FACTORS INFLUENCING ICT ADOPTION AMONG PUBLIC SECONDARY SCHOOL TEACHERS: A CASE OF WEBUYE SUB-COUNTY, BUNGOMA COUNTY, KENYA

BY

SHIHUNDU LORNA NYAKOWA

A RESEARCH REPORT SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF A MASTER OF ARTS DEGREE IN PROJECT PLANNING AND MANAGEMENT OF THE UNIVERSITY OF NAIROBI

2014

DECLARATION

This is my original work and has not been presented to any of the study programme in any University.

…………………………….. …………………………………..
Lorna Nyakowa Shihundu   Date
L50/73148/12

This research project has been submitted to me for examination as the University Supervisor

…………………………….. …………………………………..
Dr. Luketero   Date
Lecturer- senior lecturer,
University Of Nairobi

DEDICATION

This research report is dedicated to my husband Mr. Hastings Aseka Ombuya for his support both morally and monetary.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

CD   Compact Disc

CD-i   Compact Disc Interactive

CD-ROM   Compact Disc Read Only Memory

CPU   Central Processing Unit

DVD   Digital Versatile Disc

ICT   Information Communication Technology

IRC   Internet Relay Chat

ITV   Interactive Television

PC   Personal Computer

Telcos   Telecommunication Companies

TV   Television

HDTV   High Definition Television

WWW   World Wide Web

MDG   Millennium Development Goals

IICD   International Institute for Communication and Development

TOJET   Turkish Online Journal of Educational Technology

ABSTRACT

Educational attainment is recognized as one of the fundamental indicators of development of a nation. The present world cannot think of development of a country without Technical Education and Training. Yet, there is lack of information on several aspects of the use of ICT among teachers. The purpose of this study was to determine the accessibility, utilization and preparedness in using ICT among public secondary school teachers in Webuye Sub-county, Bungoma County. Specifically the study objectives were; to determine the teachers' perception in using ICT, determine the levels of ICT access of teachers examine the levels of preparedness of the teachers in using ICT; and establish effects of teachers' academic background in using ICT in public secondary schools in Webuye Division, Bungoma County. The study employed as correlational research design. Random, simple and purposive sampling techniques were used to obtain 100 teachers in secondary school and 25 principals. Other key informants were 5 Ministry of education officials from the five divisions of the study area. Data was collected using questionnaires administered using random and simple techniques to the teachers and interview schedules to the principals and education officers. The questionnaire return rate was 90.77% which was sufficient for generalization of the study findings. Collected data was organized, coded and analyzed using Statistical Package for Social Sciences (SPSS 17.5) and presented in frequency and percentage tables. The findings revealed that for ICT to be effective adopted in public secondary schools, more emphasis should put in developing the competence of teachers. Teachers' perception in terms of using ICT were found to be positive but hampered by other aspects such as unavailability of adequate equipment. The study recommends that teachers' ICT development should be stepped up with corresponding supply of necessary equipment and training. Further continuous and consistent technical assistance should always be available for the teachers whenever required. These study findings will be useful in helping bridge the gap between ICT policies and their implementation in leaning processes, especially in secondary schools. Recommendation of this study will be used to improve level of adoption of ICT in learning and hence promote the adoption of ICT in the entire teaching/leaning processes. The Ministry of education is to adopt ICT training in schools in order to improve the academic background of teachers' performance in ICT so that they prepare learners and staff of Kenyas economy, and meet the nations millennium goals, vision 2030. According to (MOE sessional paper No. 1 2005)

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

The desire of countries to be globally competitive, grow economically and improve their social conditions has created a renewed interest for increased investments in educational improvements and enhanced application of ICT in learning institutions. The ability to use digital technology, communication tools, and/or networks appropriately to solve information problems in order to function in an information society is currently well recognized as the key pillar of Information and Communication Technology (ICT) (Harrison, Rainer and Hochwarter, (2009). Thus globally, ICT knowledge has been viewed to fundamentally affect the way humans do their work, learn and even develop their economies (Geogia, 2011). Over the last decade, there has been exponential growth in the use of ICT, which has made impacts both on the society and on people's lives (Yuen, Law and Wong, 2012). It is therefore not surprising to note that increasing attentions are being put into the use of ICT in education all over the world (Yuen *et al*., 2003). Generally, three objectives are distinguished for the use of ICT in education (Plomp, ten Brummelhuis, and Rapmund, 1996): the use of ICT as object of study, the use of ICT as aspect of a discipline or profession; and the use of ICT as medium for teaching and learning.

As ICT becomes ubiquitous and embedded in the modern society, they continue to offer the potential to restructure organizations, promote collaboration, increased participation by citizens in the country and make education more accessible to the larger population as well as foster cultural integration of people with different cultural backgrounds (Osimo, 2008; Ala-Mutka, 2008; Kozma, 2010). As Kozman (2009), opined, policy makers worldwide concur on the fact that education is among the public sector that affects and most affected by these developments ICT is also, it is clear that ICT is becoming increasingly recognized in schools. With numerous global advancements in ICT it is essential that educators have a thorough working knowledge of how ICT influence education sector. Effectively introducing technology into schools is also largely dependent upon the availability and accessibility of ICT resources (e.g. hardware, software and communications infrastructure).

The use of ICT in education sector is currently the lowest in Africa, and dire in Sub Saharan Africa (SSA), where it lag behinds most of the countries in the developed world. Attempts to assess the utilization of ICT in Africa have been hampered by insufficient empirical data to indicate any impact of ICT on sector productivity and lack of cross-country evidence. In some cases the evidence has been non-existent due to recent developments, the rapid revolution of ICTs and methodological challenges that include a deficiency of assessment variables and models of causality. Most of the studies undertaken have focused on information infrastructure issues, while few have been undertaken to measure the extent of ICTs in Africa, particularly in education (Kenya School Net, 2009). Clearly if technology cannot be accessed by the teacher, as in so many educational settings in SSA, then it will not be used.

Kenya has developed policies to guide the integration of ICT into economic, social and educational programmes. In Kenya, the first stakeholders driven ICT policy was approved by the cabinet in January 2006 and an ICT policy document published through the Kenya Government Gazette notice of number 24 in March 2006 (KIC, 2006). The main theme of this policy was to develop a "prosperous ICT driven society" that recognizes and puts ICT at the Centre of economic development. A summary of literature indicate that in Kenya schools, the process of integration of ICT has previously been painfully slow despite evidence that the situation has been improving in the last few years (Liverpool, 2009; Hennessy and Onguko, 2012). Schools are increasingly being equipped with computers for teaching, learning and administrative purposes, connectivity is improving and students are enthusiastic about using computers for learning, despite the lack of equipment available. Some countries are developing digital content for use across the curriculum. Nevertheless, access and usage of ICT, like the electricity supply itself, remain rather sporadic (David, Mbowa and Paul, 2003), which appears to contribute to the limitation and adoption of e-learning in the schools.

The concept e-learning simply means electronic learning. The use of e-learning in pedagogical spheres date back to 1993 when Graziadei (1993) demonstrated online computer-delivered lecture, tutorials and assessment project using, VAX notes conferencing and assorted software which allowed teaching and learning to take place in a virtual setting. The e-learning encompass the delivery of learning, training or educational programmes via electronic means using computer or other electronic devices such as CD-ROM or DVD to

provide training, educational or learning materials (Leach and Moon, 2010). It is multifaceted and embraces all form of electronic devices that are employed in teaching and learning situation to make learning easy (Hassana and Woodcock, 2010). The devices include computer and other audio-visual facilities. The most popularly used e-learning device is the computer. Computer can be used in teaching and learning in Computer Assisted Learning (CAL) and Computer Assisted Instruction (CAI), which covers different subjects and topics, teacher-made packages or improvised instructional packages.

Teacher education programmes in Kenya have struggled with selecting and implementing the most effective strategies on how to prepare pre- service teachers to integrate e-learning in their future lessons (Goktas, Yıldırım, and Yıldırım, 2008). Many programmes have attempted to develop teachers' e-learning skills through an introductory educational technology course (Polly, Mims, Shepherd, and Inan, 2010). By taking an ICT course, teachers are expected to transfer knowledge and skills to their future classrooms in using e-learning (Brush et al., 2003). However, the evidence suggests that teachers do not feel prepared to effectively use e-learning in their classrooms (e.g. Drent and Meelissen, 2008; Kay, 2006). These studies indicate the importance of teachers' understanding with regards to technology in education (Niess, 2005): teacher education should not only focus on how to use technology, but also how technology can be used for teaching and learning.

However, currently information on the adoption of e-learning in the learning institutions in Kenya is unknown especially in secondary schools of Kenya. It is on the above basis that this study sought to determine the adoption of ICT in public secondary schools using in Webuye Division, Bungoma County as a case in point.

1.2 Statement of the problem

The guideline for the effective implementation of the curriculum in the schools in Kenya potentate the use information and communication technology in instructing learners in schools. There is substantial evidence that, in the right hands and used appropriately for specific purposes in specific contexts, ICT can be an effective tool in supporting teaching and learning. However, it is now firmly established that its introduction into schools does not by itself improve the quality of education or raise attainment. Encouragingly, there is growing and widespread awareness that the pedagogical and technical expertise of the teacher is absolutely critical here. Governments in Kenya is emphasizing teacher

development as the key to effectively implementing policy and curricula, to using ICT to enhance teaching and learning, and to raising educational standards. However, a major impediment is the lack of qualified teachers. Indeed it has been observed by many that meeting the desperate need for more qualified, competent teachers is the most persistent and daunting challenge facing the African education system in general, and the integration of ICT in particular (Afe, 2002; Olakulehin, 2007).

The use of ICT has been tested to integrate many aspects that require deep thinking by the students because ICT envisage the realism of the subject under discussion among the students. Therefore if the factors causing lack of ICT usage persist then, the development of information and technology in the county will be biased. Looking at the rate at which ICT is being adopted in the business and social context, then there is renewed hope that ICT use in Kenya will result in rapid growth of the economy. However, adoption of ICT in learning institutions is currently not clearly understood. However, informal reports indicate that in many of the learning institutions, the adoption of ICT has not been satisfactory. This information has not been verified through research findings. Research by one of the key stakeholders in post-secondary education in Kenya, showed that career paths including Sciences, mathematics, Information and Technology continue to be poorly pursued by the institutions that shy away from adoption of ICT in learning (Nyamanga, 2009). None of the current research has been done in exploring the utilization and the factors affecting adoption of ICT in secondary school in Western Kenya. This therefore appears to affects the current hopes of achieving high adoption in ICT.

1.3 Purpose of the study

The purpose of this study was to investigate the factors influencing ICT adoption among public secondary school teachers in Webuye sub-county, Bungoma County in Kenya.

1.4 Specific objectives of the study

The specific objectives of the study were as follows:

1. To determine the teachers' perception in adopting ICT in public secondary schools in Webuye sub-county, Bungoma County.
2. To determine the levels of ICT access of teachers in adopting ICT in public secondary schools in Webuye sub-county, Bungoma County.

3. To examine the levels of preparedness of the teachers in adopting ICT in public secondary schools in Webuye sub-county, Bungoma County.
4. To determine effects of teachers academic background in adopting ICT in public secondary schools in Webuye sub-county, Bungoma County.

1.5 Research questions

1. What is the teachers' perception when adopting ICT in public secondary schools in Webuye sub-county, Bungoma County?
2. What is the level of ICT access to teachers in adopting ICT in public secondary schools in Webuye sub-county, Bungoma County?
3. What is the level of preparedness of the teachers in adopting ICT in public secondary schools in Webuye sub-county, Bungoma County?
4. How does the teachers' academic background affect their adoption of ICT in public secondary schools in Webuye sub-county, Bungoma County?

