisors.

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DEDICATION

To my mum, Teresa Awino Makokha, whose spirit of determination has always been my source of inspiration. I love you mum.

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ABSTRACT

Recent developments in Information and Communication Technology (ICT) have influenced approaches to teaching and learning in schools in the world. Consequently, e-learning has become more and more widespread because of its advantages over the conventional ways of teaching. The Government of Kenya developed a national ICT strategy for education and training whose objective was to encourage use of ICTs in all educational institutions. This was aimed at creating an ICT-literate citizenry for an ICT-driven economy by the year 2015. However, little is known about the state of readiness of educational institutions to implement this strategy. The purpose of this study was to assess the state of readiness for e-learning in secondary schools in Taita Taveta County, Kenya. This study adopted a descriptive survey research design. The target population included 440 teachers in 48 public secondary schools in Taita. A random sample of 201 teachers and 33 head teachers was selected from 33 randomly selected schools. Data was collected using two self-administered questionnaires to the selected respondents. Data was analysed using both descriptive (frequencies, percentages and means) and inferential (t-test and chi square) statistics using Statistical Package for Social Sciences (SPSS) version 17.0. The study findings indicate that public secondary schools lacked basic infrastructure and facilities to adopt e-learning in the process of delivery of content to learners. Teachers in public secondary schools lacked adequate skills to use e-learning facilities in teaching. Majority of the teachers had not fully integrated e-learning in teaching in secondary schools. The study recommends that the government should first equip all public secondary schools with necessary infrastructure and facilities before fully implementing e-learning programme in schools. All teachers in public secondary schools should be trained on integration of e-learning in instructional process before the programme is fully rolled out. The government should also come up with a policy document requiring e-learning to be conducted in schools if the programme is to succeed.

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ABBREVIATIONS AND ACRONYMS

ASAL	Arid and Semi-Arid Lands
ASTD	American Society for Training and Development
BoM	Board of Management
CAI	Computer-Assisted Instruction
CDF	Constituency Development Fund
CDE	County Director of Education
EFA	Education for All
FPE	Free Primary Education
FDSE	Free Day Secondary Education
GER	Gross Enrolment Rate
GoK	Government of Kenya
HTQ	Head Teacher's Questionnaire
ICT	Information and Communication Technology
IT	Information Technology
KCSE	Kenya Certificate of Secondary Education
KENET	Kenya Education Network
KNEC	Kenya National Examinations Council
LAN	Local Area Network
MOEST	Ministry of Education, Science and Technology
MP1	First ICT Master Plan or Master Plan 1
MP2	Master Plan 2
OECD	Organisation for Economic Cooperation and Development
PTA	Parents Teachers Association
SCS	Space Collaboration System
TQ	Teachers' Questionnaire
TSC	Teachers Service Commission
UAJ	University of the Air Japan
WAN	Wide Area Network

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Secondary school education is a very significant link between primary school and tertiary education as well as the job market (World Bank, 2005). This is because some graduates of this level of education end up in the labour market. Further, academic results obtained at this level are used for placement of the candidates in various courses at tertiary level of education. Unfortunately in Kenya, this crucial link is faced with various problems due to the challenges generally facing the educational system in the country. When the Government of Kenya undertook to achieve Universal Primary Education (UPE) by 2010 and Education For All by 2015 in line with the international commitment, Free Primary Education (FPE) was introduced in 2003 (GoK, 2003; GoK 2005a). This resulted in an overwhelming increase in Gross Enrolment Rate (GER) in primary schools from 86.8 per cent in 2002 to 101.5 per cent in 2004 and increase in demand for secondary school places (Kaga, 2006). Consequently, the government increased the transition rate from primary to secondary schools from 47 per cent to 70 per cent and thereby effectively increasing student enrolment in secondary schools (African Development Bank, 2007).

The Ministry of Education, Science and Technology (MOEST) observed that increased enrolment of students in secondary schools had led to overstretching of facilities and overcrowding in learning institutions as schools tried to accommodate the extra students (Government of Kenya, 2005a). With shortage of teachers' standing at 100, 000 nationally (Mwangi, 2014), the teaching fraternity in secondary schools may have been over-stretched by these developments. Previous studies indicate that most instructional methods used by teachers in Kenya are teacher-centered and make learners passive recipients of information (Situma, 2016). This makes the students to dislike some subjects (Tanui, 2003). Consequently, secondary school education in Kenya is characterized by below average performance at national exams especially in core subjects such as mathematics and sciences (Kenya National Examinations Council, 2008). E-learning is one of the approaches that may help to improve the learning

situation in secondary schools because of its advantages over the conventional teaching and learning methodologies (Kalinga, Bagile & Trojer, 2006).

E-learning is a way of learning that is enabled or supported by the use of information and communication technologies (American Society for Training and Development's, learning circuits, 2008). It involves some form of interactivity, including online interaction between a learner and a teacher or peers. According to New Zealand's Ministry of Education, it commonly makes use of computers and other ICTs to deliver learning content to learners (Government of New Zealand, 2009). The Government of New Zealand also argues that e-learning includes use of the Internet, audio and video video tapes as well as CD-ROMs, video and audio conferencing, mobile phones, data projectors, digital cameras, global positioning systems and interactive whiteboards to provide learning experiences. Kashorda and Waema (2007) observe that e-learning has the potential to enhance the quality of teaching and learning and improve effectiveness of institutions. Furthermore, e-learning will also develop the future workforce that can effectively participate in the knowledge-based economy (GoK, 2006b). It also provides opportunities to study at a pace suited to the individual learner's needs and the capacity to give instantaneous feedback on assignments (Vockell & Schwartz, 1992). This yields a high rate of reinforcement. These authors further observed that there are many computerized mathematical programs that use pictures of concrete objects as part of tutorials or feedback to teach mathematical concepts and thereby make mathematics less abstract and more interesting. Computer programmes also have an advantage over teachers with regard to how long they are willing to wait for the student to respond without becoming irritated (Saks & Haccoun, 2011). This provides a more positive affective learning environment especially for slower learners. Further, they noted that use of colour, music and animated graphics can add realism and appeal to drill exercises, laboratory activities and simulations. Instruction through simulation and games may result in increased motivation and participation by learners (Ya-nan, 2013).

Sarita and Tomar (2004) observed that the use of computer simulations can replace experiments that would otherwise be very dangerous, very expensive or require a long time to complete. For instance, processes like germination, seed ripening and genetic developments can be demonstrated through computer simulation (Buzby, 1985). In art classes, computers encourage creativity without a mess as children can create art digitally (Sawyer & Williams, 2001). Evoh

(2007) argues that use of e-learning in secondary schools imparts technological literacy among students which is necessary for the world of work. Besides, the use of computers has an enormous capacity for delivering realistic learning experiences. Computer generated audio-visual content with enhanced colour formations is very attractive to learners. E-learning has the capacity to infuse colour in instructional materials for presentation to learners. This concurs with a research by Ndirangu (2000) which observed that use of colour in instructional materials captured the learners' interest and improved their attitude towards learning science subjects.

Countries that have embraced e-learning have attested to its inherent advantages. In United Kingdom, successful implementation of e-learning in schools was shown to result into higher academic standards and enabled students to complete their work more quickly allowing more time for revision (National Foundation for Educational Research, 2000). These observations are in line with those of Aderonke (2014) who found high achievement gains among students due to computer use. Computer Assisted Instruction (CAI) was very effective with lower achieving students (Carnoy, Daley & Loop, 1986). In fact, such students as well as those who did not have computers at home experienced a sharp rise in academic achievement scores (Aderonke, 2014). Evoh (2007) adds that with e-learning, there is effective curriculum delivery by teachers as facilitators and there is improved learning by raising curiosity and technological literacy. Tanui, Kiboss, Walaba and Nassiuma (2008) observe that a computer reduces a teacher's verbosity and encourages students to learn through active participation.

Implementation of e-learning in secondary schools in Kenya may take long to be realised. This is because secondary schools may not be prepared to implement it as little is known about their readiness. An assessment by Kenya Education Network (KENET) in 2006 on e-readiness at the universities in Kenya revealed that they were not effectively using ICT for teaching and learning as intended by the National ICT Policy of 2006 in spite of the fact that these institutions were relatively more endowed with resources as compared to secondary schools (KENET, 2006). This observation might imply that secondary schools were not yet using e-learning. Again, web-based learning may also be hindered if the telecommunication infrastructure is not well developed. Even though there has been rapid expansion of ICT infrastructure in the country in the recent past, GoK (2014) reports that local institutions of higher learning have continued to produce ICT manpower that is neither guided by a human resource development policy nor well aligned to

societal needs such as e-learning. There has been overdependence of Kenya on foreign technicians and consultants for maintenance of telecommunication infrastructures. If these conditions still persist to date, then it may imply that e-learning at secondary schools may not have taken root in Kenya. This could also be the case in secondary schools in Taita Taveta County. It is for this reason that this research was launched to investigate the e-readiness in the secondary schools for e-learning, as intended by various national policy documents.

It is perhaps due to these benefits that the government of Kenya came up with various policies to enhance e-learning in schools. These policies include the Economic Recovery Strategy for Wealth and Employment creation (GoK, 2003), Sessional Paper number 1 of 2005 (GoK, 2005a), Kenya Education Sector Support Programme (GoK, 2005b), National ICT Policy of 2006 (GoK, 2006a) and the National ICT strategy for education and training (GoK, 2006b). The Kenya Education Sector Support Programme was a 5-year undertaking that was to run from 2006 to 2010 by which time e-learning was supposed to have been realised in schools (GoK, 2005b). However, its funding indicated a budget deficit of about Ksh. 40.5 billion. According to the National ICT strategy paper of 2006, educational institutions were to implement e-learning through funding by both private and public sectors. But it is not clear how the private sector was to fund the programme.

1.2 Statement of the Problem

In order to achieve the Millennium Development Goals (MDGs) and Education For All (EFA) by the year 2015, the Government of Kenya introduced the Free Day Secondary Education (FDSE) programme in 2008. This resulted in an increase in student enrolment in public secondary schools in the country. The programme may have compounded the problems that existed in education in Kenya. These problems include over-stretched facilities, overcrowding in learning institutions and high student-staff ratios. Applications of ICTs in e-learning may be used as an alternative to solve some of these problems, for example, access to online resources and providing students with some measure of self teaching. Further, use of movies, video and computer animations bring sound and movement to the static textbook lessons and make students' classes to be lively. Again, the Internet has many websites that can help teachers develop or improve lesson plans, exchange ideas, obtain information, and find free animations and simulations to make their lessons interesting. It also has been observed that computer-based

learning systems such as interactive video are highly attractive to use, with colourful and impressive images on the screen, interesting sounds and graphics, fascinating tasks for the learner to carry out and with the knowledge that there will be immediate feedback from the system. However, e-learning may not be successful if e-readiness as indicated by presence of computers, source of power, relevant e-content and trained personnel are not in place. It is for this reason, therefore, that this research was necessary in order to determine the state of readiness of secondary schools in Taita Taveta to implement e-learning. No study has been done in this area in this region. This study intended to fill this gap.

1.3 Purpose of the Study

The purpose of this research was to assess the state of e-readiness for e-learning in secondary schools in Taita Taveta County, Kenya.

1.4 Objectives of the Study

The objectives of the study were to;

i. Determine level of adequacy of e-leaning facilities in public secondary schools in Taita Taveta County.

ii. Establish teachers' level of skills in the use of e-learning facilities in public secondary schools in Taita Taveta County.

iii. Find out the level of integration of e-learning in teaching in public secondary schools in Taita Taveta County.

iv. Establish whether there was any significant difference in the adequacy of e-learning facilities between Sub-County and County secondary schools in Taita Taveta County.

1.5 Research Questions

The research questions of this study were as follows:

i. What is the level of adequacy of e-leaning facilities in public secondary schools in Taita Taveta County?

ii. What is the level of skills of teachers in the use of e-learning facilities in public secondary schools in Taita Taveta County?

iii. What is the level of integration of e-learning in teaching public secondary schools in Taita Taveta County?

1.6 Research Hypothesis

HO: There is no statistically significant difference in the adequacy of e-learning facilities between Sub-County and County secondary schools in Taita Taveta County.

1.7 Significance of the Study

The findings of the study are important in many ways. First, they bring out the state of readiness of the secondary schools in the County to participate in e-learning. This will enable the government to come up with appropriate measures to make sure that the schools are able to undertake e-learning in line with the National ICT Policy. This could involve equipping the schools with appropriate ICT facilities and in-servicing the teachers. To the teachers in the County, the study could enable them to re-evaluate their skills in preparation to embrace e-learning. This is because the success of any educational program depends on how effectively teachers have been prepared for it. The findings could also motivate the private sector to come up and help equip the schools. This is because the National ICT strategy for education and training indicates that the programme will partly be funded by the private sector.

1.8 Scope of the Study

This study involved public County and Sub-County secondary schools and teachers in those schools in Taita Taveta County. Head teachers of each target school were the respondents with respect to the facilities it the schools. This is because head teachers are the policy makers and authorise the use of funds in the acquisition of facilities at the school level. National schools were not involved in the study as they are funded by the government under a separate scheme. Private secondary schools charge different amounts of fees hence some may acquire facilities that public schools may not be able to get. Such schools were also not be sampled. Teachers are the implementers of the curriculum at school and critical for implementation of e-learning.