1.6 Significance of the study

The scholarly importance of this study rests on the fact that this study was to provide information to members of the scholastic community regarding a gap in knowledge on why low usage of ICT persists in secondary schools. This is important for helping to ensure that decision making in education means better practices and not practices that might violate children's rights and best interests.

The contribution of university research on ICTs to achievement of MDG's goals is of significance not only to schools in the sample but would have impact for further activities in the region. Such ICT studies targeting expanded access in secondary education, advanced life-long learning, improved quality of education and gender equality programmes in education are rare in the region and will not only provide collaboration among researchers on ICTs but also underline the contribution to achievement of MDG's 2015 goals. Also important, the project would promote capacity building in the secondary schools under study by encouraging academic entrepreneurship in the region if intended plan of action succeeds.

Overall, this knowledge of what is perceived to contribute to the persistence of lack of ICT usage and what is perceived to reduce lack of ICT usage provides practical and scholarly

educational leaders with a better knowledge base to improve their schools in combination with their own local educational strategies.

1.7 Limitation of the study

The sample used for this study posed a limitation in the ability to generalize the findings of this study to all schools although it was the initial intentions to make generalizations. Different work settings and differences in how schools are managed in Kenya and the differences in the geographical regions may further limit the ability to generalize the findings of this study to the larger populations of schools.

1.8 Delimitation of the study

Scope of the study was limited geographically to secondary schools within Webuye sub-county in Bungoma County. The study targeted secondary school teachers, school principals and zonal educational officers. Content of this study was limited to use of e-learning in the secondary schools. Time of this study was limited to four months.

1.9 Assumptions of the study

The study was based on the following assumptions; all factors not included in the study remain constant, all the respondents will give honest and sincere answers and the data collected will be accurately recorded and analyzed and the sample chosen was a representative of the total population.

1.10 Definition of significant terms

Connectivity   The ability to link to the Internet via a computer

ICT   Information and communication technologies. The technology and tools used to transfer information and speed up communication processes.

Broadband   A type of data transmission in which a single medium (such as fibre optic wire) can carry several channels at once.

Portal   A website or service that provides access to a wide range of services which can be either local or remote, structure or unstructured. The user stays inside the portal interface, which provides access to remote websites on the user's behalf.

Value Chain   A value chain is a string of diverse companies working together to create or satisfy market demand for a particular product or a bundle of products

Web-enabled   Business systems that are supported by Internet technologies

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

This chapter contains the review of literature and provides readers with a brief review of the history and general issues of adoption of ICT learning institutions in education within the society, including: the global and historical context of ICT adoption, a summary of the last three decades and an educational perspective, lack of ICT usage in computer knowledge as experienced by students, literature on challenges to adoption of ICT and conclusion to the review of literature.

The methodology used for this literature review was to systematically search internet resources, abstracts and databases including ERIC, British Library Direct, Academic Search Elite, Libris, Questia and High Beam and journal sources such as Emerald, Sage, Science Direct, Intuit and Open DOAR. General search engines (Google Scholar, etc.) were used to find 'grey' materials. Searches were also made of relevant websites, online reports and dissertations from Europe and worldwide.

2.2 Information and Communication Technology (ICT)

There is no firm agreement on the definition of ICT, as these technologies evolve almost daily. Here it is assumed that ICT includes, but is not limited to, personal computers, laptops, printers, LCD projectors, palm devices, iPods, fax machines, cell phones, Internet, and Intranet. This includes the ability to use technology as a tool to research, organize, evaluate, and communicate information and the possession of a fundamental understanding of the ethical/legal issues surrounding the access and use of information. (p. 11). This definition encompasses three areas of ICT literacy, namely cognitive, technical, and social. It recognizes that in the technologically connected world, one does not live in isolation and therefore needs 'soft' as well as 'hard' skills to confidently, reliably, and responsibly use ICT.

Research shows that a crucial factor influencing new teachers' adoption of technology is the quantity and quality of technology experiences included in their teacher education programmes (Agyei and Voogt, 2011; Drent and Meelissen, 2008). Unfortunately, research findings suggest that technology is significantly under-used by teachers and beginning

teachers (Dawson, 2008; Kirschner and Selinger, 2003). According to researchers, a gap exists between what teachers are taught in their courses and how teachers use technology in a real classroom (Ottenbreit-Leftwich, Glazewski, Newby, and Ertmer, 2010; Pope, Hare, and Howard, 2002). Research continues to reveal that beginning teachers feel they are not well-prepared to effectively use technology in their classrooms (e.g., Sang, Valcke, van Braak, and Tondeur, 2010; Tearle and Golder, 2008). A number of factors have been identified to explain why teachers do not feel prepared to use technology in their classrooms, including insufficient access to technology (e.g., Dawson, 2008), lack of time (e.g.,Wepner, Ziomek, and Tao, 2003) and lack of technology skills (e.g., Teo, 2009). While there is no doubt that these factors contribute to a lack of technology integration, increasing access to technology, time, and technology skills training does not seem to be enough to adequately prepare teachers to successfully integrate technology into their future classrooms (Kirschner and Selinger, 2003).

Recent calls have indicated that to prepare teachers for effective technology integration, teacher education programmes need to help them to build knowledge of good pedagogical practices, technical skills, and content knowledge, as well as how these concepts relate to one another (Koehler and Mishra, 2009). Many teacher education programmes have recognized the challenges associated with developing teachers' abilities to use technology in the classroom and have proposed original, innovative strategies (e.g., Angeli and Valanides, 2009). Given the lack of a comprehensive review about these approaches, the purpose of this study was to reveal the most useful strategies for contemporary technology integration in pre-service teacher education programmes. More specifically, a synthesis of qualitative research was used to locate, critically appraise, and synthesize the evidence base for interventions to prepare teachers to integrate technology into classroom practices.

2.3 Teachers' perception in ICT adoption in secondary schools

Over the last two decades, the use of ICT has been an important topic in education. On the one hand, studies have shown that ICT can enhance teaching and learning outcomes. For example, in education, scholars have documented that the use of ICT can improve students' conceptual understanding, problem solving, and team working skills (Culp, Honey and Mandinach, 2005; Gerban, 1992; Tao and Gunstone, 2009; Toomey and Ketterer, 1995; Zhou, Brouwer, Nocente and Martin, 2005). As a result, most curriculum documents state the importance of ICT and encourage schoolteachers to use them. However, teachers need to be

specifically trained in order to integrate ICT in their teaching (Batane, 2004; Jacobsen, Clifford and Friesen, 2002; Markauskaite, 2007; Mitchem, Wells and Wells, 2003; Yildirim, 2000).

Although schools are known to be resistant to innovation and change (Kearsley, 2004), the proliferation of ICT is beginning to affect how teachers teach (Reid, 2002). One of the current issues about the use of ICT in Canadian schools is how it is integrated into the curriculum (Plante and Beattie, 2004). Since the curriculum documents provide arguments for introducing ICT in the school setting, schools expect that graduates from teacher education programs have a reasonable knowledge of how to use ICT (Montgomerie and Irvine, 2001). Most current teachers' preparation and subsequent in-service courses were devised in reference to traditional educational technology and settings. … Thus, [the participants in these courses] are not familiar with the processes, interaction patterns, features and possibilities of technology-mediated educational transactions.

It seems that effective development of teachers' ICT proficiency is not a straightforward process, but is the one that asks for a careful, multilayered approach. First, a needs assessment is important to find out what ICT skills and knowledge teachers need at schools. Second, designers of teacher education programs should know the teachers' perceptions of ICT and their attitudes toward ICT integration into curriculum (Murphy, 2000). This is because these attitudes and perceptions are instrumental in how future teachers will use ICT in their teaching (Sasseville, 2004). Although there is a great deal of research on technology and teacher education, because of specifics of various teacher education programs, changes in population trends, and rapid technology advancements, there is a constant need for more research about the role of ICT in teacher education programs in this specific context. Third, teacher education programs need to take into account the two typical arguments in favor of the ICT appropriation in schools. One argument emphasises the importance of technological skills. Supporters of this argument urge teacher education programs to provide future teachers with as many technological skills as possible. The other argument accords a more important role to developing teachers' perspectives of and pedagogical knowledge about technology integration. Proponents of the latter argument believe that content-related technology knowledge is the most important factor for technology integration in teaching. This knowledge is referred to as technology pedagogical content knowledge (TPCK) (Mishra and Koehler, 2006). The institutions that uphold the teacher education programs need to be

aware of these two competing arguments and use the opportunity to build a balanced ICT program for teachers.

In the empirical study on teachers, Zogheib (2003) investigated the relationship between their attitudes (confidence in their own ability to use the Internet and liking of the Internet); achievement-related and value-related motivational beliefs about the Internet; and their perceived likelihood to use the Internet in instruction. The author examined the achievement-related beliefs within a motivational framework that described teachers' actual knowledge and perceived experience about the Internet. Value-related beliefs encompassed six measures for which the Internet would be valuable: personal needs, future career goals, a partner, children, future students, and society in general. Likelihood of using the Internet in instruction focused on teaching needs, students' learning, and differential access to resources. Overall, three out of the four independent variables were significant for future Internet use: attitudes, perceived experience, and perceived values. Value-related beliefs were the most dominant predictors of almost every item of Internet use. Perceived experience was a significant predictor only for teachers creating a homepage for students to use. An attitude (confidence and liking of the Internet) was only a significant predictor when teachers' access was restricted to the school. Surprisingly, actual knowledge was never a main predictor of future Internet use. Zogheib concluded that the computer course "provided [teachers] with a clear and effective plan [on] how to use the Internet in the classroom" (p. 103). It appears that the course was not the problem, but the problem was in the lack of opportunities for teachers to use the Internet during teaching practice due to associate teachers' lack of experience in that domain. Zogheib finished the report with recommendation that faculties of education should focus on ensuring that computer-related knowledge is "translated into practical applications in classroom settings" (p. 108).

In the next study, Zogheib (2006) investigated computer use among teachers in view of their experience with technology, demographic factors, motivation for use, personality factors and learning styles. Data collection in this explanatory mixed-method design study was done through conducting a survey and interviews. The quantitative part of the study indicated that female teachers use computers less than their male counterparts. Also, teachers in P/J division used computers less than those in J/I and I/S divisions. Data revealed that those teachers, who do not speak English at home, use computers more than others. In the interviews teachers reflected on the "computer training" course that was then part of the

teacher education program and is also the topic of the study described in this paper. teachers stated that the course was informative but that it started from the wrong assumption that participants had some previous computer technology training. Those who were advanced computer users did not find the course too difficult, while those who were in initial stages of technology use thought they would have to re-teach themselves if they ever intended to use the programs briefly described in class. One of the suggestions was to have class assignments focus more on practical issues than on evaluating and critiquing articles.

The twelve interviewees criticized the whole teacher education program for not providing enough computer experience. This experience was mainly limited to using the text editors or online searches. The participants stated that very few professors in the program encouraged the teachers to use computers. This whole issue was compounded by similar and even worse experiences in the teaching practicum: associate teachers did not use computers and appeared disinterested in integrating technology in their classes. There was a discrepancy between computer skills of associate teachers and their students who knew "a lot more" (Zogheib, 2006, p. 92). Further major findings in the Zogheib (2006) study were that the Primary/Junior teacher education program lacks computer training, that other programs need extended time for the computer course and that the course should consist of two stages. The first stage should provide the basic skills training, while the second stage should be about pedagogy related to use of these skills.

Qureshi (2004) investigated correlations between university students' demographic characteristics (gender, age, marital status, employment status, student status, and number of dependents), their prior online/computer experiences, preferred learning styles, motivation, and elements of the online course design, as independent variables, and their satisfaction with the online course components, as dependent variable. Although the teachers were not included in this study, its results may be relevant for this research. Qureshi recommended that a specific course design model should be used for the Web-based environment. The individual characteristics of students, their learning preferences and previous experience with technology and online learning should be taken into account in designing the online courses. Also, adequate technical support appeared to be relevant for students' satisfaction with online courses.

Through a concurrent mixed-model approach, Magliaro (2006) investigated whether variables such as: gender, age, ethnic origin, previous undergraduate degree, division, computer experience, use of software packages, computer training, computer ownership and socio-economic status have a statistically significant impact on the computer self-efficacy beliefs of teachers. In addition, Magliaro used open-ended questions to explore teachers' computer self-efficacy results by examining their past technological interaction experiences and beliefs based on the four sources of self-efficacy (performance accomplishments, vicarious experiences, verbal persuasion, and emotional arousal). Magliaro reported a significant difference among the study participants with respect to their undergraduate degree (in favour of participants with a Science degree), division (only between P/J and J/I), and previous experience with computers and software packages. However, there was no noted significant difference across genders (Magliaro and Ezeife, 2007).

In addition to research done elsewhere, these four studies in particular informed the research and the methodological approach used in this study. Consequently, the authors developed a survey instrument having in mind possible triangulation of the final results. The intent was to provide a "big picture" of the findings along the common themes in all the above mentioned studies, with the aim to infer conclusions that will potentially affect the decision-making procedures in teacher education programs. The forces driving the implementation of e-learning in the commercial world are now widely recognized and accepted across virtually all industry sectors. Many even speak of the Merrill Lynch e-learning "megatrends" (Learn frame, 2001), such as the changing demographics resulting from the aging of the baby boomers and a reduced "knowledge half-life", (so that many books are out-of-date before they are printed) which, together with the rapid expansion of technology, force firms and their employees into ongoing lifelong learning and training activities. At the same time, organisations are witnessing a number of the benefits of e-learning, such as cost savings, and increased flexibility and productivity (Hall, 2001a). Organisations in both public and private sectors increasingly view continuous learning as the key to maintaining their competitive advantage (Goldstein and Ford, 2001). E-learning is considered the appropriate solution to the call for a just-in-time accessible, ubiquitous approach to providing learning at a lower cost (Borotis and Poulymenakou, 2004). Because the ways in which the online curriculum is delivered are new – and very different from the traditional approach – however, a major factor influencing the success of e-learning is teacher training. Instructors must themselves be educated in how to take advantage of these updated teaching methods. "An ineffective

teacher can waste the time of 30 or 40 students. But bad teaching online can touch thousands. A significant body of literature (see, for example, Heinrich, 1995; Fullan, 1994; Wang, 2002) supports the view that the way teachers teach is a product of their own schooling, training and experiences. It is unreasonable to expect teachers to change their existing pedagogical approaches if they have not been provided with sufficient and appropriate training in how to integrate ICT (Information and Communication Technology) and new teaching technologies into their instruction programs.

Readiness is defined as being "prepared mentally or physically for some experience or action" (Webster's New Collegiate Dictionary). Borotis and Poulymenakou (2004) define e-learning readiness as "the mental or physical preparedness of an organization for some e-learning experience or action". E-Learning readiness assessment helps an organization to design e-learning strategies comprehensively and to implement its ICT goals effectively (Kaur and Abas, 2004). Learners must also be "e-ready" so that a coherent achievable strategy, tailored to meet their needs, may be implemented (infodev, 2001). In sum, e-learning readiness assessment provides key information to organisations to supply solutions which can cater to the specific needs of each learning group (McConnell International, 2000).

Before implementing e-learning programs, therefore organizations need to expand the usual needs assessment process by creating a high-level requirements document that includes: 1) objectives (macro organizational objectives and micro target learner population objectives); 2) an e-learning readiness score; 3) a list of advantages and potential obstacles to e-learning adoption; and 4) a list of possible e-learning configurations (Chapnick, 2000). Chapnick designed a model for measuring the e-learning readiness of an organisation by answering the questions: a) Can we do this? b) If we can do this, how are we going to do it?; and c) What are the outcomes and how do we measure them?

His proposed model groups different factors into eight categories: Psychological readiness-this factor considers the individual's state of mind as it impacts the outcome of the e-learning initiative. This is considered one of the most important factors and has the highest possibility of sabotaging the implementation process. Sociological readiness-this factor considers the interpersonal aspects of the environment in which the program will implemented. Environmental readiness-this factor considers the large-scale forces operating on the

stakeholders both inside and outside the organization. Human resource readiness-this factor considers the availability and design of the human-support system. Financial readiness-this factor considers the budget size and allocation process. Technological skill (aptitude) readiness-this factor considers observable and measurable technical competencies. Equipment readiness-This factor considers the question of the proper equipment possession. Finally, content readiness-this factor considers the subject matter and goals of the instruction.

Most of the existing e-readiness instruments were not developed for use in primary or secondary schools – the majority of these having been constructed for business organisations, universities or higher education institutions (Borotis and Poulymenakou, 2004; Chapnick, 2000; Hoban, Lawson, Mazmanian, Best and Seibel, 2005; Rosenberg, 2000). As e-learning is being launched in Hong Kong's schools at the system level, there is a clear need to develop a framework for e-learning readiness which is specifically designed for the needs of primary and secondary schools.

An additional factor to be taken into consideration is a body of research findings which link gender differences to levels of computer acceptance (Yuen and Ma, 2002; Russell and Bradley, 1997) – an issue which is also relevant to teachers' e-learning readiness. In his research into 462 middle and high school students, Young (2000) found significant gender differences in attitudes to computers. The male domain scale showed that boys were more likely to have claimed computers as a male area. Russell and Bradley (1997) found that male teachers reported significantly greater confidence with computers than did female teachers; and recommended that the design of teacher professional development should take gender differences into account, allowing for the particular needs of female teachers.

2.4 Levels of ICT access of teachers in ICT adoption in secondary schools

The use of e-learning in classes is very essential. It will not only help to make the teaching and learning of to share in educational revolution (Liverpool, Ndam and Oti, 2010) which e-learning brings into educational system but also to tap the benefits of a more effective method of teaching and learning offers (Yaakub and Finch,2010). The efficacy of e-learning in education was questioned by Borba and Bartolini (2010) and replied stating that e-learning may not be different from other technological innovative strides that have been present in education for long but failed to produce significant impact in the teaching and learning of the subjects. If close scrutiny is carried out (Kidwell, Ackerberg and Robert, 2008) it would be

discovered that much is still needed to be done to ensure that advantage of e-learning technology is optimally exploited.

There is also the question of how effective e-learning has solve the problem learning mathematics. Dhariwal (2010)comparatively x-ray the traditional method and e-learning approach to teaching mathematics and science subjects and averred that e-learning make room for individualized learning whereby learners progress at their own pace which is absent in traditional method of instruction. The e-learning method obviously personalize the instruction, avail the gist and gem of various learning styles of each learner, boost the confident level of learners, brings about constructive modification in the roles of teachers and learners as wells fosters desirable student teacher relationship (Dhariwal, 2010).

Kajetanowtcz and Wierzejewski (2010) pinpointed that e-learning has no rival when it comes to generation of intrinsic motivation and initiation of organized active learning. They equally see e-learning as an efficient means of promoting self-study cum frequent testing in the form of formative evaluation which engender proper monitoring of educational progress and periodical achievement. Overall research report shows that e-learning provide positive effect on learners achievement.

2.5 Teacher preparedness for ICT adoption in secondary schools

Underlying the process of inclusion is the assumption that the general classroom teacher has certain knowledge and understanding about the needs of different learners, teaching techniques and curriculum strategies. Florian and Rouse (2009) state: 'The task of initial teacher education is to prepare people to enter a profession which accepts individual and collective responsibility for improving the learning and participation of all children' (p. 596). Savolainen (2009) notes that teachers play an essential role in quality education and quotes McKinsey and Company who say: 'the quality of an education system cannot exceed the quality of its teachers'. (p. 16) Studies suggest (e.g. Sanders and Horn, 1998; Bailleul et al., 2008) that the quality of the teacher contributes more to learner achievement than any other factor, including class size, class composition, or background.

The need for 'high quality' teachers equipped to meet the needs of all learners becomes evident to provide not only equal opportunities for all, but also education for an inclusive society. Reynolds (2009) says that it is the knowledge, beliefs and values of the teacher that

are brought to bear in creating an effective learning environment for pupils, making the teacher a critical influence in education for inclusion and the development of the inclusive school. Cardona (2009) notes that concentration on initial teacher education '… would seem to provide the best means to create a new generation of teachers who will ensure the successful implementation of inclusive policies and practices' (p. 35). The OECD Report 'Teachers Matter' recognises that the demands on schools and teachers are becoming more complex as society now expects schools to deal effectively with different languages and student backgrounds, to be sensitive to culture and gender issues, to promote tolerance and social cohesion, to respond effectively to disadvantaged students and students with learning or behavioural problems, to use new technologies, and to keep pace with rapidly developing fields of knowledge and approaches to student assessment. Teachers, therefore, need confidence in their ability and the knowledge and skills in inclusive education to meet the challenges that they will encounter in the present school climate. (Carroll et al., 2003) This review sets out to provide an overview of literature which will inform further work on the Agency Teacher Education for Inclusion project, with a focus on initial teacher education for mainstream teachers. In particular, it provides information regarding; changing conceptions of inclusion, the European context for teacher education for inclusion, policy frameworks to support teacher education for inclusion and effective practice in initial teacher education for inclusion with a focus on models of training, curriculum, teaching practice and assessment.

This review assumes that teacher education for inclusion should prepare teachers to engage with learner diversity arising from age, gender, sexual orientation, ethnic, cultural, linguistic or religious background, socio-economic status, disability or special educational needs.

Having established factors that contribute to use of ICTs, the questions that follow are: what influences the formation of teacher attitudes and beliefs that relate to preparedness to use ICTs in classrooms? And how can the likelihood of appropriate use be maximised? According to the literature, much of the answer to these questions lies within the teacher preparation experience, and as such, with teacher colleges and universities, as well as the schools in which teachers perform placements.

There are many views on what the experience should include to increase the likelihood that ICTs will be used in classrooms. Wozney, Venkatesh and Abrami (2006, p. 175) identify technology related training as a key factor, suggesting that it "plays a crucial role in

developing teachers' competency with computer applications as well as influencing teachers' attitudes towards computers." Ward (2003, p. 11) suggests that the "first step to ensuring teacher use of computers, as teaching and learning tools, must be to provide them with sound educational reasons for doing so." Similarly, Cuckle, Clarke and Jenkins (2000) referring to a study by Wild (1996), assert "that it is important that students are able to identify a purpose for IT use early in their courses and are able to reflect on IT use for learning and teaching" (p. 19). They also suggest that "for ICT training during initial teacher training to be really effective, schools and training institutions in partnership need to take a proactive role in promoting ICT", and add that the "difficulties encountered by students need to be tackled in partnerships between schools and training institutions" (pp. 17,19). Steketee (2005) in a review of teacher experience and preparation to use ICTs in classrooms proposed a classification of preparatory approaches. These are not mutually exclusive, but do tend to identify the principal approach employed. Steketee (2005, p. 102) describes the approaches as follows: i. the ICT skills development approach; ii. the ICT pedagogy approach; iii. the subject specific approach; iv. the practice driven approach.