1.9 Limitations of the Study

The study was limited by the following situations:

i. The research findings only apply to public Sub-County and County secondary schools in Taita Taveta County.
ii. The findings are generalised with caution to other Sub-counties that have similar characteristics as Taita Taveta

1.10 Assumptions of the Study

The following were the assumptions of the study;

i. Teachers and head teachers responded honestly to the test items contained in the questionnaire.
ii. All secondary schools surveyed had one form of ICT technologies or the other.
iii. Teachers were using these technologies in teaching and learning.

1.11 Operational Definition of Terms

In this section, operational definitions are presented as used within the context of this study.

County secondary schools: Secondary schools in Kenya which were built and equipped by the government. They are financed by the government and admit students from the entire County.

E-learning: This is a process of learning that is enabled or supported with the use of information and communication technologies (ICT). It involves some form of interactivity, including online interaction such as video and audio conferencing between the learner and their teacher or peers. For the purpose of this study, e-learning is the extent to which teachers and learners use computers and computer accessories in teaching and learning process.

E-readiness: This refers to state of preparedness of an individual or the society to participate in and exploit the advantages associated with ICTs. It includes the individual's state of readiness to use ICTs to achieve e-learning. The individuals in this case are secondary school teachers while the society of interest is the public secondary school in Taita. Schools will be deemed to have e-readiness if they have electricity, computers and computer accessories, computer technicians and teachers who have the skills required for e-learning to take place.

Information and Communication Technology (ICT) facilities: Equipment and infrastructure including computers and related accessories such as audio and video video tapes as well as CD-ROMs. Other ICT facilities include data projectors, digital cameras, mobile phones and interactive whiteboards

Information and Communication Technology (ICT) skills: Competencies that enable an individual to come up with, make use of, and carry out basic maintenance practices on the ICT facilities.

Integration of e-learning in education: Combining e-learning with the conventional methods of teaching and learning to bring about learning.

Intranet: A Local or Wide Area network that is owned by an organisation and is only accessible to people who have access codes of that organisation. In this study, the organization is a

public secondary school and the people here are teachers, students and any other authorised person.

Local Area Network (LAN): A group of personal computers and other devices, such as printers or servers, that are located in a relatively limited area, such as an office, and can communicate and share information with each other throughout the school. In a school set up, a LAN will involve computers located in classrooms, libraries, laboratories, the staffroom and other offices in the school.

Private secondary schools: Secondary Schools in Kenya that are financed and managed by private entrepreneurs (individuals or non-governmental organisations) as opposed to government funding.

Public secondary schools: Secondary Schools in Kenya which are partly financed by the government and are run by head teachers employed by the government.

Sub-County secondary school: This is a type of secondary school that was initially constructed and equipped through the local community's initiative. The level of equipment of such schools varied depending on the economic status of the members of the local community where the school was built. Such schools have since been taken over by the government. These schools admit students from the Sub-County in which the school is located.

Wide Area Network (WAN): A computer network that spans a relatively large geographic area and usually made up of two or more interconnected local area networks. The Internet is a WAN.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews literature on the role of e-learning in teaching and learning. It takes a look at documented evidence including research findings on the importance of e-learning in schools. It then examines the methods of teaching currently used in secondary schools in Kenya and the state of e-readiness of these schools. It further goes on to illustrate how e-learning has been put to practice in developed countries, using illustrations from the US, Singapore, Japan and Britain. The chapter ends with theoretical and conceptual frameworks that guided this study.

2.2 The Role of E-learning in Teaching and Learning

E-learning, also referred to as electronic learning, uses ICTs to provide learning experiences. It includes use of the Internet, audio and video video tapes as well as CD-ROMs (ASTD's Learning Circuits, 2008). According to the Ministry of Information, Communications and Technology, Information Communications Technology (ICT) refers to technologies including computers, telecommunications and audio-visual systems that enable the collection, processing, transportation and delivery of information to users (GoK, 2006a). In an educational context, the users would be the learners in secondary schools. The use of ICTs to deliver instruction is commonly referred to as e-learning (Mayes & Freitas, n.d.).

E-learning has several merits over the conventional teaching and learning methods. Computer-Assisted Instruction (CAI), which is a form of e-learning, can cater for the individual needs of many students at a time and record all the responses of all learners with reliability (Mohanty, 2005). The time taken and the extent of correctness of a student's responses are all recorded by the computer. This helps the teacher to plan instruction and provide materials according to the strategy that is best suited to the individual learner. Further, computer-based learning systems such as interactive video are highly attractive to use, with colourful and impressive images on the screen, interesting sounds and graphics, fascinating tasks for the learner to carry out and with the knowledge that there will be immediate feedback from the system (Ellington, Percival & Race, 2003). Using a computer keyboard (or any other appropriate input device), the learner interacts

with the information on the screen and immediately receives constructive feedback. This makes the system completely responsive to each individual learner's actions, needs and wishes. The technology is user-friendly and even appeals to computerphobes. Ellington *et al* (2003) observes that computers have a large capacity for data storage in the hard disks and on CDs and DVDs. The information stored in this manner can be quickly tracked down by the computer and displayed on the screen. This makes search for information to be very fast thereby saving on time compared to searching for information from text books in a library. Further, with the Internet, learners can now study from anywhere and anytime with huge savings on travel and accommodation, especially due to use of various search engines like google to access information quickly on the net (Kalinga et al, 2006 ; Muniasamy, 2014).

E-learning also promotes higher order thinking skills such as critical and creative thinking skills. For instance, while computers work on repetitive tasks (such as long calculations and statistical computations), students can concentrate on analytical activities that require higher order thinking skills (Vockell & van Deusen, 1989). The computer, therefore, indirectly enhances thinking skills by making it possible for students to spend their overall time more effectively. These authors argue that the computer can provide a better opportunity for practicing core thinking skills with the advantages of individualisation and immediate feedback. They further observe that the computer is also suited to cooperative learning, in which students assume distinct responsibilities during learning, help one another as necessary, and be individually responsible for their own learning. ICTs can enable access to education by groups, such as girls and the physically challenged, which have been traditionally excluded from education for cultural and social reasons. Pandey (2004) observes that in cultures with strict rules regarding interaction between genders, girls may be forced to leave school before puberty to avoid contact with male colleagues and teachers. He reasons that Internet-based technologies can enable such girls to continue with their studies from home or small learning centres. For the physically challenged, Björk, Ottosson and Thorsteinsdottir (2008) add that there are special computer softwares that can be used to ameliorate learning disabilities or to enhance the memory of individuals with traumatic brain injury emphasising that keyboard adaptations can enable individuals with motor disabilities to write.

E-learning has the capacity to bring back curiosity to education and capture the learners' interest. Oliver (2002) posits that use of movies, video and computer animations bring sound and movement to static textbook lessons and make students' classes to be lively. Oliver also argues that the Internet has many websites that can help teachers develop or improve lessons, exchange ideas, obtain information, and find free animations and simulations to make their lessons interesting. In traditional classrooms, students work in isolation, doing tasks that emphasise conformity and boost competition. Trained in such environments, students may leave the school without a clue as to how to share ideas, divide tasks, or even accept different opinions. Jones (2010) observes that since ICTs can overcome physical and geographical barriers and facilitate communication, they have the potential to eliminate the artificial boundaries between schools and the outside world, and promote an environment that emphasises collaboration rather than competition.

Teachers can benefit professionally from using ICTs in schools. Tinio (2002) argues that ICTs can overcome teachers' isolation, breaking down their classroom walls and connecting them to colleagues, mentors, curriculum experts, and the global teacher community though the Internet. This can enhance teachers' professional development and make them better teachers. Besides that, what teachers are expected to know and do is increasing every year. Teachers not only have to know their subject matter and basic pedagogy, they also are expected to model higher-order thinking processes, work in interdisciplinary teams, and demonstrate leadership and communication skills. Tinio argues that ICTs can help teachers to meet these expectations, by providing productivity tools, access to information and colleagues, and collaboration opportunities.

Research findings confirm that indeed use of e-learning has a positive impact on overall learner achievement in an educational programme (Olson, Codde, deMaagd, Tarkelson, Sinclair, Yook and Egidio,2011; Wekesa, Kiboss & Ndirangu, 2006; El-Seoud, Taj-Eddin, Seddiek, El-Khouly, and Nosseir, 2014). For instance, Internet-based courses utilise potentials of advanced tools such as multimedia and Internet facilities. Access to such learning tools creates an open learning environment where both the flexibility of timing and autonomy of a learner meet the requirements of lifelong learning (Tick, 2006). In another research, the number of staff meetings decreased when teachers shared information through the Internet (Nambu, Murase, Horiguchi &

Yamada, 2001). This enabled them to get more time to prepare their lessons. Where e-learning was used, students stayed on after school to work on assignments and were even willing to go to school on Saturdays so as to access technology to complete their work; school attendance rose significantly; and students were generally more excited about learning (Dexter & Jeanpierre, 2001). Elsewhere, use of discussion boards on the Internet enabled students to collaborate with their peers in other schools (Noordin, Ong, Chong, Rahman & Tsu, 2001). This gave them an opportunity to exchange ideas as well as learning materials instantly. Further, the Organisation for Economic Cooperation and Development (OECD) (2006) adds that learners who use computers regularly perform better in key subjects.

Computer simulation programmes are also useful in e-learning. According to QuinStreet Inc. (2014b), simulation is the process of imitating a real phenomenon. Advanced computer programs can simulate weather conditions, chemical reactions, atomic reactions and even biological processes. ScienceDaily (2014) argues that computer simulations are a useful part of mathematical modelling of many natural systems in physics, chemistry and biology, human systems in economics, psychology, and social science and in the process of engineering new technology, to gain insight into the operation of those systems.

Another significant e-learning facility is word processing software. Farlex, Inc. (2014) defines word processing as the creation, input, editing, and production of documents and texts by means of computer systems. Word processing helps teachers to save time by letting them modify materials instead of creating new ones all the time. Farlex also argues that word processors are used to prepare lesson plans, schemes of work, notes, learning activities and exams. Education.com (2014) adds that use of a word processor can allow sharing of documents such as class notes between teachers and students and the work produced is more appealing and legible than hand written one.

2.3 Teaching and Learning Methods in use in Kenyan Secondary Schools

Maundu, Sambili and Muthwii (1998) note that common teaching methods include lecture, demonstration, laboratory practicals, projects and field trips. Others include question and answer method, e-learning, group discussions, case-studies, role-plays, games and simulations. Research findings indicate that most instructional methods used by teachers in Kenya are teacher-centered

(Situma, 2016). Most lessons are conducted through lecture method with very little or no participation by students. Students are mainly involved in note taking, doing assignments, calculation on chalkboard and answering questions only.

Lecturing has many shortcomings. Kam-Fai (1973) argues that this method wastes the student's time if the lectures repeat what is found in the class textbooks, or if the lectures contain obsolete materials. Kam-Fai also observes that this method does not give students an opportunity to participate in class activities thereby reducing learners' motivation to learn. As a result, progress of learning is impeded. He, further, observes that lecture method of teaching promotes the authoritarian role of instruction and minimises the importance of student's spirit of curiosity and scientific inquisitiveness thereby discouraging critical thinking and initiative. The result might turn a learner into a passive, apathetic individual; being satisfied to do minimal work necessary for passing the course. Logsdon (2009) adds that the method is boring to students, especially when the instructor has a gentle, monotonous voice which lulls the class into sleep. He also posits that lecture method emphasises rote memory on the part of the students and leads to lack of creativity and initiative. The approach further suppresses the spirit of practical orientation to learning and instead promotes an undesirable emphasis on the theoretical one (Malik & Khan, 2006). Shallcross and Harrison (2006) observe that repeated use of the chalkboard during lectures impair legibility of materials. As a consequence of all these problems associated with the lecture method, the students end up disliking some subjects (Tanui, 2003). This is probably why performance in key subjects at KCSE remains below average. E-learning can effectively deal with these shortcomings of the teacher-centred teaching methods (Kalinga, 2006).

However, for e-learning to take root in schools, Kenya may have to borrow ideas from countries which have succeeded in integrating ICTs in the teaching and learning in their schools. In Singapore, a newly industrialised country, the Ministry of Education of Singapore reports that ICT was implemented in education in stages (Government of Singapore, 2008). This is because e-learning can only be successful if its implementation is done in a step by step approach (Sarita & Tomar, 2004). The first stage, called the First ICT Master Plan (1997 – 2002) or simply MP1 focused on setting up the essential infrastructure for schools and the basic training of teachers on the integration of ICT into the curriculum. MP1 was implemented in three phases and concentrated on training of teachers in the use of technology for classroom teaching, provision of

hardware and software to schools and providing support (technical assistance) for schools to implement ICT. Master Plan 2 or simply MP2 ran from 2003 to 2008 to strengthen the gains made during MP1. The approach towards implementation of e-learning was the same in Malaysia (Asirvatham, Kaur & Abas, 2005). In Britain, (a country with the most developed strategies for e-learning in Europe), use of ICT in education started with its incorporation in the mandatory pre-service teacher training followed by a nationwide programme to train all teachers in use of ICTs for teaching (Sarita & Tomar, 2004). These authors also state that in Britain, there is a detailed curriculum showing how ICTs should be used for teaching in each subject. Such a stepwise approach is what many developed countries have used to bring about adoption of ICTs for teaching. Even in Rwanda, primary and secondary schools together with teacher training colleges were first equipped with computers and teachers trained before actual use of ICTs was started in these institutions (Ruberwa, 2007). Perhaps without implementing such a detailed plan in Kenya may delay effective integration of ICT in schools in Kenya in general and Taita Taveta in particular.

2.4 E-readiness in Kenyan Secondary Schools

According to Nelson (2002), e-readiness for e-learning is determined by the roll-out of technological infrastructure, human factors such as skills and education as well as access to traditional media such as radio and television. The state of e-learning in an institution is closely related to her condition of e-readiness (Asirvatham et al, 2005). In Kenya, a research project conducted in 2011 in Nakuru County found that public secondary schools lacked adequate infrastructure and connectivity to support effective e-learning (Karanja, 2011). Karanja also found that standardized software, application programmes and suitable digital content were lacking in majority of the schools. These observations concur with those of Ouma, Awuor and Kyambo (2013). In an earlier research in the Rift Valley Province, more than 50% of teachers had never used the Internet and less than 30% had e-mail addresses (Wims & Lawler, 2007). These findings clearly indicated very low state of e-readiness for integration of e-learning in Kenyan schools. This might have been caused by inadequate e-learning facilities and lack of appropriate skills among the teaching staff. It was, therefore, important to find out the actual position in Taita Taveta with respect to teachers' ICT skills and e-learning facilities in secondary schools in the County.

According GoK (2014), ICT matters are regulated by several pieces of legislation, including Kenya Information and Communications (Amendment) Act, 2013 (no. 41A), Science and Technology Act (Cap. 250) of 1977, and Kenya Broadcasting Corporation (KBC) Act of 1988. However, none of the stated Acts expressively provides for a legal framework to regulate e-learning. The Government of Kenya came up with several policy documents to entrench e-learning in schools. These include Sessional Paper number 1 of 2005 (GoK, 2005), National ICT Strategy for Education and Training (GoK, 2006), Kenya Vision 2030 (GoK, 2007) and National ICT Masterplan (GoK, 2014)

Clark (1990) argues that proper prior preparation is, however, mandatory if e-learning is to be carried out successfully. This is because use of ICT in education without proper planning can be detrimental to academic achievement of learners from low income families as they may not be able to afford the necessary equipment for further practise at home (Akinsanmi, 2005). Roloff (2002) posits that preparation should involve provision of prerequisite conditions which include technical infrastructure, social conditions and personal attributes. According to Rouse (2014), the infrastructure refers to the electrical power, the network, hardware and software while the necessary social conditions include a positive culture towards learning, knowledge and the method of delivery. Taha (2014) found that teachers' personal attributes needed include computer literacy and a positive attitude towards technology. Brdicka (2003) adds that before ICT can catch up in schools, a certain level of ICT competence among the staff is required. In the colleges, universities, and schools, pre-service education needs to adjust to the digital world. Graduates of teacher education should be comfortable with ICT application and innovation. This is because the actual quality of lessons is dependent on the teachers' skills (Song, Lee, Jang & Ahn, 2001). Russell and Bradley (1997) and Young (2000) observed that teachers who are more confident with the use of computers are more likely to embrace e-learning as compared to those who are not. This suggests that the rate of adoption of e-learning is likely to be influenced by a teacher's confidence in use of computers. Further, collaboration among teachers and between teachers and other specialists in education is important for effective implementation of e-learning. Brdicka (2003) argues that school head teachers must foster this collaboration for successful implementation of e-learning to occur.

At the national level, Kiptalam and Rodrigues (2010) discovered that access to ICT facilities was a major challenge facing most African countries, with a ratio of one computer to 150 students against the ratio of 1:15 students in the developed countries. Further, there was an overdependence of Kenya on foreign technicians and consultants for maintenance of telecommunication infrastructures since institutions of higher learning have continued to produce ICT human resource that is not well aligned to local societal needs (GoK, 2014). In Kenya, the Ministry of Education, Science and Technology adds that the other challenges facing ICT in the country include high levels of poverty that hinder access to ICT facilities; limited rural electrification and frequent power disruptions; high cost of Internet provision; and high costs of ICT equipment, infrastructure and technical support (GoK, 2005a). At school level, Karanja (2011) identifies key obstacles to ICT use in Kenya as inadequate number of computers, teachers' computer literacy as well as inadequate e-content for instruction. However, e-learning in Kenya got a boost by the operationalisation of undersea fiber optic cable (Ondari, 2009). This was to enhance e-learning by enabling fast and cheaper access to the Internet resources. According to Ayere, Odera and Agak (2010), basic e-learning facilities include computers, e-materials, Internet appliances and trained personnel. However, even with such e-learning facilities in place, integration of e-learning in secondary schools can only be achieved if a proper programme is put in place to guide the process. This can best be illustrated by what has been done in developed countries.

2.5 E-readiness For E-Learning: Perspectives from Developed Countries

Schools are considered as ideal learning institutions if they can assist in acquisition and putting to use of new knowledge such as e-learning facilities (Brdicka, 2003). A closer look at education in developed countries reveals a high level of e-readiness for integration of e-learning as compared to the practice in developing countries. It is perhaps because of this that the institutions of learning in these countries are doing relatively well in comparison to those from developing countries. The US, Singapore, Japan and the UK have especially been outstanding in this area. Carnoy (2004) reports that in the US, most schools have introduced laptops for all students and have trained teachers to organise their teaching in such a way as to enable students to do all their written assignments on their laptops. Many school administrators have access to data from district computers. In many schools, individual teachers are connected to central data files either

in the school or district office. As a result, teachers and students have access to the latest information in education. Many teacher assignments and student work is web-based (Carnoy, 2004).

In Japan, the government launched e-Japan Priority Policy programme in 2003 to enhance provision of Information Technology (IT) environment in schools and enrichment of IT education (Government of Japan, 2003). The government then developed several major networking systems for use in education. These included;

i. Space Collaboration System (SCS) - a satellite network system, for video-conferencing in learning.
ii. Use of Broadcasting (University of the Air Japan, UAJ) – for broadcasting lectures throughout the country using satellite networks.
iii. El-Net System (Lifelong Learning) – it uses Super Bird B communication satellite with terrestrial stations for continuous professional development for teachers.

By 2006, 89 per cent of public schools were connected to broadband network (Fukumoto & Kikuchi, 2008). By 2009 there was over 99 percent computer penetration in schools, with pupil to computer ratio of 7:1(Suzuki, 2009). Internet penetration rate was 97.9 per cent with 85 per cent having Local Area Network (LAN) access in the classroom. The government policy on ICT Education was to increase student to computer ratio to 1:1.

In Singapore, e-learning was implemented in stages known as ICT Masterplans for education (Koh and Lee, 2008). The authors report that the programmes involved were Masterplan 1 (MP 1), Masterplan 2 (MP 2) and Masterplan 3 (MP 3). The first ICT Masterplan for education (1997 – 2002) involved establishing ICT infrastructure such as computer laboratories, a wired network, digital resources for teaching and learning as well as training of teachers in integration of e-learning in pedagogy in all schools. The second ICT Masterplan (2003 – 2008) involved introduction of the internet in classrooms in all schools and generally enhancing e-learning readiness of schools by supporting school-based programmes on e-learning. Kong, Chan, Huang and Cheah (2014) add that the third ICT Masterplan for education (2009 – 2014) was aimed at ensuring that each student meets the expected achievement in e-learning and that each teacher is provided with support through e-learning mentorship programme. The forth ICT Masterplan for education (2015 – 2020) intends to provide quality learning in hands of every learner,

empowered with technology, by ensuring that there is optimal e-learning infrastructure in all schools and new media literacy for both teachers and learners.

In Britain, European Schoolnet (2008) notes that the government created the curriculum Online Portal where schools can find all the multimedia teaching and learning resources they need. Where commercially produced, schools can use the government's e-learning credits and other funds to purchase the content. The computer to pupil ratio is 1:6 in primary and 1:3.6 in secondary schools. Over 99 per cent of schools are connected to the Internet, with 78 per cent of primary and 99 per cent of secondary schools connected to the broadband. The government has connected a single national education network through 10 regional broadband consortia with the ability to connect to every school in the country. According to the Department for Education and Skills (DfES) of the United Kingdom, 16 million users in education have access to broadband and 350,000 teachers use ICT for planning and administration (European Schoolnet, 2008). The same source also reports that one million primary school children use e-learning in class each day. Further, the British government allocated £60 million (about Ksh. 6.5 billion) for 2006-2007 and 2007-2008 to the DfES, to enable the most disadvantaged children to have access to a computer and the Internet at home. Table 1 summarises the ICT situation in schools in Britain.

Table 1

ICT Infrastructure Facts in Schools in Britain

Primary schools	Secondary schools
• There is about 1 computer for every 7 pupils • 95% have interactive whiteboards • 91% have a network in place • 99% are connected to the Internet • 78% have a broadband connection • 85% of teaching staff are reported to be very confident or confident in using ICT in their job.	• There is about 1 computer for every 4 students • 99% have interactive whiteboards • 99% have a network in place • 99% are connected to the Internet • 99% have a broadband connection • 81% of teaching staff are reported to be very confident or confident in using ICT in their job.

Source: European Schoolnet (2008)

Where e-learning was used for instruction, school attendance by students rose significantly and the students were generally more excited about learning (Dexter & Jeanpierre, 2001). Even academic achievement scores tended to improve (Siddiqui, 2004).

2.6 Theoretical Framework

The theoretical framework that guided this study was the Human Capital Theory by Schultz (Pasour, 2013). This theory posits that education and training improves productivity of employees by giving them important knowledge and skills. According to Olaniyan and Okemakinde (2008), human capital represents investment people make in themselves which improves their level of output. The theory is based on transferability of acquired skills (Kessler & Lulfesmann, 2002). Harvey (2004) opines that the justification for this theory is that the better the quality of the human capital, the higher the level of productivity. Xiao (2001) argues that as technological innovations continue to be adopted in the work place, production techniques that were previously effective become obsolete. According to the same author, such changes cause a mismatch between the organizations' modern investments and the competence of their employees making the employees less effective. Marope (2005) further observes that the quality of human capital depends on the quality and quantity of education and training. The author adds that the higher the penetration of ICT in education, the better the quality of education hence the better the quality of human capital. This eventually makes the individual more productive at work. A secondary school that embraces technology is bound to produce graduates of relatively high quality than those from schools that use traditional methods of teaching and learning. This theoretical argument emphasizes the need to use modern technology like ICTs for teaching and learning so as to equip the learners with relevant skills for a revolutionized job market.

2.7 Conceptual Framework

According to Oso and Onen (2005), a conceptual framework is a diagrammatic representation of variables that the researcher operationalises in order to achieve the objectives of the study. The conceptual framework for this study was as illustrated on Figure 1. In this model, independent variables are availability of ICT facilities and teachers' ICT skills. Facilities of concern here are computers, computer accessories and computer connectivity – LAN/WAN. ICT skills refer to computer literacy, ability to teach using computers, basic computer maintenance skills and skills

to develop materials for teaching and learning using ICTs. Dependent variable here is e-learning as seen in the way teaching and learning activities are conducted in a school. This may involve use of electronic media like computers for teaching, use of Internet to get learning materials and giving Internet-based assignments. The influence of independent variables over the dependent one will be affected by the intervening variables which in this case are the school category (whether Sub-County or County school) and the school management – through their policies. Figure 1 summaries this situation.

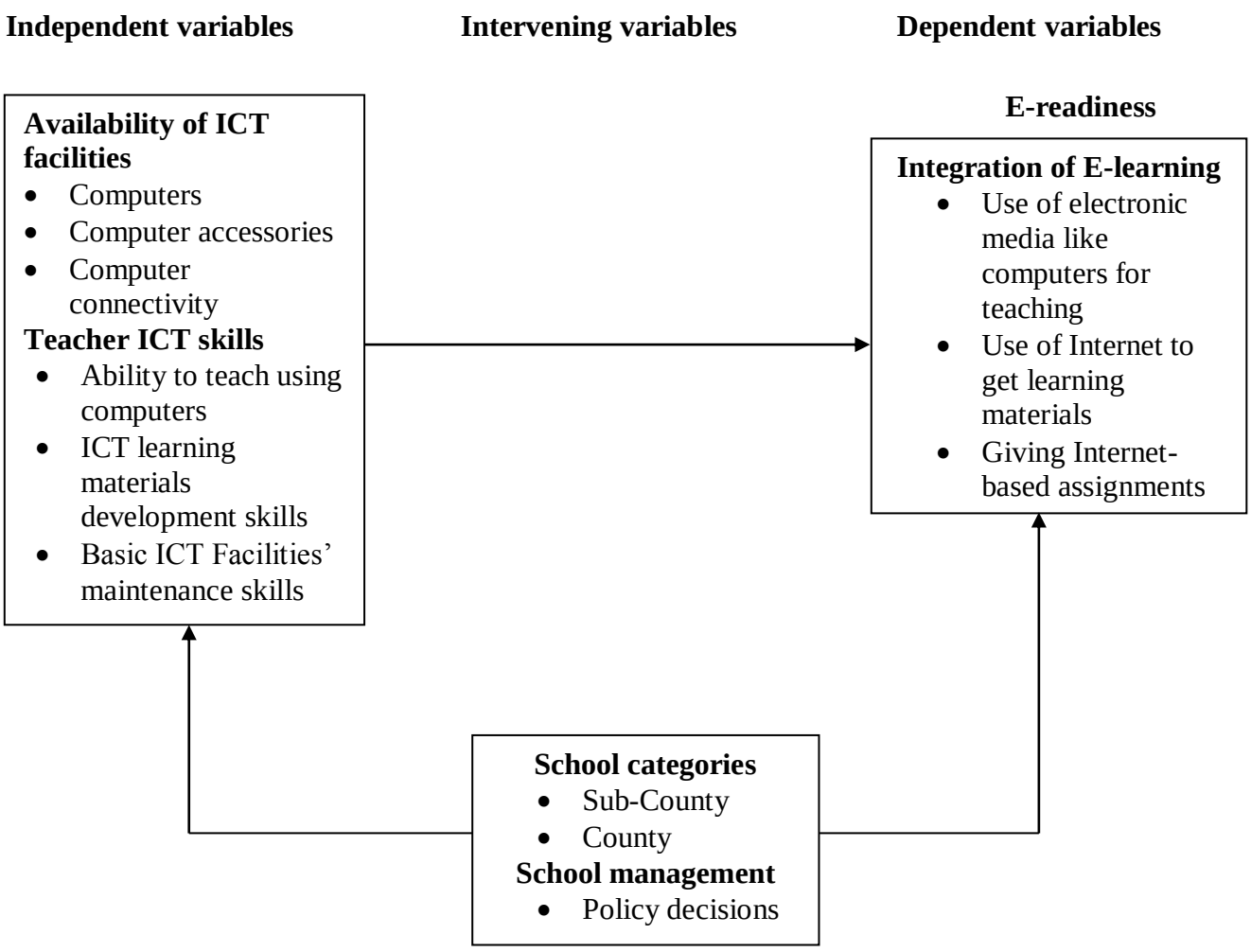

Figure 1: The E-learning Adoption Process. Adapted from Carnall, 1995.