As its name suggests, the ICT skills development approach comprises the addition of one or more ICT subjects within the preparatory course. Zhiting and Hanbing (2002) reporting on initiatives in China consistent with this model advise that 'add on' approaches such as this have problems. They report that because of the technical focus of the subjects, and the fact that IT teachers taught the subjects, there was no reference or relation to pedagogical application. Also, as the teaching approach for these subjects was typically traditional, there was little innovative application of technology for teaching these subjects that could serve as exemplar models. Lastly, and as a result of these circumstances, the teachers "don't know how to use new technology in their classroom" (Zhiting and Hanbing, 2002, p. 69). Summing this up and referring to Wang (2002), Steketee (2005, p. 103) suggests that although there is evidently a need to develop ICT skills, that "skill alone is not enough to encourage students to confidently integrate ICT into their classroom programs."

The next model, the ICT pedagogy approach appears to meet this need, as it not only includes the addition of a skill component to a teaching program as per the model above, but also adds one or more ICT pedagogy subjects. Steketee (2005, p. 104) reports that although this model proved useful to develop ICT skills, to develop the ability to design "classroom based resources", and to increase student teacher "understandings associated with effective

implementation strategies, as well as their self-efficacy as to their ICT competencies"…. , "this understanding has not been transferred in any notable way to the classroom context." Explanations offered for the minimal efforts to integrate ICT into the classroom as a result of this approach include an apparent perception by teachers that these ICT skill and pedagogical subjects are somewhat removed from the curriculum, an add-on (Steketee, 2005). It is also suggested that the degree of self-efficacy attained with this approach may be a factor, as "teachers who have high levels of efficacy regarding teaching with technology are more likely to participate more eagerly, expend more effort, and persist longer on technology-related tasks than teachers who have low levels of efficacy" (Ertmer et al, 2003, p. 97).

The subject specific approach tackles the deficiency of the preceding model by both integrating and modelling "effective implementation skills in the context of genuine subject areas" (Steketee, 2005, p. 104). It also exposes teachers to "new and innovative ways of learning", and provides them "with a practical understanding of what learning and teaching with ICT looks and feels like" (Steketee, 2005, p. 104). This approach is consistent with Mishra and Kohler's (2006) model of the types of knowledge needed by educators to effectively use technology in their teaching. They emphasise the importance of Technological Pedagogical Content Knowledge, that is, knowledge of the learning technologies that offer affordances to particular content areas. Both affirming and building upon Steketee's appraisal, Lock (2007, p. 586) found that teachers "can begin to design learning experiences for their students that appropriately integrate technology based on the modeling and experiences they have observed and experienced in their teacher education programs." Although the approach employed in this project reportedly achieved deep and meaningful learning, the project did not include or require application in a classroom. Given this, it is not clear how prepared these teachers became to use ICTs in their classroom.

The practice driven approach incorporates attributes of the first three approaches, however, it has a significant focus on designing and developing ICT facilitated and/or supported classroom programs that will be implemented during the teachers' practicum. One example of this approach cited by Steketee (2005) is the University of Wollongong Graduate Diploma course studied by Brown (2002). During this course students were required to research the ICT environment at the school where they were to perform their placement, and having done so to "design [and develop appropriate ICT] activities with their supervising teacher" and to then implement them in the classroom and evaluate what was learned (Brown 2002, p. 542).

While it is evident that this approach was likely to have achieved a 100% result of ICT integration in classrooms during the practicum, it is not stated by Brown (2002) how this approach impacted the attitudes and beliefs of the teachers.

Shedding light on developing understandings and beliefs with this approach, a study by Taylor (2004) found that students believed that a range of experiences enabled their "understandings to grow", and that "classroom experience seemed to be central" to increasing this understanding. Taylor (2004) identified three stages in this development of understandings. In the first most students appeared to have a "good understanding of the possibilities for the use of ICT in … teaching, yet they received others' assertions about the value of ICT without questioning them" (Taylor, 2004, p. 48). The second stage was characterised by increasing awareness and analysis of their own and others practice. Stage three was represented by "reasonably sophisticated reflection and theorization for at least some strands in their thinking" (Taylor, 2004, p. 48). If all of the points made in this section are considered together, it would seem clear that human factors are very important, and that the nature and composition of teacher preparation programs does impact significantly on teacher beliefs and attitudes and consequently their preparedness to use ICTs in classrooms. Also, while the success of the practice driven approaches mentioned here is acknowledged, there is a question on its potential "unless there is a strong relationship between faculty wide lecturers, tutor teachers and teachers, and a genuine commitment by all parties" (Steketee, 2005, p. 106). Given the situation outlined earlier in this paper that there are many countries where levels of ICT integration in classrooms vary and are typically below those desired, achieving this kind of relationship and commitment would seem a challenging proposition. However, while it is recognized that arrangements of this kind require significant levels of cooperation and commitment, it is suggested that the principles could be employed in many circumstances.

Another 2002 pilot on learning to use ICT for science learning and teaching (reviewed by David, 2008) showed that for the 140 schools that participated, the impact of equipped computers (with relevant software, support by a technician and access to a dedicated website for information sharing) reached far beyond individual teachers. It prompted department-wide exploration of new teaching strategies and renewed enthusiasm for sharing and collaboration. As a result, this approach was extended in 2004 to other subjects in science teaching and integrated into the teacher training curriculum (Enhancing Subject Teaching

Using ICT) (Fisher *et al*., 2011). Therefore, when looking at the current widespread diffusion and use of ICT in modern societies, especially by the young – the so-called digital generation – then it should be clear that ICT will affect the complete learning process today and in the future.

Kenya is one of the countries in Sub-Saharan Africa (SSA) that has dedicated effort and resources to the promotion and implementation of ICT in education and training; and they continue to do so (Amutabi, 2010). There is, in other words, a widespread belief that ICTs have an important role to play in changing and modernizing educational systems and ways of learning. There is, however, little scientific evidence of the concrete contributions of ICTs to the teaching and learning domain especially in the tertiary institutions in Kenya, despite the efforts of the last decades. Hence, there is a need to bring evidence together on the impact of ICT on learning in the tertiary levels of education in Kenya.

2.6 Teachers academic background and the level of adoption of ICT in learning institutions

Pozo and Stull (2006) highlighted the importance of teachers' academic backgrounds and courses learned at the university in success of teachers in understanding and suing e-learning. The teacher understanding also depends on which subjects they teach at the school (Dhariwal, 2010). The teachers who come from underprivileged academic environments have worse school Teachers understanding s than the less underprivileged teachers (Conger *et al.*, 1997; Haveman and Wolfe, 1995; Wilson, 1987). Bratti *et al.* (2007) show that the differences in teachers' understanding can be explained by the differences between the areas in academic terms of structures, type of institutions and the individual characteristics of the teacher.

Didia and Hasnat (1998) examined the determinants of teachers understanding on an introductory finance course. They found that subject studies, as a measure of maturity, had a significant influence on teachers understanding. Reid (1983) focused his study on an introductory university economics course and also found that prior knowledge of the course was a significant variable, with teachers with prior knowledge performing better. Jaggia and Kelly-Hawke (2009) included variables concerning school inputs and teachers' academic background in order to test whether these two variables influence teachers understanding. They found that higher levels of education in some course did not have any consistent

relationship with teachers understanding of some courses in ICT. However, academic background was clearly very important in explaining differences in learning outcomes. There seems to be a very close link between the ICT revolution and the academic variables. Academic structure, social environment and related variables are not sensitive to ICT, yet ICT may act on secondary education and contribute to better achievement. However, ICT may have an impact on Teachers' motivation. Becker (2000) found that ICT increases student engagement, which leads to an increased amount of time Teachers spend working outside class.

The present-day teachers are essentially in a different situation from previous generations, with the large majority of Teachers having ICT skills that are of a different type from their teachers' (and parents'), often better and wider; even the time spent using a computer efficiently supports the improvement of ICT skills. It is obvious that for the younger generation using ICT is easy and ordinary, characterizing a life-style consisting of the functions of both working and learning, as well as functions of leisure time, like gaming or uploading and listening to music. Nardi and O´Day (2009) call this phenomenon 'information ecology', by which they mean a system of people, practices, values and technology in a certain environment. In such an "ecosystem", technology in not in the centre but it is integrated into the existing practices and manners, and users and tools form a wide variety, complementing each other. There is a cultural gap between Teachers and teachers in terms of the digital world, and, as mentioned in Pedersen *et al*. (2006), very few teachers know what is going on in the digital world of a 13-year-old student (see also Ilomäki and Rahikainen, 2001). This differentiation and Teachers' ICT competence are challenges for teachers because the digital skills are nowadays basic skills, such as reading and writing (Pedersen *et al*., 2006). Digital skills divide into very different sub-skills of which only some are important and used in school. As presented above, Teachers' informal learning of ICT and experiences in using ICT are far more attractive than the school can typically offer.

As a result, Teachers face few challenges in using ICT in school. Moreover, there is probably in every school a group of Teachers with high-level expertise in ICT. These "student-experts" have the kind of adaptive expertise which is useful in novel situations with technology: they learn quickly in practice, they have networks to help and give guidance, they are committed, and they are not afraid to face challenges. Only seldom can these

Teachers gain from the ICT use in school, although they could be an important source of help and support at school level.

There is no need to over-romanticize the younger generations' ICT competence but it should certainly have an effect on classroom practices and on the teacher's role, and as such, it is a challenge to teachers; in general, a challenge that is not met, as e.g. when Erstad (2007) describes the different strategies that teachers used when facing Teachers' better ICT competence. Some teachers competed with Teachers, to some it was a challenge for their didactic and subject-oriented skills, while others teachers simply ignored computers. Especially Internet services challenge previous practices of working and learning. Weller (2007) suggests that the essence of the Internet is in robust, decentralized, and open communication; these technological features have also become social features and influenced the social values of the net. Many virtual communities have adopted these, but, as Weller says, these elements do not characterize learning communities, not even e-learning communities. Yet, the new generation of learners will become used (and some of them already are) to these features and they demand them also in the learning communities. The challenge is how to integrate the technological possibilities, the sophisticated communication strategies of the learners used to the Internet, and the formal structures of learning organizations.

There are some characteristics in teachers' ICT skills which are essential when thinking about the use in school. Teachers' ICT skills are often learned in informal learning contexts, at home and with friends; this concerns boys especially (reported in several studies, see e.g. Eurydice, 2005). In their study, Ruthven *et al*., (2005) say that sometimes this informal learning means insufficient or odd ways of working, and that especially the information-processing skills need support: Teachers' searching procedures are inefficient and they need more systematic guidance to develop these. Similar findings were reported, for example, in a study on sixth grade children studying science (Wallace, Kupperman, Krajcik, and Soloway, 2000): Teachers were not very effective in finding useful information (but Teachers were well engaged and involved in the inquiry and search activities). In another study on literacy skills of sixth grade children (Bowler, Largeb, and Rejskindc, 2001), the researchers found that fact finding skills were inadequate, and efficient use of the web implied a background of knowledge about computers and inquiry.

23

Teachers did not understand their role as knowledge makers and the need for responsible use of information. As the authors say, understanding that one must back up statements and opinions with reliable proof should be seen as a life skill, but such understanding was missing. They emphasized further that the needs and abilities of grade-six Teachers do not match the design of the Web. As a matter of fact, information searching in the Internet is not easy for older Teachers, either, as studies among upper secondary school Teachers and experienced adult graduate student Internet users showed (Kiili, Laurinen and Marttinen, 2009; Nachmias and Gilad, 2012). Most of the upper secondary school Teachers only seldom evaluated the credibility of information, and the evaluation of relevance was more important than the evaluation of credibility. Some Teachers did not find relevant and correct information, although teachers were not aware of this and they trusted the Teachers' information skills too much (Kiili, Laurinen and Marttinen, 2009).

Similarly, the search processes of adults were ineffective and often unsuccessful (Nachmias and Gilad, 2002). Lallimo, Lakkala and Paavola (2004) present in their review8sthat the starting point for effective information-seeking with technological support is embedded in a sound theoretical understanding of the information seeking process, as it is intertwined with meaningful pedagogical practices. The authors put the question whether ICT presents totally new challenges for Teachers' information-seeking skills, or is it more a question of supporting teachers' basic information-seeking skills regardless of the technology.

The academic context of the learner may also affect ICT adoption at school. In affluent settings, many learners have access to computers at home, and should therefore be confident with the use of the technology within the schooling environment (Muller *et al*, 2007). In contrast, many learners in schools in disadvantaged areas do not have these amenities at home and, therefore, are less familiar with their use. Such learners will have a low propensity to the use of the computers (Bovee *et al*, 2007). This agrees with Chigona *et al* (2010) when they report that most of the learners in disadvantaged schools do not have computers at home so that they (learners) are introduced to such technologies for the first time at school.

Similarly, educators who come from less privileged academic settings are less likely to have computers at home. Because they are less likely to constantly use a computer, their skills are less advanced compared to more regular users. A key role of education is to empower Teachers with skills and attitudes that are essential to their success in our knowledge society

future. Cuttance (2001) suggests that new ways of thinking and solving problems in supportive classroom learning environments require well-developed motivation, self-regulation strategies and meta-cognitive capacities to engage Teachers successfully.

A central aim is to ensure teachers, such as those in the middle-years, acquire essential information skills (Barratt, 1998) appropriate to the knowledge society, and to nurture modes of learning, or learning styles, such as visual, auditory and kinesthetic (Hinkley, 2001) to maximize the learning potential of individual Teachers. This means that a new challenge confronting education is concerned with meeting the needs of *all* Teachers: personalised learning where learning is designed around Teacher's needs (Hargreaves, 2004). Hargreaves (2004) highlights the importance of 'nine gateways' to personalizing learning-curriculum, workforce, organization, student voice, mentoring, advice and guidance, new technologies (ICT), assessment for learning and learning to learn, with each potentially "enhancing student motivation and commitment to learning" (p 7). This paper is concerned with two of the aforementioned gateways to personalizing learning: student voice the use of new technologies (ICT).

It would be meaningless to say we are personalizing learning unless we involve them in the process" (Hargreaves, 2004:10). Practices that focus on designing curriculum experiences have been encouraged as central features of reform initiatives to improve the quality of learning in schools. The use of student voice benefits teachers and therefore possible changes to teaching practice and curriculum experiences. In this context, this paper considers student voice from middle-years Teachers (early adolescents), Years 5 to 9, from Victorian Government schools. The voice of Teachers is able to make a significant contribution to what they regard are important factors, particularly with the use of ICT, that affect learning. Furthermore, the need to consider personalized learning adds to the importance of identifying with Teachers in an effort to improve student teachers understanding.

2.7 Theoretical Framework: Theory of Domestication

Domestication is described as the process of technology adoption into everyday life. The concept of domestication was originally adapted from other disciplines such as anthropology and consumption studies, as well as from the media studies considering the context in which ICTs were experienced by the people using them (Haddon, 2006). According to Haddon (2006) the framework looks beyond the adoption and use of ICTs (as well as gratifications or

benefits) to ask what the technologies and services mean to people, how they experience them and the roles that these technologies can come to play in their lives. The processes observed in this framework are about how individuals encounter technologies and deal with them, sometimes rejecting them and at other times accepting them (Haddon, 2006). Domestication consists of three main processes namely *Commodification*, *Appropriation* and *Conversion* (Frissen, 2000). Some researchers split the appropriation stage into Objectification and Incorporation stages, thus making four stages (Habib, 2004). In this study we adopted the four stage process of domestication.

Commodification (also known as imagination) refers to the way a technological product is designed and is given an image by the users as it emerges into the public space. At this stage symbolic and functional claims about the product are noted. The images could be a result of an advertising campaign. The product is evaluated on how well it would fulfill the consumers' perceived needs (Habib, 2004). In the case where the consumer has a choice of adopting, the commodification process may affect his/her decision to acquire the product. Once purchased by an individual or an organisation, the product or object goes through a process of *appropriation*. At this stage the product is possessed by the owner and becomes authentic. When looking at appropriation, the objectification process is considered to examine how the product finds space and enters the geographical area of the owners. Objectification does not necessarily mean the product is accepted by the potential adopters. Products entering the school sphere may not be immediately integrated into its pedagogy. The product is then incorporated into the daily routines of its owners. Incorporation begins by first integrating the product in temporal structures both formally (in the work schedules) and informally (in the routines and habits).

In the *conversion* stage, the adopters of the innovation show their adoption by displaying it to the outside world physically or symbolically (Habib, 2004). In case of ICT for curriculum delivery, the display could be by individual teachers within a school environment or by the entire school as an adopter displaying to other schools. The first two stages of the domestication process are equivalent to what is normally referred to as adoption in most adoption frameworks (Pedersen and Ling, 2003). Thus, it is noted that the domestication framework allows for investigating the processes beyond the acquisition of the technology.

In this review I employed the domestication framework as the lens to understand; how the educators in schools in disadvantaged communities are domesticating ICTs in their pedagogy; the factors affecting integration of ICTs in the schools The domestication framework has been used to study the adoption processes of a variety of technologies including personal computers, televisions and mobile phones (Perdesn and Ling, 2003). Again it should be noted that although the framework is mainly used to study person or household adoption of technology, others recommend that it can also be used to study organizational domestication of technology. For instance, Habib (2005), used domestication to study the adoption of learning management system at a university.

2.8 Conceptual framework

Influencing or constraining factors to the integration of ICT in teaching practice can be categorized in different ways. In a framework addressing challenges to classroom technology use, Groff and Mouza (2008) distinguish several critical factors going from legislative, district/school level factors over factors associated with the students and the teachers to factors inherent to the technology itself and factors associated with the technology enhanced project. Mumtaz (2000) distinguishes three interlocking factors: institution, resources and teacher. Ten Brummelhuis (in Drent and Meelissen, 2008) categorizes influencing factors in factors which can be manipulated and factors which are not manipulative. At the school level, important contextual factors are socio-cultural setting of a school and structural characteristics like government ICT policy, ICT infrastructure and school type. At teacher level, two types of barriers are common; external or first-order barriers, such as limited resources or lack of technical support, and internal or second-order barriers, which include teachers' attitudes to ICT (Snoeyink and Ertmer in Jones, 2004).

Teachers' perception of
ICTs
- Attitude
- Perception on student use

Moderating variables

Computers

Teachers' access to ICTs
- Availability of equipment
- Availability of infrastructure

Dependent variable

ICT ADOPTION

Levels of teacher
preparedness
- Technical support
- Professional development

Teachers' academic
backgrounds
- Training attended
- Early involvement in ICT

Gender

Age

Figure 2.1: Conceptual framework guiding the current study

Figure 2.1 describes our research model, based on literature and experience in integration of
ICT in education. Use of e-learning in teaching practice is the dependent variable. Non-
manipulative factors are gender, age and subject teaching. Influencing first-order
manipulative factors are access to ICT, intensity of use, confidence and skills. Of a different,
internal order, are perceived values of ICT and conceptions of student learning.

2.9 Chapter summary
It is clear from the literature reviewed, and suggested by this study, that teacher intrinsic
factors may impact on whether and perhaps how they use ICTs in classrooms. Aspects such
as perceived usefulness, benefit or advantage, ease of use, and the ability and confidence to
use ICTs, appear to be critical elements. When all of the points are considered together, it

would seem clear that human factors are very important, and that the nature of teacher preparation and training programs does impact significantly on teacher beliefs and attitudes, and consequently their preparedness to use ICTs in classrooms. As well as contributing to an understanding of the issue of teacher preparedness to use ICTs for teaching in their classrooms, it is suggested that this study could also inform on the nature of teachers preparedness to use ICT's in their teaching. The importance of models of practice experienced as a student as a limiting factor in the range of possible approaches to be considered for use as a teacher, may well apply equally to teachers of secondary schools, many of whom have no experience with online learning technologies as a student.

This chapter on literature review leaves no doubt that all the factors affecting adoption of computer especially among tertiary college students should be perceived as a unit within a system for successful educational performance. What is quite apparent is that these factors are quite many and it is only by delineating them well can specific data be obtained and analyzed. However, the determination of attitude, perception and ability without using the pre-tested instruments as a foundation is deemed to fail.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

Methodology refers to the system of methods or procedures used in sampling and collecting data required for a particular research. It is also the application of the principles of data collection methods and procedures in any field of knowledge. This section describes research design, target population, sampling design and sample size, data collection methods, validity and reliability of research instruments and data analysis technique.

3.2 Research design

The study adopted correlational research design. Since there is an association between teachers perception, levels of ICT access, levels of preparedness and teachers academic background with use of e-learning, there will be a need to correlate these variables hence justification of the use of correlational design (Kerlinger, 1986).

3.3 Target Population

The target population was public secondary school under the Ministry of Education programme-computer for schools, TSC employed teachers, principals and Zonal education officers in Webuye sub-county, Bungoma County in Western Province. There are currently 25 schools and about 360 teachers and five educational zones namely Lugusi, Milo, Webuye, Bokoli and Ndivisi. Therefore the target population will be 360 TSC teachers, 25 principals and 5 zonal education officers making a total study population of 390.

3.4 Sample Size and sampling procedure

This section describes the sample size and sampling procedure to be employed for this study.
3.4.1 Sample Size
To determine the sample size, the researcher used 30% of the secondary school teachers population as the sample size as suggested by Kothari (2004). Thus the sample size for the study was 130 comprising of teachers, principals and zonal education officers in Webuye District.

3.4.2 Sampling procedure

The study employed both purposive and systematic random sampling to obtain respondents for the study. Purposive sampling ensured that all the principals participated in the study alongside the zonal education officers. This was because the researcher believed as managers in their jurisdictions, the principals and zonal education officers would provide all round information concerning the subject of study.

Systematic random sampling was used to select the 100 teachers from the 25 schools where by four teachers were randomly selected from a list of TSC employed teachers in every school.

3.5 Data Collection Instruments

The main instruments for data collection were questionnaires and interviews.

Questionnaire

The teachers' questionnaire will be used to gather information from the teachers demographics, levels of specialization and teachers background. These will be both close ended and open ended questionnaires. The questionnaire will be a convenient tool especially where they are large numbers of subjects to be handled.

Interview schedule

Interview schedule which involves oral administration of questionnaires or interview schedule was used (Mugenda and Mugenda, 1999:83). The researcher carried out in depth interview with the school principals and with the Ministry of Education officials. This being face to face interaction with the respondent, the researcher personally administered interview schedules to get first-hand information on the key concepts of the study to supplement the information from the questionnaires.

3.5.1 Piloting of the study

The research instrument was piloted in order to standardize it before the actual study. The pilot study was done among TSC teacher in two zones in Webuye Sub-county. The zones included Lukusi and Webuye. This helped in identifying the problems that the teachers encountered in adopting ICT integration in their teaching. The research instrument would yield the required data for the main study.