In this model, the ultimate direction of the arrows is towards e-learning, implying that e-learning depends on factors from which the arrows originate. There are many other ICT facilities that can be used to bring about e-learning. However, included in this model are those that can enable learning through the Internet due to the latter's ability to provide latest information to learners. Intervening variables will be controlled by randomisation.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter highlights the research design, target population, sampling procedures and sample size. The chapter also describes the research instruments, their validity and reliability, the data collection procedures and how the data was analyzed.

3.2 Research Design

This study adopted a descriptive survey design. Mugenda and Mugenda (2003) define descriptive survey as a process of collecting data in order to answer questions concerning the current status of the subjects under study. Mugenda and Mugenda also add that descriptive research determines and reports the way things are. Further, Mertler and Charles (2005) argue that when dealing with people, places, situations and conditions about which we wish to know more, then descriptive survey is the best. Gay, Mills and Airasian (2006) state that cross-sectional descriptive survey design is one in which data is collected from chosen individuals in a single time period hence very convenient to use. These arguments favoured this design because the study involved collection of data about the skills possessed by secondary school teachers and the ICT facilities present in secondary schools in the target area at the time of the research, hence the choice of descriptive survey design for this study.

3.3 Target Population of the Study

The population for this study was head teachers and teachers from public secondary schools in Taita Taveta County. The teachers comprised of those who were employed by the government. The reason for selecting only this category of teachers is that they were all trained and were expected to have relatively same skills level. The population comprised of 440 teachers in County and Sub-County public secondary schools in Taita Taveta County. Teachers employed by the Board of Management (BoM) in these schools were not considered for the study as some schools might have employed teachers who were not trained. Further, teachers in private secondary schools were not sampled for the same reason. Besides, some private schools charged relatively higher fees than public secondary schools while others were funded by donors and

were therefore, able to acquire facilities that public schools may not have afforded. Private secondary schools were, therefore, not sampled for purposes of establishing the situation of ICT facilities in the County. National schools were also not sampled since each of them was given substantial amount of money by the government for upgrading their facilities. There were 10 County schools having 167 teachers and 38 Sub-County schools with 273 teachers bringing the total to 48 schools and 440 teachers. Table 2 summarizes the number of schools and teachers in the region.

Table 2

Population Distribution by Category of School

Category of Schools	Number of Schools	Number of Teachers
County	10	167
Sub-County	38	273
Total	48	440

Source: County Director of Teacher Management, Taita Taveta (2012)

3.4 Location of the Study

The study was carried out in Taita Taveta County in Kenya. The County is one of the six Counties in the former Coast Province and is situated to the South-West in the region bordering Tanzania. Taita Taveta County borders Tana River and Makueni Counties to the North, Kwale and Kilifi Counties to the East, Kajiado County to the North-West, and Tanzania to the South-West. According to the Taita Taveta Development Plan (2008 – 2012), the region covers an area of 16,482 km^2 (GoK, 2008). This region is composed of three Sub-counties, namely; Voi, Mwatate and Taita. The place is an Arid and Semi-Arid (ASAL) area with 64.8% being occupied by Tsavo East and West National Parks and 24% being rangeland. It has a high poverty level of 57% (GoK, 2008). With the shortage of teachers' standing at 66, 000 nationally (Agutu, 2010), it is important to find out how education in this County is fairing on towards achieving Education For All (EFA) by 2015. Kerlinger (1973) argues that a researcher should be familiar with the location if the study is to be carried out successfully. This is the reason why the researcher selected this area as he was familiar with it.

3.5 Sampling Procedures and Sample Size

For the purpose of this study, the public schools in the Sub-County were stratified into two categories; County and Sub-County secondary schools. This is because the two types of schools might have had different facility establishments since County schools were put up and equipped by the Government, hence likely to have better facilities than Sub-County schools which were put up and equipped through community initiative (Harambee approach). Being an ASAL area and with a high poverty level of 57% as indicated in the District Development Plan of 2008 - 2012 (GoK, 2008), community initiative may have failed to raise adequate funds for initial development of facilities in Sub-County schools. Further, Constituency Development Fund (CDF) may have contributed to inequality in facilities in schools as the funds were not disbursed equally to all schools in Kenya. The stratification resulted into 10 County and 38 Sub-County secondary schools.

Kathuri and Pals (1993) argue that the minimum sample size for a survey research should be 100 for each major subgroup and 20 for each minor subgroup. They also add that sample size for a study whose population is 440 should be 205. Therefore, 205 teachers were selected to participate in the research. The sample size of schools for the purpose of assessment of facilities was put at 40 (double what Kathuri recommends for minor subgroup) to cater for problems that might have arisen in case of unreturned questionnaires or questionnaires with serious statistical errors. Head teachers or their representatives from the 40 schools answered the questionnaires on facilities. There were 38 Sub-County and 10 County (combined total of 48) secondary schools with a teacher population of 273 and 167 teachers in Sub-County and County schools respectively, giving a total of 440. The sample sizes were as follows;

Sample size for Head teachers from Sub-County schools = (38/48) X 40 = 32
Sample size for Head teachers from County schools = (10/48) X 40 = 8
Sample size of teachers from Sub-County schools = (273/440) X 205 = 127
Sample size of teachers from County schools = (167/440) X 205= 78

The sample, therefore, included 78 teachers drawn from 8 County and 127 teachers drawn from 32 Sub-County secondary schools. Table 3 is a summary of the sample sizes of schools and teachers that participated in the study.

Table 3

Sample Distribution of Teachers and Head Teachers by School Category

Category of schools	Head Teachers	Teachers
Sub-County	32	127
County	8	78
Total	40	205

Using the list of Sub-County schools at the Taita Taveta County Director of Teacher Management's office as the sampling frame, those included in the sample were determined using a table of random numbers. The same procedure was used in identifying the County schools that were included in the sample. Head teachers in these schools or their representatives provided information about ICT facilities. The number of teachers included in the sample from each school was proportionately determined depending on the number of teachers in that school. The teachers in any given school were further classified based on gender to ensure that the sample obtained is representative of gender diversity in the schools. Using the list of teachers in the head teacher's office as the sampling frame, the specific teachers included in the sample were decided using a table of random numbers. The head teachers and teachers who participated in the study were drawn from the same schools. The sub-sample of head teachers was equivalent to the sample size of schools which was 40. However, out of the 40 schools which were targeted, head teachers of 7 of them did not fill the questionnaires completely and were thus not used in data analysis. For the teachers, 4 of the questionnaires were also incomplete and hence were not used in data analysis. Therefore, 33 principals and 201 teachers participated in the study.

3.6 Instrumentation

Two questionnaires were used to gather data for this study, Teacher's Questionnaire (TQ) and Head Teacher's Questionnaire (HTQ).

3.6.1 Teachers' Questionnaire (TQ)

This instrument was designed to collect data on teacher's ICT Skills and level of integration of ICT in teaching. It was divided into three parts comprising of 34 items. Part I had two items intended to collect data on the category of the school and the duration a teacher had taught in that particular school. Part II was designed to collect data on the skills inventory of teachers on use of E-learning facilities. This part had 15 items. Each item was rated on a five point scale (very adequate, adequate, inadequate, very inadequate or no skills) to give an indication of the teacher's skills. Teachers were asked to rate themselves on each item appropriately. Part III comprised of 17 test items designed to collect information on the frequency of integration of each item in E-learning by the individual teachers. Each teacher was asked to rate himself on every item on a five point scale (Always, often, sometimes, Rarely never) in order to depict the frequency of integration of each item in the teaching and learning process.

3.6.2 Head Teacher's Questionnaire (HTQ)

This instrument was designed to collect data on ICT facilities used for teaching in schools. It was divided into two sections with a total of 14 items. Section I had two items to collect data on the school category and the duration that the principal had been in charge of the school. Section II had 12 test items intended to collect data on adequacy of each facility in the school for purposes of implementation of E-learning. Each facility was rated by the head teachers or their nominees on a five point scale (very adequate, adequate, inadequate, very inadequate or unavailable) to give an idea about its adequacy in the school.

3.7 Validity of the Research Instruments

According to Fraenkel and Wallen (2000), validity refers to the appropriateness, meaningfulness, and usefulness of the specific inferences researchers make based on the data they collect. This is dependent upon the instruments used. To ensure validity of the instruments used in this research, the researcher gave them to the two university supervisors to authenticate them. Mutai (2000) argues that input of university supervisors is vital in validating the instruments. They assisted to enhance the construct and content validity of the instruments. Their recommendations were incorporated in the draft of the instruments before piloting. The instruments were then piloted in schools that did not participate in the study. This helped to further establish the content validity of the instruments and also address any difficulties that the respondents encountered. According

to Mugenda and Mugenda (2003), the sample for pilot study should be between 1 – 10 % depending on the actual sample size. They add that the percentage should be higher if the sample is smaller. Since the samples in this study were relatively small, the researcher took a relatively big sample size for inclusion in the pilot study. This resulted into 10 teachers and 9 head teachers from 9 schools.

3.8 Reliability of the Research Instruments

According to Gay, Mills and Airasian (2006), reliability is the degree to which a test consistently gives similar results when administered on the same subjects repeatedly. To be sure of the reliability of the instruments for this study, the responses from the pilot study were used to compute the reliability coefficient of the instruments. This is because this approach requires a single administration of the test instrument hence it is relatively easy to use and is cost effective (Fraenkel & Wallen, 2000). The Cronbach's alpha coefficient (α) was then computed since it is appropriate where multiple alternative responses are expected. These authors further argue that for research purposes, a reliability coefficient (α) of 0.7 or above is acceptable. Therefore, the instruments were considered reliable for use as they attained 0.9740 and 0.9492 α-level for TQ and HTQ questionnaires respectively.

3.9 Data Collection Procedures

The researcher obtained a letter of introduction from Egerton University's Graduate school to enable him to obtain a research permit from the National Commission for Science, Technology and Innovation. The researcher then wrote to head teachers of the selected secondary schools informing them of the intended research. This was done before the actual visit. The researcher later visited the schools to collect data using self administered questionnaires. The researcher's presence was necessary in order to make any clarifications that were required and also to ensure high completion and return rates of the questionnaires. The respondents were given ample time to respond to the questionnaires before these instruments were collected by the researcher on the same day.

3.10 Data Analysis

After data collection, the responses were coded and then keyed into the computer. Further, the teachers' responses on the Teachers' Questionnaire (TQ) were summed up to form the teachers

ICT skills score. This indicated whether the teachers in the region had ICT skills or not. Frequencies and percentages were used to analyse qualitative data. Quantitative data was analysed using Independent Samples t-test and chi square test to determine if there was any significant difference between ICT facilities in Sub-County and County secondary schools in Taita at 0.05 level of significance. This is because Oso and Onen (2005) observe that this level is good enough for data analysis because it means that the finding would have a five percent (.05) chance of error, which is the converse of a 95% chance of being true. They argue that such a level of significance is acceptable for statistical analysis. The Head Teacher's Questionnaire (HTQ) scores were summed up to form the adequacy index scores on school ICT facilities. This indicated the inventory of ICT facilities for teaching in public secondary schools in the area. A similar analysis was done for ICT facilities as done for teachers' ICT skills. Statistical Package for Social Sciences (SPSS) version 17.0 for windows was used for data analysis.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents the results and discussion of the research findings on the state of e-readiness for incorporation of e-learning in teaching in secondary schools in Taita Taveta County, Kenya. E-readiness was assessed in terms of the presence of computers and associated infrastructure as well as teachers with skills to teach using these resources. Data were collected with reference to each of the objectives and analysed with aid of the Statistical Package for Social Sciences (SPSS) version 17.0 for Windows. Results are presented using both descriptive and inferential statistics. The presentation and discussion are done in line with the research objectives of the study which were to:

i) Determine level of adequacy of e-learning facilities in public secondary schools in Taita Taveta County.

ii) Establish teachers' level of skills in use of e-learning facilities in public secondary schools in Taita Taveta County.

iii) Find out the level of integration of e-learning in teaching in public secondary schools in Taita Taveta County.

iv) Establish whether there was any significant difference in level of adequacy of e-learning facilities between Sub-County and County Secondary Schools in Taita Taveta County.