3.5.2. Validity of Research Instrument

Validity is the accuracy and meaningfulness of inferences, which are based on research results. Validity is the degree to which results obtained from the analysis of the data actually represents the phenomenon under study. If such data is a true reflection of the variables, then inferences based on such data will be accurate and meaningful. The instrument was rated in terms of how effectively it sampled significant aspects of the purpose of the study. The content validity of the instrument was determined in two ways. First the researcher discussed the items in the instrument with the supervisor, lecturers from the department and colleagues. They indicated by tick or cross for every item in the questionnaire if it measured what it was supposed to measure or not. A coefficient of those that measured was computed. A coefficient of above 0.5 implied that the instrument was valid. Advice given by these people helped the researcher determine the validity of the research instruments. These suggestions were used in making necessary changes.

3.5.3 Reliability of the instruments

Koul (1993) states that the reliability of a test refers to the ability of that test to consistently yield the same results when repeated measurements are taken of the same individual under the same conditions. Basically, reliability is concerned with consistency in the production of the results and refers to the requirement that, at least in principle, another researcher, or the same researcher on another occasion, should be able to replicate the original piece of researcher and achieve comparable evidence or results, with similar or same study population.

To establish the reliability of the questionnaire, pre-testing through piloting was done in secondary schools not used in the sample from Webuye District. The reliability of the items was based on the estimates of the variability among the items. The reliability coefficient was determined using the test retest method. This is because the method was more accurate as it determined the stability of the instrument. A reliability coefficient of at least 0.5 was considered high enough for the instruments to be used for the study (Kerlinger, 1986). Feedback obtained from the pilot study assisted the researcher in revising the instrument of data collection to ensure that it covers the objectives of the study. The main reason for piloting the questionnaire was to ensure that the items detected the kind of responses the researcher intended to get, that the items they are acceptable in terms of their content, and

they adequately covered any aspects of the unit which the researcher particularly wished to explore. In a case where it was discovered that the items in the questionnaire were difficult for the respondents, they were rectified accordingly.

3.6 Data Collection procedure

Data was collected from the respondents in the Public secondary schools in Webuye Sub-county Bungoma County. The sample was determined through random sampling techniques. The data was collected by the researcher so as to get first-hand experience in conducting a study. The researcher sought permission from the Ministry of Education and conducted the study.

3.7 Data analysis Technics

Data was analyzed descriptively. Data analysis was facilitated by use of SPSS (Statistical Package for Social Sciences version. 17.0) Computer Package. Qualitative methods of data analysis employing descriptive statistics were employed in analyzing qualitative data where frequencies and proportions were used in interpreting the respondent's perception of issues raised in the questionnaires so as to answer the research questions. Descriptive statistics such as frequency distribution, percentages and weighted means were calculated. After appropriate analytical procedures were undertaken, the data was presented in a synthesized the results.

3.8 Ethical consideration

The ethical and legal requirements needed to be observed by teachers as they adopt the use of ICT in teaching should be that they seek authority to use content where required .Access content in line with the Ministry of Education requirements and Education guide lines. Use ICT equipment as they observe the rules of copy right.

3.9 Operational definition of variables

There are two variables that were considered in this study, the independent and dependent variables. The information is shown in the table below.

Table 3.2

Objectives	Variables	Indicators	Measurement Scale
To determine how teachers perception influences ICT adoption in Public sec. school Webuye Sub County	**Independent** teachers perception of ICT	- attitude - perception of students use	**Nominal**
	Dependent ICT adoption in Public schools		**Ordinal**
To establish how teachers access to ICT influences it's adoption in Public sec. school Webuye Sub-County	**Independent** teachers access to ICT	- availability of Computers - availability of infrastructure	**Nominal**
	Dependent ICT adoption in Public schools		**Ordinal**
To examine the extend to which teachers preparedness influences ICT adoption in Public sec. school Webuye Sub-County	**Independent** teachers preparedness to ICT	- technical support - professional development	**Nominal**
	Dependent ICT adoption in Public schools		**Ordinal**
To assess the extend to which the teachers academic background influences ICT adoption in Public sec. school Webuye Sub-County	**Independent** teachers academic background	- training attended - early involvement in ICT	**Nominal**
	Dependent ICT adoption in Public schools		**Ordinal**

CHAPTER FOUR

DATA ANALYSIS, PRESENTATIONS AND INTERPRETATIONS

4.1 Introduction

This chapter covers the findings, presentations and discussions of the results for the study on "The factors influencing the use of e-learning among public secondary school teachers in Webuye sub-county, Bungoma County in Kenya". The main sub headings include instrument return rate, demographic characteristics of the respondents, teachers' perception in using e-learning in secondary schools, levels of ICT access of teachers in using e-learning in secondary schools, levels of preparedness of the teachers in using e-learning in secondary schools and teachers academic background in using e-learning in secondary schools in Webuye sub-county, Bungoma County

4.2 Instrument Return Rate

This study targeted secondary schoolteachers, principals and zonal education officers within Webuye sub-county. Table 4.1 shows the distribution and return rates of respondents for this study.

Table 4.1; Questionnaire Return rate

Target category	Number targeted	Number responded	Return rate (%)
Teachers	100	95	95.00
Principals	25	20	80.00
Zonal education officers	5	3	60.00
Total	**130**	**118**	**90.77**

Out of 130 questionnaires and interview schedules administered to the secondary schoolteachers, principals and zonal education officers, 118 were responded to representing a return rate of 90.77% (118/130x100).

The return rate was high since the study coincided with the normal school operations since the schools were in session. Principals and zonal education officers were also available due to the appointments booked by the researcher in advance.

4.3 Demographic Characteristics of the Respondents

This section presents the demographic characteristics of the respondent with the aim of establishing the general background of the respondents that participated in the study. The areas that to be discussed include gender, age, teaching experience, respondents teaching subjects and how long the respondent had served in the position.

4.3.1 Respondents by Gender

An item was included in the questionnaire which sought information on the gender of the secondary school teachers responding to the survey. Out of the 95 interviewed, 52 which represents 54.7% were male and 43 which represented 45.3% were female as shown in table 4.2. From the study, it was revealed that there was no large variations in the composition of teacher by gender.

Table 4.2; Gender

Gender	Frequency	Percentage
Male	52	54.7
Female	43	45.3
Total	**95**	**100.0**

However the slight variation observed reflects the reality that exists in the educational institutions in Kenya. For a long time there has been concerted efforts to attain gender parity in the institutions targeting pupils, students, teachers and other actors in the education sector.

4.3.2 Respondents by age

The study also sought to estimate the range of age of the secondary school teachers. 6.3% were below 30 years old, 28.4% were between 31-35 years old, 40.0% were between 36-45 years old, 20.0% were between 46-55 years old and 5.3% were over 55 years old. Table 4.3 summarizes the distribution of respondents by age.

Table 4.3; How old are you?

	Frequency	Percent
30 years or less	6	6.3
31-35 years	27	28.4
36-45 years	38	40.0
46-55 years	19	20.0
More than 55	5	5.3
Total	**95**	**100.0**

From the study, it was revealed that the majority of the secondary teachers were between 36 and 45 years of age. Teachers in this age range are believed to be at peak of their carrier. Those who are below 30 years are believed to be teachers who were recently employed and teach subjects with acute shortage of teachers since the government teacher employment policy stipulates that employment be done strictly based on need.

4.3.3 Respondents by teaching experience

An item that read "For how long have you been teaching since you left college (teaching experience)?" was included to gauge the level of the teachers' teaching experience. The table 4.4 shows 3.2% of the teachers have taught for less than one year, 45.7% of officials had attained primary school education, 41.6% secondary education while 11.6% have attained college or university level education.

Table 4.4; Teaching experience

	Frequency	Percent
Less than 1 year	3	3.2
1-3 years	20	21.1
4-7 years	40	42.1
8-10 years	27	28.4
More than 10	5	5.3
Total	**95**	**100.0**

A similar study conducted in Thailand by Stamper (2002) commented that classroom teachers have only incidental knowledge of ICT use. Teachers recruited to fill teacher shortages in Thailand during the 1970s were not required to have a teaching degree or to take pre-service courses in appropriate uses of new technologies. Teachers of this cohort currently hold lead instructor positions, have seniority on school teaching staffs, have little incentive to adopt new teaching methods. Acquiring ICT skills now will not affect their rank, assignments, or pay scale. Practicing teachers need to find pedagogically sound ways to apply technology in the classroom. This is difficult to do when one is not familiar with it and has no motivation to adopt its use (Stamper, 2002).

4.3.4 Respondents' teaching subjects

The study had a question item that read "which subject(s) do you teach the target class?" Table 4.5 summarized the number of teachers by subjects they teach.

Table 4.5; Respondents' teaching subjects

	Frequency	Percent
Languages (English or Kiswahili)	8	8.4
Mathematics	19	20.0
Sciences (Biology, Physics or Chemistry)	25	26.3
Technical subjects (woodwork, metalwork etc)	22	23.2
Computer Studies	14	14.7
Other	7	7.4
Total	**95**	**100.0**

In terms of learning, it has been argued that a few subjects are being intrinsically changed because of ICT. For example learning *science* is increasingly related to having access to scientific databases, with information-sharing over the network, and with the use of digital devices for data processing. *Language* and *societal communications* are being modified because of the presence of Internet (i.e. chats, e-mail, forums and digital newspapers) and of handheld devices with communication capabilities.

4.4 Teachers perception and the ICT adoption in secondary schools

A question item that read 'Do you consider that ICT use during lessons has a positive impact on the following aspects?' was included in the study instrument to obtain the responses of the respondents on whether there is a positive impact on the use of ICT during the lessons. The responses were weighted on lickert scale then the average (mean) weights obtained and compared to corresponding response on lickert scale.

Table 4.6 shows that the respondents believed that there was a somehow positive impact on the use of ICT during the lessons on the aspects such as students' concentration on their learning, students feeling more autonomous in their learning, facilitating collaborative work between students and improving the class climate where students are more engaged. These aspects scored a mean weight of 3. However, the respondents felt there was a little positive impact of the ICT use during lessons on such aspect as students understanding more easily what they learn remembering more easily what they have learned. These two aspects scored a mean weight of 2.

Table 4.6; Impact of ICT during lessons

	Strongly disagree	Disagree	Agree	Strongly agree	$\sum f_i$	$\sum f_i \square_i$	$\sum f_i \square_i / \sum f_i$
	1	2	3	4			
a) Students concentrate more on their learning	5	13	40	37	95	299	3.15
b) Students feel more autonomous in their learning	1	11	46	37	95	309	3.25
c) Students understand more easily what they learn	9	37	37	12	95	242	2.55
d) Students remember more easily what they've learnt	3	17	46	29	95	208	2.19
e) ICT facilitates collaborative work between students	6	18	37	34	95	289	3.04
f) ICT improves the class climate (students more engaged)	5	9	48	33	95	299	3.15

The study sought to find out the extent to which the respondents agree with statements about students use of ICT. The question item was ' to what extend do you disagree or

agree with each of the following statements about the use of ICT at school? The weighted mean for the responses was computed using the lickert scale where a strong agreement was awarded 4 and a strong disagreement was awarded 1. Table 4.7 summarizes the findings where retrieval of information, working in a collaborative way and learning in an autonomous way had an average weight of 3 which indicate a general agreement that ICT helps the students in these tasks. The respondents seemed not to agree that ICT should be used by students to do exercises and practice. This aspect scored mean weight of 2.55 indicating a slight disagreement.

Table 4.7; Use of ICT by students

	Strongly Agree	Agree	Disagree	Strongly disagree	$\sum f_i$	$\sum f_i \omega_i$	$\sum f_i \omega_i / \sum f_i$
Weights (ω_i)	4	3	2	1			
Do exercises and practice	12	38	35	10	95	242	2.55
Retrieve information	27	49	14	5	95	288	3.03
Work in a collaborative way	30	44	16	5	95	289	3.04
Learn in autonomous way	36	44	14	1	95	306	3.22

A broad but useful generalization about teachers' attitudes towards ICT is that of considering three basic categories of teachers: innovators, resistant and mainstream. Many discussions inside Enlaces use these categories when reviewing training results and considering possible modifications. Innovators will rapidly recognize the potential of ICT in education, will be willing to explore its uses with their students and in their professional duties (i.e. management) in the early stages of the training process. They will also be willing to become responsible for administrative and technical tasks related to the equipment (i.e. running the technology lab). Innovators are normally the ones who volunteer for the first training courses and participate in the pilot stages of the ICT program. The schools' ICT coordinator will normally be a volunteer from this group.

Working only with innovators at the beginning of an ICT Program can be very deceiving for policy- makers because this group's active commitment is not necessarily shared by the rest of the teachers in all schools. Enlaces learned during its evolution, which included an increasing number of mainstream teachers, that progress with them is much

more difficult to achieve. Policy-makers should be aware that although innovators can play a great role in having a "working demo" running at early stages, the expectancies created by them may not be fulfilled in the next up scaling level, when less committed teachers become involved in the program.

Table 4.8; Positive impacts of ICT use in teaching and learning

	Strongly Agree	Agree	Disagree	Strongly disagree	$\sum f_i$	$\sum f_i \omega_i$	$\sum f_i \omega_i / \sum f_i$
Weights (ω_i)	4	3	2	1			
Motivation	38	40	14	3	95	303	3.19
Achievement	32	44	17	2	95	296	3.12
Higher order thinking skills	32	39	19	5	95	288	3.03
Competence in transversal skills	28	37	22	8	95	276	2.91

Teacher anxiety over being replaced by technology or losing their authority in the classroom as the learning process becomes more learner-centered—an acknowledged barrier to ICT adoption—can be alleviated only if teachers have a keen understanding and appreciation of their changing role.

To underscore the relevance of ICT use, the researcher presented a question item that read "to what extend do you disagree or agree with each of the following statements about the use of ICT at school?" Table 4.9 shows that weighted mean was above three implying that the respondents agreed ICT use in teaching and learning is essential to prepare students to live and work in the 21st century and that for ICT to be fully exploited for teaching and learning radical changes in schools are needed.

Table 4.9; Relevance of ICT use

	Strongly Agree	Agree	Disagree	Strongly disagree	$\sum f_i$	$\sum f_i \omega_i$	$\sum f_i \omega_i / \sum f_i$
	4	3	2	1			
ICT use in teaching and learning is essential to prepare students to live and work in the 21st century	43	35	14	3	95	309	3.25
For ICT to be fully exploited for	47	35	9	4	95	152	3.32

teaching and learning radical
changes in schools are needed.

The responses from the interview schedule summarized from interviewing the school principals and education officers indicated that they too were in agreement that the teachers' perception in the use of ICT in e-learning had a tremendous influence.

Teachers are key players in any educational innovation effort inside the classroom. Therefore, Enlaces (Links), the Chilean ICT program in education developed since 1990 focused on a teacher training and support strategy that presently lasts for two years (and several additional activities beyond the second year) in each school; this strategy carefully considers how to best develop teachers' ICT skills as well as their self-confidence in classroom uses of ICT. Depending upon their attitude towards technology, teachers might be grossly classified as innovators, resistant, or mainstream. Consequently, training strategies should address the special needs and attitudes about technology of all three groups. Achieving significant uses of technology inside the classroom is still a major challenge worldwide, and there is no reported breakthrough on this (Pedro et al, 2004).

ICT as applied in the study contributes to generating skills that prepare adolescents, including young entrepreneurs and workers, for employment opportunities in the 21st century. This was found in the vocational training projects that train people for specific technical jobs. Equally, the training institutions described in the study directly contribute to MDG8 by producing knowledge workers with specific ICT skills. In 2007, 75% of the participants indicated that they had experienced an improvement in their employment opportunities (IICD, 2007).

Field researchers have learned that teachers work under a given social and cultural context that is a key influence in the way they perceive and use ICT for their personal and professional practices. One notable measure of the social and cultural pressure on Chilean teachers to use ICT is that 64% of them own a PC and 41% of them have an Internet connection at home. In addition to the social and cultural context, teachers' perception of ICT in education is also influenced by their own experience and opportunities to use ICT for personal or professional reasons. In our experience, it seems necessary that teachers

understand and discuss the stages involved in their own process of becoming proficient in the variety of uses of these technologies (Pedro et al, 2004).

In Enlaces project, besides technical skills, training also considers a number of other factors that might affect teachers' decision to use ICT in the classroom. These factors can be grouped into the following two levels of barriers: the "first order barriers" comprise a number of aspects that are extrinsic to teachers: access to technology, time for practice, technical support, resources and content, and training. Even if all these barriers were removed, most teachers would not automatically use technology. The "second order barriers" are intrinsic to teachers: attitudes, beliefs, practices and resistance. Teacher beliefs mediate their planning and classroom practices, in particular the belief about their level of ability to use ICT in classrooms. Self-efficacy, the belief about one's capability to perform actions at a given level, is based on the level of skill possessed and on judgments about what can be done with current skills.

"Without skill, performance is not possible, without self-efficacy performance may not be attempted" (Pedro et al, 2004)

Many good teachers are resistant to ICT with good and strong reasons that must be taken into account. Although many of them may never get actively involved in using computers in a lab (but may use a screen projector in their classroom), they will undoubtedly provide a healthy and necessary tension that will impose on policy-makers the need to use rigorous arguments in favor of ICT in schools. Also, these teachers can play a critical role against wholesale promises of improvements in education due to the introduction of computers and the Internet. Some of them may become active in resisting change, and because ICT programs are bound to have failures sooner or later at many levels (i.e., poor hardware maintenance, incompetent teacher trainers, etc.), and more so at larger scales, these failures will provide good ammunition for these teachers.

Some of these teachers' arguments against using ICT in education are that these technologies represent a threat to their professional status because they will diminish their role (i.e. stories about software that might substitute for them), will degrade their relationship with students and will take over initiative and control within the classroom to the detriment of teachers. Other teachers are simply not willing to make changes in their teaching praxis because they perceive it adequate as it is; still others are simply afraid of

using computers and similar technologies such as TV recorders, cameras and screen projectors ("technophobes"). There is also the case of many schools with large classes (e.g. more than 40 children per room) without enough computers, poor Internet bandwidth, unreliable networks, inadequate software and other problems directly related with the technology that constitute a barrier for the teachers.

However, a teacher might carry a resistant attitude mainly because of a low level of confidence in his or her abilities. Enlaces encouraged its trainers to design exercises and tasks that provide early success (no matter how small) to increase confidence. Success stories from other teachers might not be helpful to one with a low confidence level. Rather, simple administrative applications and off-classroom uses might be a good way to start with them. For example, keeping student's marks in a spreadsheet or sending e-mail to friends and relatives are easy-to-learn exercises that provide immediate reward that may strengthen self-confidence (Pedro et al, 2004).

4.5: Level of access to ICT

The study sought to explore the availability of the ICT infrastructure in the secondary schools because this has a direct effect on the use of e-learning. The uptake of e-learning is not possible unless the necessary equipment and supporting infrastructure is present in the schools. Therefore to obtain this information from the respondents, a research question that read like this "when you use computers and/or internet during class teaching in front of the students, which equipment is available?" was put to be responded to and responses presented as shown in table 4.10.

Table 4.10; Availability of equipment

Statement	YES (%)	NO (%)
a) Students are equipped with computers and/or internet	9.5	90.5
b) Only the teacher use a computer and/or internet	5.3	94.7
c) Both, teacher and students, use computers and/or internet.	0.0	100.0
d) Has the school provided you with a laptop or tablet PC for your own use this school year?	12.6	87.4
e) ICT use in teaching and learning positively impacts on students	78.9	21.1

Another question item sought to find out the conditions of accessibility for some of the listed equipment from the respondents during their lessons. The question put was "under which conditions do you have access to the following in lessons in your class?" The responses were summarized as shown in table 4.11.

Table 4.11; Conditions for accessibility

Condition	No access (%)	Access on demand (%)	Permanent access (%)
a) Desktop computer without internet access	90.5	5.3	4.2
b) Desktop computer with internet access	90.5	8.4	1.1
c) Non-internet-connected laptop or note book computer	90.5	9.5	0.0
d)Internet-connected laptop or note book computer	91.6	8.4	0.0
e) E-reader(a device to read books and newspapers on screen)	100.0	0.0	0.0
f) Mobile phone provided by the school	81.1	12.6	6.3
g) Interactive whiteboard	100.0	0.0	0.0
h) Digital camera or camcorder	100.0	0.0	0.0
i) Computer laboratory	77.9	12.6	9.5

The findings of this study indicate that both the availability and accessibility of various equipment especially the basic ones is too low for the use of e-learning. Permanent access is non-existent for most of the equipment apart from a few like having desktop computer without internet access, with internet access, mobile phone provided by the school and a computer laboratory. There was no access for most of the equipment and where there was any, it was very low.

The school principals and the education officer admitted during their interview that there is a serious shortage and inadequate ICT equipment in the schools. They agreed that this has a direct impact on the use of e-learning in schools. Some of the gadgets and equipment are very expensive and the schools' budget are already far much stretched to accommodate the extra items with budgetary implications.

According to IICD report, any initiative, be it government, NGO or private sector based, should make lobbying for more investments in computers a priority. Most teachers, instructors and students cited insufficient access to computers as the main obstacle in ICT for education programmes. This is particularly relevant for educational institutions located in the rural areas where the school or training institution is often the only access point for computers. Although this will require massive investments in the infrastructure, it is nevertheless essential in order to guarantee equal access and overcome the digital divide (IICD, 2007).

The organization also observed that there should be introduction of combined off-line and online based applications. Access to the Internet is viewed by most as an important tool for education as it allows for easier access to online teaching and learning resources. It also facilitates networking between teachers and between students. Finally, it is an important tool to exchange administrative and management information in the sector. Internet access is recommended where services are provided at a low cost and are of acceptable quality. Yet, in many areas Internet access is either unavailable or very costly. In such cases, alternative exchange modes such as CD ROMS need to be integrated right at the start of a project (IICD. 2007).

An important role of ICT inside a school is that of providing a new framework that can foster a revision and an improvement of teaching and learning practices. Though many positive results have been reported on a small scale, there has been no breakthrough in learning improvements because of ICT on a large, replicable scale. Nevertheless, teachers and students can take advantage of the growing availability of educational resources as software packages and Web pages. Teachers will need curricula-related content and clear strategies and examples to effectively use these materials in the classroom. They will find that students can become highly motivated towards learning (and even toward regularly attending school) if technology makes up part of their classroom experience. Teachers can fruitfully use this positive attitude to explore new learning strategies in which students can be more actively involved in learning, as opposed to being simply passive information receivers.

Collaborative, project-based and self-paced learning are just a few alternatives amply documented and particularly appropriate to use when ICT are present. Primary and

secondary students with special talents (i.e. mathematics, music or literature) will find a vast amount of digital tools and resources as well as groups of similarly inclined youngsters all over the world with whom to share and develop their talents. On the other hand, students with special needs will also find resources and tools for remedial or self-paced learning. This can have a particularly high impact on more deprived and culturally isolated schools where primary students have fewer information resources and learning opportunities (Pedro et al, 2004).