The chapter is divided into six sections including the demographic characteristics of the sampled respondents, adequacy of e-learning facilities, teachers' skills in the use of e-learning facilities, level of integration of e-learning in public secondary schools, school category and adequacy of e-learning facilities and results of the null hypothesis.

4.2 Demographic Characteristics of the Respondents

This section presents a brief description of the demographic characteristics of the sampled respondents in this study. Such a description is considered important in providing a better understanding of the characteristics of the respondents included in the study. The demographic characteristics included school category and years of service in the school. The analysed data were based on a sample comprising 201 teachers and 33 Principals.

4.2.1 Distribution of the Sampled Public Secondary Schools by their Categories

The study was conducted in 33 public secondary schools in Taita Taveta County. The schools were divided into two categories which included County and Sub-County schools. Figure 2 illustrates the distribution of the 33 sampled schools from the two categories of schools.

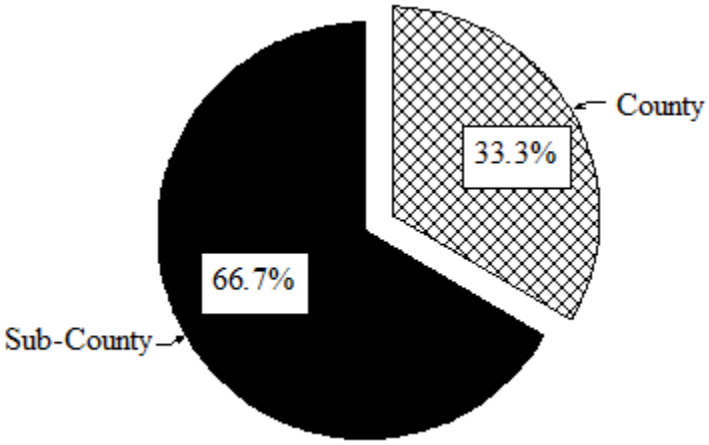

Figure 2: Distribution of the Sampled Public Secondary Schools by their Categories.

Figure 2 indicates that 66.7 percent of the sampled schools were Sub-County secondary schools while 33.3 percent were County secondary schools. The unequal distribution of the public secondary schools in the two categories was based on the fact that the study area had more Sub-County schools as compared to County schools. The Principal of each school was included in the study to provide data on school facilities.

4.2.2 Distribution of the Sampled Teachers by Schools Category

The sampled 201 teachers were drawn from the 33 schools and distributed in the two categories as illustrated in Figure 3.

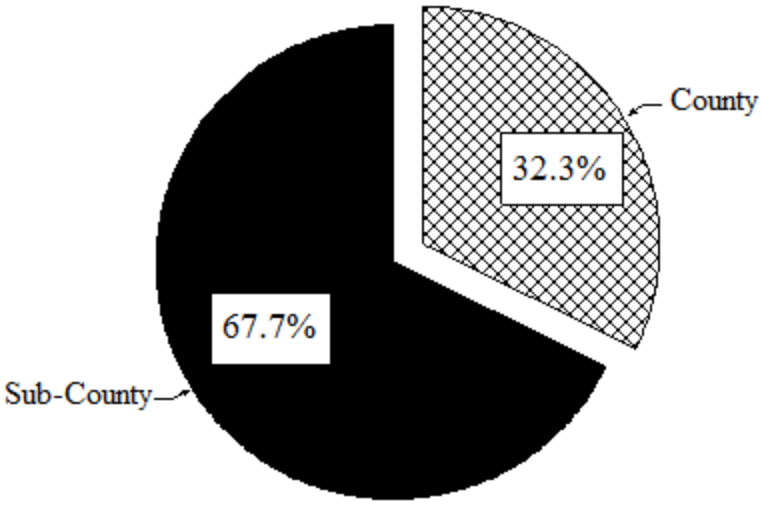

Figure 3: Distribution of the Sampled Teachers by Schools Category

Figure 3 indicates that out of the 201 sampled teachers, 32.3 percent were drawn from County secondary schools while 67.7 percent were drawn from Sub-County secondary schools. The variation in the sample distribution was based on the number of schools from each category.

4.2.3 Number of Years Served in Current School

The efficiency of any employee in the implementation of a new program in an organization depends on, among other things, the duration that one has served (Mihalic, Irwin, Fagan, Ballard & Elliott, 2004). This helps in understanding the work environment and its needs. In this study, the sampled Principals and teachers were asked about the number of years that they had worked in their current schools. Table 4 summarises their responses.

Table 4

Number of Years Served in Current School

	Principals		Teachers	
Years of service	f	%	f	%
1-5	28	84.8	125	62.2
6-10	3	9.1	45	22.4
11-15	1	3.0	12	6.0
16-20	1	3.0	14	7.0
21-25	0	0	4	2.0
26-30	0	0	1	.5
Total	33	100.0	201	100.0
Mean	3.82		5.93	

Source: Field Data

Table 4 indicates that Principals had served in the same position in the current schools for a mean of 3.82 years, with majority of them (84.8 percent) having served for between 1 and 5 years. Teachers had worked for a mean of 5.93 years with a majority of them (62.2 percent) having worked for between 1 and 5 years. The mean number of years worked in current station suggests that Principals and teachers had a wide teaching experience in their stations which is critical for understanding students' pedagogical needs and how to integrate them in e-learning.

4.3 Adequacy of E-Learning Facilities

The first objective of the study sought to determine adequacy of e-leaning facilities in public secondary schools in Taita Taveta County. Table 5 presents the distribution of responses obtained after the analysis.

Table 5

Adequacy of Individual E-learning Facilities in Secondary Schools

n=33	Response (%)		
Facility	Adequate	Inadequate	unavailable
Power (mains, generator, solar)	84.8	6.1	9.1
Internet Connectivity	15.2	33.4	51.5
Computer rooms/Laboratories for e-learning facilities	0.0	69.7	30.3
Furniture (desks, chairs, tables) for the facilities	6.1	63.6	30.3
Projectors (LCD)	0.0	51.5	48.5
Laboratory Technicians/Support Staff	3.0	51.5	45.5
Computers (desktops and laptops)	0.0	78.8	21.2
Instructional multimedia material (CD-ROMs, DVDs, video tapes)	3.0	51.5	45.5
Word processing software (MS Word)	0.0	78.8	21.2
Spreadsheet applications (MS Excel)	0.0	78.8	21.2
Database software(MS Access)	0.0	78.8	21.2
Presentation software (PowerPoint)	0.0	78.8	21.2
Computerised tutorials	0.0	3.0	97.0

Table 5 indicates that majority of schools in the study area had one form of power or the other, ranging from mains or grid electricity, generators to solar as indicated by a high percentage of the respondents (84.8%). This means that most schools in the study area could easily use computers and other ICT accessories because they had electric power. These findings are in line with those of UNESCO (2014) which found high electricity penetration in secondary schools in developing countries.. According to Kiptalam and Rodrigues (2010), adequate power supply to schools is critical if schools are to adequately use ICT for delivery of learning experiences in the

classroom. This is because electricity is required to run ICT gadgets such as computers and LCD projectors. Results from the study in Taita Taveta County indicated that most schools could easily use computers for teaching and learning purposes since the power to run them was available in majority of the schools.

The study in public secondary schools Taita Taveta County reported very low adequacy level of the other 12 facilities that were investigated, with all of them reporting less than 20% level of adequacy. Of the 12 facilities, Internet connectivity had the highest adequacy level but only 15.2% of the schools indicated that they had adequate Internet connectivity while most of them (51.5 percent) did not have Internet connection at all. These findings agreed with those of UNESCO (2014) which found low internet connectivity in secondary schools in developing countries.. Lack of Internet connectivity can be a major setback to distance learning in schools. It is again not clear what form of connection schools in Taita Taveta had, whether it was by modems or by fiber optic cables. According to Kalinga et al (2006), Internet is very critical since it enables teachers and learners to access latest teaching and learning materials from anywhere in the world. Besides, Oliver (2002) adds that Internet also enables teachers to network with one another and be able to share teaching materials. This improves efficiency of the less competent teachers such as those who are new in the profession. Kenya is connected to four undersea fibre optic cables all of which pass through Taita Taveta. These cables are TEAMS, SEACOM, EASSy and the Lion2 (Nyabiage, 2013). For effective e-learning, schools in the area should be connected to this internet backbone. According to GoK and Kenya ICT Board (n.d), fiber optic cables carry a greater amount of bandwidth than metal cables. This means that they can carry more data. Further, use of the fibre optic cable significantly reduces the cost of connectivity to broadband while increasing the connectivity speeds, leading to increased capacity and eventually reducing the overall cost of e-learning (QuinStreet Inc. 2014a).

Physical facilities including furniture (desks, chairs, tables) and computer rooms/Laboratories for e-learning facilities were inadequate or unavailable in most schools in the study area. Only 6.1 percent of the schools had adequate furniture (desks, chairs, tables) for the e-learning facilities while none of them had adequate computer rooms. These findings agreed with those of UNESCO (2014) which reported that there were very few computer labs in secondary schools in developing countries with some countries completely lacking computer laboratories in schools.

A computer laboratory enables easy planning and technical support (UNESCO, 2005). This is because, with a computer laboratory, there is more responsibility in use of ICT facilities and it is easier to achieve safety and maintenance requirements in a lab. The lab can also be used for storage of all types of ICT hardware and software for school needs.

From the results, it can be observed that all schools did not have enough computers. Seventy eight percent (78.8%) of schools had inadequate computers while the rest lacked computers completely. None of the schools had adequate number of computers. These findings are in agreement with those of Karanja (2011) who identified key obstacles to ICT use in Kenya as inadequate number of computers. Kiptalam and Rodrigues (2010) also discovered that access to ICT facilities is a major challenge facing most African countries, with a ratio of one computer to 150 students.

A very high percentage of schools also reported that they did not have adequate software to run the computers. Seventy eight percent (78.8%) of the schools indicated that they had inadequate basic software needed to run the computers while the rest reported that they lacked the softwares. The softwares of concern were word processors, spreadsheets, databases and presentations, each of which was not adequate in all schools under the study. They all rated at the same percentage probably because majority are normally sold as one package known as Microsoft office. Further, 97 percent of the schools lacked computerised tutorials which are a form of e-content. The other 3 percent of the schools had inadequate tutorials. These findings are also in agreement with those of Kiptalam and Rodrigues (2010) who discovered that availability of locally relevant content ranked low. According to Ayere et al (2010), computers and e-materials or e-content are basic e-learning facilities and have to be provided for E-learning to take place effectively.

However, even though most of the sampled schools lacked adequate basic facilities to implement e-learning, they had the potential to implement the programme since they had started putting some of the requirements into place. While launching the program in 2008, the Ministry of Education aimed at using computers and wireless connectivity for all types of class work in public secondary schools. In this case, the teacher was to use a laptop to which the students were to connect from their low-cost laptops known as classmates. Thus, the blackboard was to be replaced with a touch screen and students were to send their work to the teacher through wireless

connectivity. Successful implementation of e-learning program in public secondary schools partly depends on adequacy of e-learning facilities (Olson et al, 2011).

4.3.1 Overall Adequacy of E-Learning Facilities in Schools

The overall adequacy of e-learning facilities in the schools was determined by the interaction and cumulative aggregate of all e-learning facilities reported in this study. Thus, the ratings of each facility were scored on a scale ranging from 1 to 5 (where 1 = unavailable, 2 = very inadequate, 3 = inadequate, 4 = adequate and 5 = very adequate). The responses were then collapsed into three ordinal categories ranging from 1 = no facilities to 3 (for very adequate)

The individual facility scores were then summed up to form an adequacy index score for each respondent. The index score varied between 12, indicating no facility available, and 36, indicating adequate (all facilities adequate). The higher the score, the higher was the level of adequacy of the e-learning facilities among the respondent schools, and vice versa. The index score was then presented in three ordinal categories in order to differentiate between the levels of adequacy among the respondent schools. This included a score of 12 (not available), 13-24 (inadequate) and 25-36 (adequate). Table 6 indicates the overall level of adequacy of the e-learning facilities in the sampled schools.

Table 6

Overall Adequacy of E-Learning Facilities in Schools

Level	Frequency	Percentage
Adequate	0.0	0.0
Inadequate	31	93.9
No Facilities	2	6.1
Total	33	100

Table 6 indicates that on the overall, 93.9 percent of the schools had e-learning facilities which were, however, inadequate to implement the e-learning programmes while the remaining 6.1 percent did not have these facilities at all. No school had adequate facilities for e-learning. This

confirms the individual rating of the facilities where majority of them were available, although inadequate. This led to a conclusion that schools in Taita Taveta had low e-readiness for e-learning with respect to facilities. This concurred with findings of Karanja (2011) who found very inadequate e-learning infrastructure in public schools in Nakuru. According to Bashar and Khan (2007), adequate infrastructure helps to boost growth of e-learning in schools. Absence of necessary facilities makes it difficult for teachers to integrate e-learning even if they have skills required for integration process.

The 33 Principals and 201 teachers were asked whether their schools were ready to adopt e-learning. They all reported that they were not ready due to lack of or inadequate basic infrastructure and facilities. These results support previous studies such as Kiptalam and Rodrigues (2010) who observed that access to ICT facilities is a major challenge facing most African countries, with a ratio of one computer to 150 students against the ratio of 1:15 students in the developed countries. This may hinder application of e-learning in schools.

4.4 Teachers' Skills in the Use of E-Learning Facilities

The second objective of the study sought to establish skills possessed by teachers in using various facilities useful to e-learning programmes in public secondary schools in Taita Taveta County. Table 7 shows the distribution of the teachers' responses.

Table 7

Teachers' Skills in Various Aspects of E-Learning in Secondary Schools

n = 201	*Response (%)*		
Facility	Adequate	Inadequate	No skills
Email	33.4	45.2	21.4
Internet	30.4	47.2	22.4
DVD recorders/players	25.0	44.2	30.8
Word processing	24.1	60.5	15.4
Reproduction (printing/scanning/photocopying)	21.4	50.2	28.4
Digital cameras	18.5	45.7	35.8
Spreadsheets	16.0	50.7	33.3
Computerised tutorials	14.0	34.3	51.7
Simulation programmes	10.5	32.8	56.7
Presentation software	10.4	51.3	38.3
Database applications	9.4	52.8	37.8
Use of programmes for creating interactive multimedia	8.5	40.8	50.7
Desk top publishing	7.4	49.3	43.3
Drill and practice programmes	7.0	34.3	58.7
Graphics software	6.5	41.8	51.7

Table 7 indicates that the sampled teachers varied in their rating of their skills for various aspects of e-learning in secondary schools. Few teachers indicated that they had adequate skills required to implement e-learning. They only rated 2 out of 15 skills necessary for e-learning on a mean score of 30 and above percent adequacy. These were skills in use of email and the Internet. For the other facilities, less than 30% of teachers reported that they had adequate skills to use them. Only 10.4 per cent of them had adequate presentation software skills. This can equally hinder or slow down uptake of e-learning.

Teachers included in the study reported very low level of adequacy in skills in simulation programmes, computerised tutorials, drill and practice programmes as well as use of programmes for creating interactive multimedia, all of which can motivate learners in class. Of these facilities, computerised tutorials had the highest percentage with only 14 per cent of the respondents indicating that they had adequate skills in its use. Teachers that were sampled had very low skills levels with respect to use of presentation software. Skills in use of presentation software, such as PowerPoint, are very important for effective e-learning. PowerPoint enables the teacher to create dynamic, informational slides through use of text, graphics and animation, which can be displayed on projection screens for training or other educational purposes.

Findings of this study are in agreement with those of Ouma et al (2013), who observed that there were very low computer skills among teachers and suggested that improvement in teachers' ICT skills was essential for successful implementation of e-learning in Kenya. Teachers who have skills on how to navigate the Internet can also impart the same to learners for use in education. This will enhance e-learning in schools. The findings of this study also agree with those of Karanja (2011) who identified key obstacles to ICT use in Kenya as teachers' computer literacy among other factors. The findings are also in line with those of Pelgrum (2001) in Afshari (2009) who found that teachers' lack of knowledge and skills was one of the most inhibiting obstacles to the use of computers in schools. With low skills in e-learning, teachers in Taita Taveta may take long to fully embrace e-learning.

It is, however, encouraging to note that all teachers who indicated that they had adequate or inadequate skills actually implied that they had these skills but at varying levels. From this perspective, therefore, many teachers had some skills for the implementation of e-learning. The percentage of skills in the use of all facilities included in the research was above 40 percent for each of the facility. A higher percentage of teachers reported having skills in use of Email, at 78.6 percent (obtained from 33.4 percent + 45.2 percent) followed by use of Internet, at 77.6 percent (obtained from 30.4 percent + 47.2 percent). It is, therefore, important to note that teachers in schools in Taita had some skills in use of e-learning facilities, although the majority of them did not have adequate skills for e-learning. Based on the fact that they were the persons to implement the e-learning programme in schools, the teachers were expected to have adequate skills in all the aspects of e-learning.

The overall levels of skills in e-learning among teachers were determined by the interaction and cumulative aggregate of all the ratings of all the aspects of e-learning. Thus, the ratings of each aspect of e-learning were scored on a scale of 1, indicating none, to 5, indicating very adequate skills. The individual aspect scores were summed up to form a skills index score for each respondent. The index score varied between 15, indicating no skills, and 75, indicating very adequate skills. The higher the score, the higher was the level of skills in e-learning among the respondent teachers, and vice versa. The index score was later collapsed into three ordinal categories in order to differentiate between the levels of skills among the respondent teachers. This included a score of 15 (no skills or none), 16-45 (low skills) and 45-75 (high skills). Table 8 depicts the overall level of skills of teachers in e-learning in the sampled schools.

Table 8

Overall Teachers' Skills in E-Learning in Schools

Level	*Frequency*	*Percent*
None	14	7.0
low	149	74.1
High	38	18.9
Total	201	100.0

Table 8 indicates that on the overall, 74.1 percent of the teacher respondents had low level of e-learning skills, 18.9 percent had high level of skill while 7.0 percent did not have any skills in e-learning at all. This indicates that majority of teachers, 93 percent (obtained from 74.1 + 18.9 percent) had some skills necessary for e-learning, even though most schools had inadequate e-learning facilities. Findings of this study are concur with those of Ouma et al (2013), who observed that there were very low computer skills among teachers. Karanja (2011) earlier identified key obstacles to ICT use in Kenya as inadequate number of computers, teachers' computer literacy as well as inadequate e-content for instruction. Song, Lee, Jang and Ahn (2001) observed that for efficient implementation of e-learning in schools, teachers should be comfortable with use of ICT facilities. This is because the actual quality of lessons is dependent

on the teachers' skills. Teachers who are more confident with the use of computers are more likely to embrace e-learning as compared to those who are not.

4.5 Level of Integration of E-Learning in Public Secondary Schools

The third objective sought to determine the extent of integration of e-learning in teaching in public secondary schools in Taita Taveta County. Table 9 shows the distribution of the responses.

Table 9

Integration of E-Learning in Secondary Schools

E-learning facility	**Responses (percent)**		
n=201	**Often**	**Sometimes**	**Never**
Uses a word processor to prepare lesson plan, scheme of work, notes, learning activities, exams	27.9	37.8	34.3
Uses printers/scanners/photocopiers to produce learning materials for my class	26.4	40.3	33.3
Uses spreadsheets to produce a time table, attendance records, analysis exam results etc	21.9	39.8	38.3
Sources teaching and learning materials from the Internet	19.4	47.3	33.3
Produces notes, handouts using a desk top publisher	18.9	38.8	42.3
Uses digital cameras to produce learning materials	16.0	26.8	57.2
Uses a database applications to keep records, manage data	13.4	41.8	44.8
Creates images, diagrams drawings using a graphics software	13.0	34.3	52.7
Uses DVD recorders/players during my lessons	10.0	39.3	50.7
Uses materials from CD-ROM, DVDs, video tapes during my lessons	9.5	39.3	51.2
Exchanges teaching materials with my colleagues using the Email	9.0	41.3	49.8
Uses presentation software (PowerPoint) during lessons	9.0	37.3	53.7
Uses computerised tutorials during my lessons	8.5	39.3	52.2
Creates web pages with learning materials for students	7.9	24.9	67.2
Uses programmes for creating multimedia to produce interactive content for my lessons	6.5	38.3	55.2
Uses simulation programmes during lessons	6.5	28.3	65.2
Uses drill and practice programmes in class	5.0	29.3	65.7

Table 9 indicates that the sampled teachers varied in their rating of the various aspects of integration of e-learning in teaching in secondary schools. Majority of the teachers did not use e-learning often. The most integrated facility was the word processor to prepare lesson plans, schemes of work, notes, learning activities and analyse exams, at a relatively low percentage of 27.9% followed by use printers/scanners/photocopiers to produce learning materials for classes (26.4 percent). The least integrated facilities were Use of drill and practice programmes in class (5 percent), Use of simulation programmes during lessons (6.5 percent), use programmes for creating multimedia to produce interactive content for my lessons (6.5 percent), Creating web pages with learning materials for students (7.9 percent), and use computerised tutorials during my lessons (8.5 percent). These findings agree with those of Aderonke (2014) who reported low level of teachers' use of digital tools and resources for instruction. These findings also concur with those of Wims and Lawler (2007) who found that less than 50% of the teachers had never used the internet and less than 30% had email addresses. This implies that less than 30% of teachers had used emails for communication. Email is a useful tool for distance learning and can allow teachers to send assignments to learners even during school holidays when students are at home. Low use of emails implies that very few teachers can send assignments to learners online. This is an indicator of low e-readiness. Brdicka (2003) observed that for e-learning to be successful, teachers must have a certain level of competence in use of ICT facilities.

It is, however, important to note that there was some integration of e-learning in classroom teaching using all facilities under this study, albeit at a low percentage. Teachers reported integration in use of printers/scanners/photocopiers to produce learning materials with 26.4 percent reporting that they often used these facilities while 40.3 percent indicated that they used the facilities sometimes. This gives a combined total of 66.7 percent integration. A high percentage of teachers also reported high integration of sourcing teaching and learning materials from the Internet with 19.4 percent indicating that they did it frequently while 47.3 percent sometimes sourced teaching and learning materials from the internet. Teachers also showed a high degree of use of a word processor to prepare lesson plans, schemes of work, notes, learning activities and exams. 27.9 percent of them revealed that they often used word processors and 37.8 percent indicated that they used it sometimes giving a combined total of 65.7percent. Use of spreadsheets to produce time tables, student attendance records, analysis exam results was also reported to be highly integrated with 21.9 percent of teachers saying that they often used

spreadsheets while 39.8 indicated that they used it sometimes. This gave 61.7 percent integration of spreadsheets by teachers in the instructional process. Only three facilities had a low percentage of teachers who had integrated them classroom teaching. These were creation of web pages with learning materials for students, at 32.8 percent, use of drill and practice programmes in class, at 34.3 percent and use of simulation programmes during lessons at 34.8 percent. These percentages are an indication that they were actually integrated in classroom instruction process except that the frequency was relatively low.

However, the fact that the use of PowerPoint presentation in actual classroom delivery rated relatively low at 46.3 percent in integration, suggests very limited use of the facility. This is because PowerPoint is one of the most common software used to present information to an audience such as a class. Further, oral interviews also revealed that typing and printing of notes and exams was commonly carried out by school typists while preparation of the timetables as well as exam analysis was done by the academic master in most schools. On the overall, the teachers had low integration of e-learning in teaching in schools. This could be attributed to the fact that the teachers had inadequate skills for integration of e-learning. Principals had also reported low adequacy of e-learning facilities.

The overall level of integration of e-learning in teaching in schools was determined by the interaction and cumulative aggregate of all the ratings of all the aspects of integration of e-learning. Thus, the ratings of each aspect of integration of e-learning were scored on a scale of 1, indicating never, to 3, indicating often. The individual aspect scores were summed up to form an integration index score for each respondent. The index score varied between 17, indicating no integrations, and 51, indicating that integration was often. The higher the score, the higher was the level of integration of e-learning in teaching in schools among the respondent teachers, and vice versa. The index score was then presented in three ordinal categories in order to differentiate between the levels of integration of e-learning among the respondent teachers. This included a score of 17 (no integration), 18-35 (sometimes) and 36-51 (often or regular integration). Table 9 depicts the overall level of integration of e-learning in teaching in the sampled schools.

Table 10

Overall Integration of E-Learning in Teaching in Schools

Level	*Frequency*	*Percent*
Never	32	15.9
Sometimes	140	69.7
Often	27	14.4
Total	201	100.0

Table 10 indicates that on the overall, 69.7 percent of the respondent teachers had sometimes integrated e-learning in teaching and 14.4 percent had often integrated e-learning in teaching. This implies that 84.1 percent of teachers integrated e-learning in teaching in one way or the other. Only 15.9 percent had never integrated e-learning in teaching. This suggests that there is great potential for integration of e-learning in schools if the facilities and the skills could be upgraded. The 33 Principals and 201 teachers were also asked about the main challenges that they faced in integrating e-learning in their schools. They unanimously reported that they lacked adequate training in ICT while schools lacked basic infrastructure and e-learning facilities. There were no funds set aside for acquisition of e-learning facilities. They noted that the teachers expected to use e-learning methods were not adequately trained to do so. In addition, some of the schools located in the interior areas of the region had no basic infrastructure such as electricity. There was lack of qualified teachers to teach using ICTs in schools as well. They noted that demand by the teachers for training in use of ICTs in teaching had been tremendous and the number of teachers who were trained to teach ICT cannot meet the demand. There were more teachers willing to be taught computing skills than there were competent instructors to teach them. These findings are in agreement with those of UNESCO (2014) whose report revealed that less than 5% of teachers in developing countries had skills for integration of e-learning in schools. With teachers who lack skills, integration of e-learning may take long to achieve.

4.6 School Category and Adequacy of E-Learning Facilities

The fourth objective of this study sought to establish whether there was any significant difference in the adequacy of e-learning facilities between County and Sub-County secondary

schools in Taita Taveta County. This objective was adopted because County schools, initially called provincial schools were established through government funding and there is a belief that they were more endowed with resources than Sub-County schools, initially referred to as district schools (harambee schools) which were mostly established through community initiative. This may have brought about disparities in resource endowment between the two categories of schools. Such disparities could limit availability of e-learning facilities in the less endowed schools. Respondents were presented with 12 items which measured adequacy of facilities in both County and Sub-County schools. They were asked to react to a five-point likert scale to the given statements. Scores ranged from 1 = unavailable to 5 = very adequate. Their responses were then summed together to give an adequacy index score for each item in each category of schools. The score for each item ranged from 11 to 55 for County schools and from 22 to 110 for Sub-County schools. The scores were then used to compute the mean adequacy score and standard deviation for each category of schools. Table 11 presents the results on adequacy of e-learning facilities in the two categories of schools.

Table 11

Adequacy Index of E-learning Facilities By School Category

Facilities	County Schools n=11	Sub – County Schools n = 22
Computer rooms/Laboratories for e-learning facilities	23	35
Power (mains, generator, solar)	44	77
Furniture (desks, chairs, tables) for the facilities	27	37
Computers (desktops and laptops)	22	40
Projectors (LCD)	20	31
Word processing software (MS Word)	22	38
Spreadsheet applications (MS Excel)	22	38
Database software(MS Access)	22	38
Presentation software (PowerPoint)	22	38
Instructional multimedia material (CD-ROMs, DVDs, video tapes)	22	32
Computerised tutorials	12	22
Internet Connectivity	22	39
Laboratory Technicians/Support Staff	25	53
Mean Adequacy score	27.73	23.59
Standard Deviation	2.796	6.515

Table 11 indicates that County Schools had a higher mean adequacy index (at 27.73) as compared to Sub-County Schools which had a mean adequacy index of 23.59. These findings suggested that County Schools were more endowed with e-learning facilities than Sub-County Schools in Taita Taveta County. In terms of e-readiness, County schools seemed to be more

prepared to implement e-learning as compared to Sub-County schools. These findings agreed with those of PricewaterhouseCoopers LLP (2004) who found differences in ICT establishment and access to ICT facilities by teachers in different categories of schools in Britain. Schools with more ICT facilities have a higher e-readiness than those with less ICT facilities. More equipped schools are in a better position to integrate e-learning in instructional process. This is because teachers who have skills for integration of e-learning can take advantage of presence of prerequisite facilities to integrate e-learning in the classroom.

4.6.1 Results of the Null Hypothesis

The hypothesis of this study was that there was no statistically significant difference in the adequacy of e-learning facilities between Sub-County and County secondary schools in Taita Taveta County. To test this hypothesis, the means of adequacy of e-learning facilities in the two categories of schools, County and Sub-County, were compared using an Independent Samples T-Test. Table 12 summarizes the output of the t-test.

Table 12

T-test Results of Adequacy of E-Learning Facilities by School Category

School category	*n*	*Mean*	*Std. Deviation*	*t-value*	*df*	*Sig. (2-tailed)*
County	11	27.73	2.796	2.003	31	0.054
Sub-County	22	23.59	6.515			

Table 12 indicates that the sampled County schools recorded a higher adequacy of e-learning facilities with a mean score of 27.73 compared to mean score of 23.59 reported for the Sub-County schools. The calculated t-value was 2.003 with a p- value of 0.054. Since the calculated t-value (2.003) was higher than the critical value (1.96) and that the calculated p-value (0.054) was also higher than the significance level of 0.05, the findings led to acceptance of the null hypothesis. This means that there was statistically no significant difference in adequacy of e-

learning facilities between Sub-County and County secondary schools. This suggested that, in spite of the common belief, public County secondary schools did not have more e-learning facilities than Sub-County ones. In terms of e-readiness, County schools did not have any advantage with respect to the pre-requisite e-learning facilities over Sub-County schools. Results reported in this analysis disagreed with those of PricewaterhouseCoopers LLP (2004) who found differences in ICT establishment and access to ICT facilities by teachers in different categories of schools in Britain. This could be attributed to the fact that there is no legal framework requiring schools in Kenya to integrate e-learning in instructional process. County schools, therefore, lack motivation to invest in e-learning, in spite of the perceived higher resource endowment. Results obtained using Independent Sample T-Test were also corroborated by chi-square test using cross tabulation. Table 13 shows a cross tabulation of adequacy of e-learning facilities by school category.

Table 13

Chi Square Results of Adequacy of E-Learning Facilities by School Category

			School Category		
			County	Sub-County	*Total*
Adequacy	No Facilities	Count	0	2	2
		percent	0.0	9.1	6.1
	Inadequate	Count	11	20	31
		percent	100	90.9	93.9
	Adequate	Count	0	0	0
		percent	0.0	0.0	0.0
Total		Count	11	22	33
		Percent	33.3	66.7	100
$\chi^2 = 3.667$		df = 1	$p = 0.056$		

Table 13 reveals that all the County secondary schools had inadequate e-learning facilities, while 90.9 percent of the Sub-County schools had inadequate e-learning facilities. All remaining Sub-

County schools had no e-learning facilities at all. This was further supported by the chi-square value, since p (0.056) > 0.05 significance level indicating that there was no significant difference in adequacy of e-learning facilities between County and Sub-County schools.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary of the findings, conclusions and recommendations of the study and suggestions for further research.

5.2 Summary of the Findings

The study reported in here sought to assess e-readiness for integration of e-learning in secondary schools in Taita Taveta County, Kenya. A summary of the findings based on the objectives and hypothesis of the study are presented in the sections that follow.

5.2.1 Adequacy of E-learning Facilities

Based on this objective, it was found out that majority of the schools lacked facilities needed for integration of e-learning pedagogy. For instance, all surveyed schools reported that they lacked adequate computer rooms, computers and computer software such as word processors, spreadsheets and presentation softwares. It was also found that only 15.2% of the schools had adequate internet connectivity. These findings revealed a very low level of e-readiness for e-learning with respect to adequacy of e-learning facilities in the County. This is because computers, computer software and the internet are key facilities needed for e-learning to be successful.

5.2.2 Teachers' Level of Skills in Use of E-learning Facilities

Based on this objective, the study found that majority of the teachers lacked adequate skills to use e-learning facilities in teaching. Very low percentages were reported for adequacy of skills in use of key e-learning competencies like use of presentation software, drill and practice programmes, computerised tutorials, word processing and use of the internet. This is critical given that most e-learning programmes rely heavily on use of computer technology and the internet.

5.2.3 Level of Integration of E-learning in Teaching

Based on this objective, the study findings revealed that very few teachers integrated e-learning in teaching-learning process on a regular basis. Less than 30% of teachers reported that they used various e-learning approaches in class on a regular basis. This implies that more than 70% of teachers never used e-learning regularly with a very high proportion of them reporting that they have actually never used it at all. This was probably due to lack of facilities and skills for integration of e-learning in classroom activities.

5.2.4 The Difference in the Adequacy of E-learning Facilities Between Sub-County and County Secondary Schools

On whether there was a statistically significant difference in adequacy of e-learning facilities between Sub-County and County secondary schools, the study found that there was no statistically significant difference in adequacy of e-learning facilities between Sub-County and County secondary schools. The t-value obtained (2.003) was higher than the critical t-value (1.96). This led to acceptance of the null hypothesis that stated that, there was no statistically significant difference in the adequacy of e-learning facilities between Sub-County and County secondary schools in Taita Taveta County as indicated by the independent samples t-test.

5.3 Conclusions

From the study findings, it can be concluded that schools in Taita Taveta County were least prepared to implement e-learning. Majority of the schools lacked many facilities such as computers and related accessories, accessibility to the internet and e-content as well as buildings for the same. This led to a conclusion that lack of facilities would hindered implementation of e-learning programme in secondary schools by teachers who may have hard skills for the same.

Further, majority of the teachers lacked the necessary skills and knowledge to use and integrate e-learning in the teaching-learning process. They were, therefore, not integrating it in the instructional process. This led to a conclusion that even if e-learning facilities were availed, majority of teachers would still not be able to implement the programme due to their limited skills.

On integration of e-learning by teachers in the classroom, it was established that very few teachers were practising it. This led to a conclusion that teachers in Taita Taveta county were not

ready for integration of e-learning in secondary schools. This may have been due to inadequate facilities and lack of appropriate skills.

Despite the perception that County Schools are more endowed with resources than Sub-County ones, the study found that there was no statistically significant difference in resource endowment between the two categories of schools. The findings led to a conclusion that there is no motivation for schools to acquire e-learning facilities, neither is there any motivation for implementation of the programme. This could be attributed to absence of a clear cut policy directive requiring implementation of e-learning in schools. Therefore, the assumption that County schools could be more endowed with e-learning resources is inaccurate on the basis of this study.

5.4 Recommendations

In view of the above conclusions, this study makes the following recommendations for e-learning to take root in secondary schools in the study area:

i) Given that public schools are owned by the government, it should provide the requisite e-learning facilities to enable e-learning to succeed in secondary schools in the area. Individual schools should also look for donors and hold fundraising events to raise money to equip the schools with e-learning facilities.

ii) The government should ensure that all Teachers Training Colleges and Universities reform their curricular to include a mandatory course on integration of e-learning in content delivery for all teacher trainees. Such training will equip teachers with the necessary skills integration of e-learning in schools once they graduate from the colleges and universities.

iii) The government should introduce mandatory in-service teacher training for all serving teachers to equip them with skills in integration of e-learning in curriculum implementation in schools.

iv) The government should also come up with policy framework on e-learning to motivate all teachers in all public secondary schools to use e-learning in classrooms for delivery of content to learners. With such a kind of policy in place, it will be mandatory for all teachers to integrate e-learning in the instructional process.

v) The government should facilitate schools to set up networks for sharing e-content so as to alleviate the problem of shortage of such facilities among less endowed schools.
vi) The government should also ensure that all secondary schools are provided with electricity to provide power for the computers in schools.

5.4.1 Suggestions for Further Research

The subject of e-learning is still new in secondary schools in the country. It has therefore attracted limited research attention in the country. However, even the available studies have often tended to be too general and do not take into consideration less developed regions of the country such as the study area which lacked most of the basic infrastructure. This study therefore suggests the following areas for further research:

i) A similar study should be carried out in other areas of the country to find out the e-learning situation in secondary schools.
ii) In addition to replicating this study, future research should evaluate intervention mechanisms that schools have put in place to address the problems of lack of e-learning facilities and low skills among teachers.
iii) A comparative study could also be conducted to evaluate the e-readiness for e-learning in public and private secondary schools in the country.

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APPENDICES

APPENDIX A: HEAD TEACHERS QUESTIONNAIRE (HTQ)

Dear Principal,

I am a student at Egerton University currently conducting a research titled *E-readiness for Integration of E-learning in Public Secondary Schools in Taita Taveta County, Kenya* as part of the course work. The purpose of this questionnaire is to gather information on availability of e-learning facilities in your school. The information you provide will be treated confidentially and will only be used for research purposes only. Please do not write your name or that of the school on this questionnaire.

Patrick T. Mukhwaya

Instructions: Give your response by providing an answer in the space provided/placing a tick in the appropriate cell

Part 1: Bio-data

1. School Category: County Secondary [ ] Sub-County Secondary [ ]
2. Duration in years as Principal of the school: ……..

Part II : Availability of E-Learning facilities in the school

Rate the availability of e-learning facilities listed below (for instructional purposes only) in your school using the given scale.

Serial No	E-Learning facility	Availability				
		Unavailable	Very Inadequate	Inadequate	Adequate	Very Adequate
1	Computer rooms/Laboratories for e-learning facilities					

2	Power (mains, generator, solar)					
3	Furniture (desks, chairs, tables) for the facilities					
4	Computers (desktops and laptops)					
5	Projectors (LCD)					
6	Word processing software (MS Word)					
7	Spreadsheet applications (MS Excel)					
8	Database software(MS Access, MySQL)					
9	Presentation software (PowerPoint)					
10	Instructional multimedia material (CD-ROMs, DVDs, video tapes)					
11	Computerised tutorials					
12	Internet/e:mail services					

THANK YOU FOR YOUR ASSISTANCE

APPENDIX B: TEACHERS QUESTIONNAIRE

Dear Teacher,

I am a student at Egerton University currently conducting a research titled E-*readiness for Integration of E-learning in Public Secondary Schools in Taita Taveta County, Kenya* as part of the course work. The purpose of this questionnaire is to gather information on your skills in use of E-Learning facilities for instructional purposes and current level of e-learning integration in your school. The information you provide will be treated confidentially and will only be used for research purposes only. There is no need to write your name on this questionnaire.

Patrick T. Mukhwaya

Instructions: Give your response by providing an answer in the space provided/placing a tick in the appropriate cell

Part 1: Bio-data

1. School Category: County Secondary [ ] Sub-CountySecondary [ ]

2. Duration in years as teacher in current school: ……..

Part II: Skills in usage of e-learning facilities

The items in the table given below relate to your expertise in use of e- learning facilities. Please rate your ability to use the facilities using the given scale.

***Scale**:* Very Adequate, Adequate, Inadequate, Very Inadequate, No Skills

No	E-Learning facility	Level of skill				
		No Skills	Very InAdequate	Inadequate	Adequate	Very Adequate
1	Word processing					
2	Spreadsheets					
3	Database applications					
4	Graphics software					
5	Desk top publishing					

6	Presentation software					
7	Use of programmes for creating interactive multimedia					
8	Reproduction (Printing/scanning/photocopying)					
9	Digital cameras					
10	DVD recorders/players					
11	Simulation programmes					
12	Drill and practice programmes					
13	Computerised tutorials					
14	Internet					
15	Email					

Part III: Current level of integration of e-learning for instruction purposes in the school

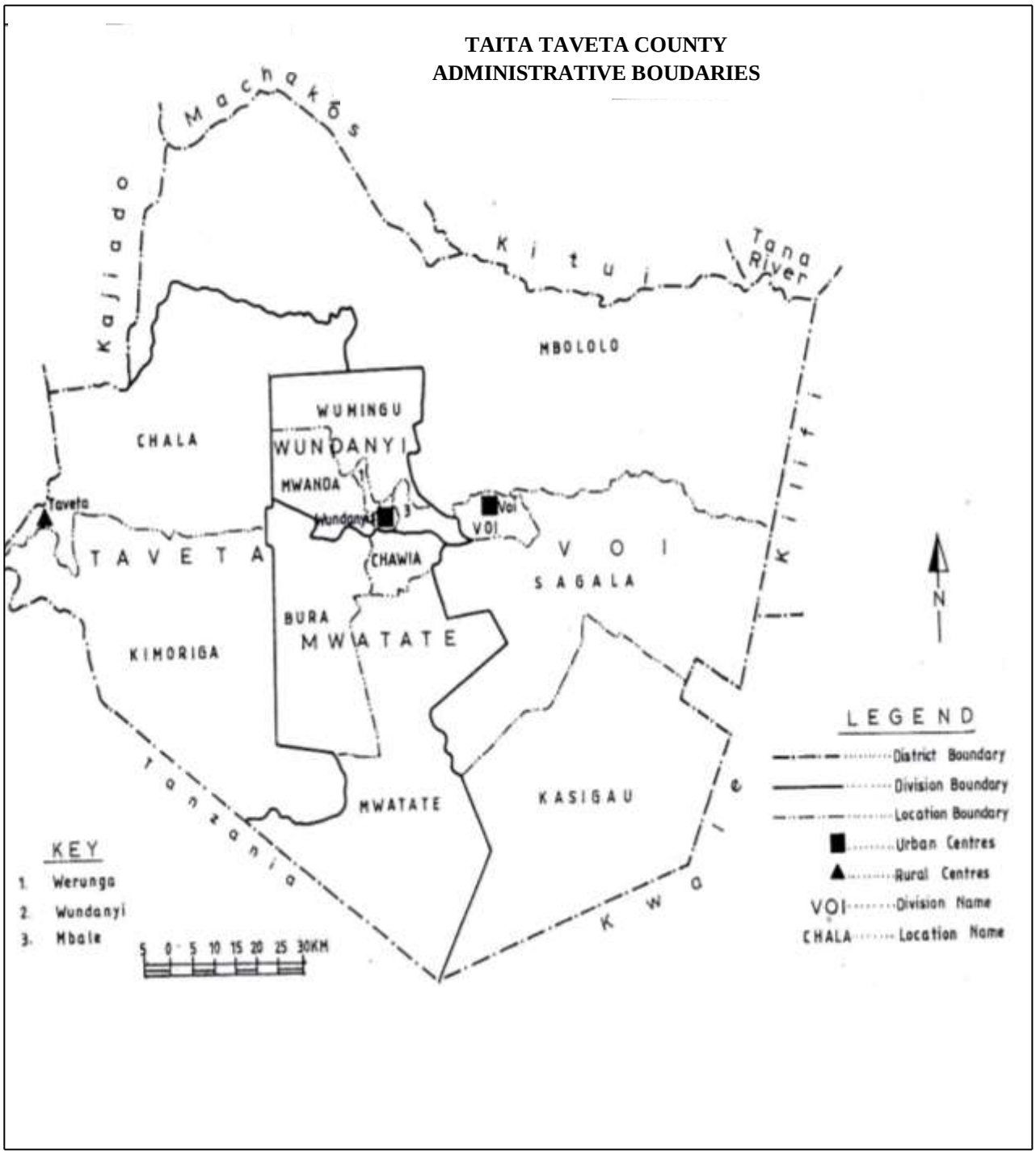
The items below are about the frequency of use of e- learning facilities for instructional purposes in your school. Please indicate your frequency of usage of the facilities using the given scale.

No	E-Learning facility	Frequency of use				
		Never	Rarely	Sometimes	Often	Always
1	Use a word processor to prepare lesson plan, scheme of work, notes, learning activites, exams					
2	Use spreadsheets to produce a time table, attendance records, analysis exam results etc					
3	Use a database applications to keep records, manage data					
4	Create images, diagrams drawings using a graphics software					

5	Produce notes, handouts using a desk top publisher					
6	Using presentation software (powerpoint) during lessons					
7	Use programmes for creating multimedia to produce interactive content for my lessons					
8	Use printers/scanners/photocopiers to produce learning materials for my class					
9	Use digital cameras to produce learning materials					
10	Use DVD recorders/players during my lessons					
11	Use of simulation programmes during lessons					
12	Use of drill and practice programmes in class					
13	Use computerised tutorials during my lessons					
14	Source teaching and learning materials from the Internet					
15	Exchange teaching materials with my colleagues using the Email					
16	Create web pages with learning materials for students					
17	Use materials from CD-ROM, DVDs, video tapes during my lessons					

THANK YOU FOR YOUR CO-OPERATION

APPENDIX C: MAP OF TAITA TAVETA COUNTY



APPENDIX D: REQUEST FOR RESEARCH PERMIT LETTER

EGERTON UNIVERSITY
Tel: Pilot: 254-51-2217620
254-51-2217877
254-51-2217631
Dir line/Fax: 254-51-2217847
Cell Phone

P.O. Box 536 - 20115
Egerton, Njoro, Kenya
Email: bpgs@egerton.ac.ke
www.egerton.ac.ke

OFFICE OF THE DIRECTOR GRADUATE SCHOOL

Ref: EM15/1969/07

Date: 5th Sept., 2012

The Secretary,
National Council of Science and Technology,
P. O. Box 30623-00100,
NAIROBI.

Dear Sir,

RE: REQUEST FOR RESEARCH PERMIT – PATRICK TOWET MUKHWAYA REG. NO. EM15/1969/07

This is to introduce and confirm to you that the above named student is in the Department of Curriculum, Instruction and Educational Management, Faculty of Education and Community Studies, Egerton University.

He is a bona fide registered M.Ed. student in this University. His research topic is entitled **"E-Readiness for Integration of E-Learning in Public Secondary Schools in Taita District, Kenya."**.

He is at the stage of collecting field data. Please issue him with a research permit to enable him undertake the studies.

We have enclosed all the **necessary documentation** required and a Bankers Cheque No. **161585** for your necessary action.

Yours faithfully,

BOARD OF POST GRADUATE STUDIES
05 SEP 2012
EGERTON UNIVERSITY P. O. Box 536, EGERTON

Prof. M.A. Okiror
DIRECTOR, BOARD OF POSTGRADUATE STUDIES

MAO/vk

APPENDIX E: RESEARCH AUTHORISATION LETTER

REPUBLIC OF KENYA

NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY

Telephone: 254-020-2213471,2241349
254-020-310571,2213123, 2219420
Fax: 254-020-318245,318249
when replying please quote
secretary@ncst.go.ke

P.O. Box 30623-00100
NAIROBI-KENYA
Website: www.ncst.go.ke

Our Ref:
NCST/RCD/13/012/64

Date:
5th October 2012

Patrick Towet Mukhwaya
Egerton University
P.O.Box 536-20115
Egerton.

RE: RESEARCH AUTHORIZATION

Following your application for authority dated *7th September, 2012* to carry out research on ***"E- readiness for integration of e-Learning in public secondary schools in Taita District, Kenya ,"*** I am pleased to inform you that you have been authorized to undertake research in **Mwatate District** for a period ending **31st December, *2013*.**

You are advised to report to **the District Commissioner and the District Education Officer, Mwatate District** before embarking on the research project.

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

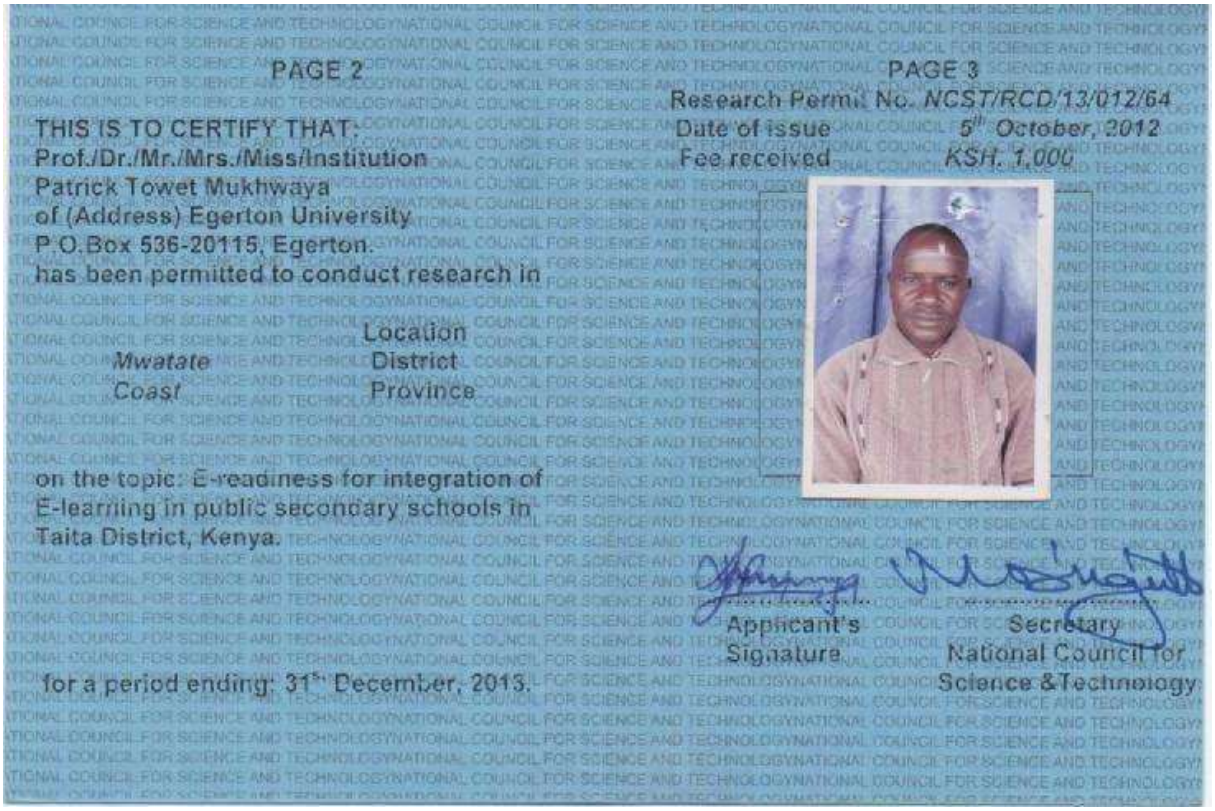
DR M.K. RUGUTT, PhD, HSC
DEPUTY COUNCIL SECRETARY

Copy to:

The District Commissioner
The District Education Officer
Mwatate District.

"The National Council for Science and Technology is Committed to the Promotion of Science and Technology for National Development".

APPENDIX F: RESEARCH PERMIT



PAGE 2

THIS IS TO CERTIFY THAT:
Prof./Dr./Mr./Mrs./Miss/Institution
Patrick Towet Mukhwaya
of (Address) Egerton University
P.O.Box 536-20115, Egerton.
has been permitted to conduct research in

Location *Mwatate*
District *Coast*
Province

on the topic: E-readiness for integration of E-learning in public secondary schools in Taita District, Kenya.

for a period ending: 31st December, 2013.

Applicant's Signature

Secretary
National Council for Science &Technology

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Research Permit No. *NCST/RCD/13/012/64*
Date of issue *5th October, 2012*
Fee received *KSH. 1,000*

APPENDIX G: INTRODUCTORY LETTER TO SCHOOL HEAD TEACHERS

Patrick Towet Mukhwaya,

C/O Moi High School – Kasigau,

P. O. Private Bag – 80300,

Voi.

Date .....

The Principal,

..... High School

P. O. Box .....

Through,

The DEO

..... District.

Dear Sir/Madam,

REQUEST FOR PERMISSION TO CARRY OUT RESEARCH IN YOUR SCHOOL

I am a student at Egerton University and has been permitted by the National Council For Science and Technology to conduct a research titled *E-readiness for Integration of E-learning in Public Secondary Schools in Taita Taveta County, Kenya* as part of the course work. The aim of this letter is to request your office to kindly allow me to carry out the exercise in your school on .....

or any other day of your convenience. For the purpose of this exercise, I would wish to engage with you or your nominee and the teachers.

Your assistance shall be highly appreciated.

Thank you.

Yours faithfully,

Patrick Towet Mukhwaya

APPENDIX H: AWARD FOR POSTGRADUATE RESEARCH FUNDS LETTER

EGERTON UNIVERSITY
Tel: Pilot: 254-51-2217620
254-51-2217877
254-51-2217631
Dir.line/Fax: 254-51-2217847
P.O. Box 536 - 20115
Egerton, Njoro, Kenya
Email: eugradschool@wananchi.com
www.egerton.ac.ke

OFFICE OF THE DIRECTOR GRADUATE SCHOOL

Ref:.....EM15/1969/07..... Date:.....30th June, 2009.....

Mr. Patrick T. Mukhwaya,
Egerton University,
Department of C.I. & Ed.Mgt.,

Thro'
COD, C.I. & Ed.Mgt.

Thro'
Dean, Fedcos

Dear Mr. Mukhwaya,

RE: AWARD FOR POSTGRADUATE RESEARCH FUNDS

I am pleased to inform you that at a Board of Postgraduate Meeting held on 10th June, 2009, you were awarded Kes.200,000.00 (Kenya Shillings Two Hundred Thousand only) to assist you in your Masters Research Programme.

Please arrange to apply for the funds immediately form DVC(R&E). Your request should pass through your major supervisor, through your COD, through Dean of your Faculty and through the Director Graduate School.

Congratulations for winning the award and I wish you success in your research.

Thank you.

Yours sincerely,

Prof. Robert K. Obura, PhD
DIRECTOR, BOARD OF POSTGRADUATE STUDIES

c.c. VC }
DVC (A&F) } – To see in file
DVC (AA) }
DVC (R&E) - note for action
Director (R&E)

RKO/qma