However, it is important to emphasize that it is not the presence of technology in itself (or of outstanding and guaranteed learning software, if such thing exists) that will stimulate significant changes inside a school. Without teacher involvement, most students in primary levels in particular, but also in higher levels may not take advantage of all the available potential on their own. Teachers need to become active participants for effective ICT educational use, such as providing guidance, help and usage rules for the students. Teachers are needed to organize the learning spaces and to guide toward the achievement of significant learning objectives.

In developing countries, students often do not acquire sufficient mathematical skills, a basic understanding of scientific concepts or an adequate reading comprehension level during their school years. ICT provides tools and content to exercise these abilities, which will be needed to take advantage of the vast amount of content present in today's networks. Information processing skills to transform data (i.e. searching, selecting, synthesizing and communicating information) into knowledge is rapidly becoming a basic requirement for the emergent information society. If ICT policies are closely related to the curriculum, teachers will more likely use them for learning practices in classrooms. Therefore, curriculum designers should consider the inclusion of ICT as transversal themes, i.e. in all curricular sectors, and in the curriculum-specification guidelines that will be used by teachers. It is not advisable to have ICT as separate, isolated technical subjects or sectors in the curriculum (e.g. programming, software tools and hardware configurations), because in this atmosphere, teachers will tend to regard ICT as special subjects and may not integrate them in their normal practice. Rather, ICT should be included as teaching and learning resources, along with examples of how to use them in classrooms, in all sectors, and in this way, turning them, explicitly, into a tool for all teachers in all grades and subject areas (Pedro et al, 2004).

4.6: Level of the teachers' preparedness and use of ICT adoption

The study sought to find out the level of teachers' preparedness and how it impacts on the use of e-learning. Starting point for the researcher was to find out whether participation in ICT training is compulsory for a teacher in a subject? Table 4.12 shows that only 13.7% of the respondents responded in the affirmative while 86.3% responded in the negative.

Table 4.12; Compulsory ICT training

	Frequency	Percent
Yes	13	13.7
No	82	86.3
Total	**95**	**100.0**

The study also sought to underscore the need for professional training in ICT. Several areas of professional development in ICT were explored. The question put to the respondents went like this "In the past two school years, have you undertaken professional development in the following areas?" The responses to this question item are summarized in table 4.13.

Table 4.13; Professional training in ICT

Areas of professional development	YES (%)	NO (%)
a) Introductory courses on internet use and general applications (word processing, spreadsheets, presentations, databases, etc)	35.8	64.2
b) Advanced courses on applications(advanced word processing, complex relational databases, virtual learning)	29.5	70.5
c) Advanced courses on internet use(creating websites/home page, video conferencing, etc)	20.0	80.0
d) Equipment specific training(interactive whiteboard, laptop etc)	12.6	87.4
e) Courses on pedagogical use of ICT in teaching and learning	21.1	78.9
f) Course on multimedia(using digital video, audio equipment etc)	0.0	100.0
g) Course on multimedia(using digital video, audio equipment etc)	0.0	100.0

		18.9	81.1
h) ICT training provided by school staff		18.9	81.1
i) Personal learning about ICT in your own time		26.3	73.7
j) Other professional development opportunities related to ICT		24.2	75.8

The findings on this question item paints a gloomy picture on the teachers preparedness in using ICT and hence e-learning. This is because the necessary basic skills to undertake the task seem to be lacking generally. Very little has been done to ensure that the teachers are well equipped and prepared to deliver the subject content on a new platform of ICT.

A follow question item to corroborate the above response was "In total, how much time have been involved during the past two school years in the above professional development opportunities?" Table 4.14 indicates that 73.7% of the respondents reported not have been involved in any professional development opportunities in the past two years.

Table 4.14; Time involved in professional training

	Frequency	Percent
No time at all	70	73.7
Less than 1 day	1	1.1
1-3 days	4	4.2
4-6 days	4	4.2
More than 6 days	16	16.8
Total	**95**	**100.0**

To determine how much support the teachers obtain from various people within the school set up, the researcher posed a question item "what type of support do the following provide you when you use ICT in lessons?" In cases where there is use of ICT during the lessons, most of the respondents reported that they received support from a more experienced teacher within the school followed by a school ICT or technology coordinator. Very little support is received from other personnel within the school as shown in table 4.15

Table 4.15; Support received within the school

Support	Response (%)			
	Rarely/ never used	Mostly technica support	Mostly technical support	Mostly pedagogical support
a) A more experienced or knowledgeable teacher	21.1	33.7	30.5	14.7
b) School ICT/technology coordinator	55.8	23.2	15.8	5.3
c) Other school staff	80.0	7.4	6.3	6.3
d) Experts from outside the school	84.2	7.4	5.3	3.2
e) An online help desk, community or website	77.9	5.3	9.5	7.4

Lastly, on the aspect of teachers' preparedness, the study wished to ascertain the teachers' input towards the improvement of ICT and enhancing e-learning within their respective schools. To obtain the responses, the question item read "do you share with your colleagues, the school head and other staff, the same vision about integrating ICT in teaching and learning at your school?" It was found out that only 30.5% of the respondents did while 69.5% did not as shown in table 4.16.

Table 4.16; Share vision for ICT integration

	Frequency	Percent
Yes	29	30.5
No	66	69.5
Total	**95**	**100.0**

Teachers and instructors need to be trained in basic ICT skills and ICT-based teaching methods to feel comfortable about using the materials. It is equally important to train them to integrate ICT in their teaching methods. There should also be support networking among teachers where teachers need to be supported to set up platforms that enable them to share their opinions, experiences and teaching materials with other teachers. Face-to-face and virtual exchanges are both equally important to motivate teachers and improve the quality of local materials.

The interview schedule findings also revealed that the necessary support for the teachers to implement e-learning was lacking hence hampering the efforts that would see the

successful uptake of the ICT use. School principals and education officers concurred that technical assistance would make teachers better placed to incorporate ICT use during their lessons.

A similar study conducted by IICD observed that networking between projects at the country level is also very valuable. For this, the national ICT for development networks supported by IICD represent one possible approach. Cross-country exchanges are also important as a way to motivate and promote the exchange of experiences in ICT for education projects and programmes. For more sustained learning, online communities of practice for practitioners can be an additional option (IICD, 2007).

Whether provided by in-school staff or external service providers, or both, technical support specialists are essential to the continued viability of ICT use in a given school. While the technical support requirements of an institution depend ultimately on what and how technology is deployed and used, general competencies that are required would be in the installation, operation, and maintenance of technical equipment (including software), network administration, and network security. Without on-site technical support, much time and money may be lost due to technical breakdowns.

In the Philippines, for example, one of the major obstacles to optimizing computer use in high schools has been the lack of timely technical support. In some extreme cases involving schools in remote areas, disabled computers take months to be repaired since no technician is available in the immediate vicinity and so the computers have to be sent to the nearest city hundreds of kilometers away.

Besides regular teachers, a fundamental player in the present Enlaces policy is the "ICT Coordinator," a specially trained teacher, normally an early adopter and technology enthusiast. These professionals have a special role in infusing ICT inside schools, supporting teachers and keeping the hardware and software up-to-date and workable. Enlaces has recognized the importance of this cadre for the proper integration of ICT inside a school, and it has gradually increased its long-term support to them. In terms of teacher training, the Chilean experience might be similar to that of many developing countries. Enlaces started in the early 1990s when no pre-service teacher training institution (mainly Faculties of Education) considered ICT for teaching and learning. After more than a decade of introducing ICT into the educational system, and with more

than 90% of the student population having access to ICT in their schools, still very few Chilean Faculties of Education consider this to be an issue. The reasons are complex and manifold and are addressed by several studies, in particular the recent OECD Report and others which highlight the weak professional preparation of Chilean teachers. This situation has become a national priority and presently the Ministry of Education is aiming to reform pre-service teacher training (Pedro et al, 2004).

As a consequence of the above situation, at the beginning of Enlaces the vast majority of teachers were not prepared to use ICT in schools, and few of them had had the opportunity or the means to learn on their own. On the other hand, given the scarcity of financial resources in many schools, it was also not realistic to expect schools to design or contract for professional development programs to train their teachers. Hence, to begin integrating ICT in schools in a reasonable time, the Ministry of Education decided to provide in-service professional training and support to teachers, through centrally funded programs and strategies (Pedro et al, 2004).

Perhaps the most important lesson from past initiatives is that a technology-centered policy, i.e. one that focuses primarily on deploying machines, software and Internet connections, will not produce meaningful results or the expected impact on students learning. Although machines and networks are a fundamental component in any ICT policy, to achieve effective gains in student's learning, improved teaching practices and more efficient management at all levels (classroom, school, district and nation), the focus should reside on people and how to improve and develop their skills and practices with the help of ICT (Pedro et al 2004).

The ICT Coordinator is a teacher with special ICT training who has a central role in the school's long-term use of the technology. After Enlaces has finished training teachers at a school, these professionals will be essential in promo ting the school's autonomy with regard to ICT decisions, priorities and investments. They also maintain a permanent link with other Enlaces initiatives in order for schools to participate. Some of the functions of the ICT Coordinator include, first, technology-to practice basic preventive maintenance of equipment (cleaning, inventory checks); hardware, network and software configuration. School interface with local or national hardware and software providers. Selecting and purchasing hardware and operating system upgrades. Administrative and

educational software; maintaining virus protection and Internet content filters, according to teachers' needs. The second function is pedagogy-to coordinate computer lab and software uses according to teachers' needs. Assisting teacher training processes, facilitating and preparing resources and supplies and also performing training. Helping to identify new uses of ICT inside the school and assisting teachers in implementing them. The third function is administrative-to deal with school priorities and investments and negotiating the ICT budget with the school administrators (IICD, 2007).

In the Enlaces experience, coordinators readily took care of the hardware and basic support to teachers for general purpose uses: word processors, spreadsheets and presentation software. However, support for ICT use on subject specific content teaching is more complex, and it requires a deeper involvement from the subject teacher. Coordinators can help in looking up web sites or searching for subject-related software in the market. However, pedagogical decisions about how and when to use a particular software or web site for learning purposes are more suitably in the hands of the subject teachers and the curriculum experts in each school (Pedro et al, 2004).

One major problem in Chile has been the negotiation with school managers to pay for the ICT Coordinators' time. Schools with low budgets and a computer room often first try a teacher volunteer system, which in our experience almost always fades away with time because of the high demands on teachers' time. Usually, only after a number of negotiations and with evidence of equipment failure and low usability rates, will school administrators start spending on an ICT Coordinator. To reinforce the importance of having an ICT Coordinator in each school, Enlaces has linked future investments such as lab upgrades (paid by the state) to the provision of paid coordination time (paid by the school). This is a plan that has proven successful in large schools, but needs constant monitoring in small and medium-sized schools (Pedro et al 2004).

4.7: Teachers academic background

To obtain information on the teachers' academic background in relation to e-learning and access to ICT, the researcher presented statements on various aspects of ICT that were considered core in the adoption of e-learning. the first set of statements explored the level of the respondents' interaction with ICT or e-learning during their time in secondary schools and training colleges. Table 4.16 summarizes the responses given by the

respondents on the question 'when you were in high/secondary school, which of the following statements best describes the use of ICT in the school you attended? Table 4.17 gives a summary of the respondents' responses on how they were affected during their school days by the various listed situations. Lastly, the study sought to find out whether the respondents received various trainings on ICT and e-learning listed during their years in training as teachers. Table 4.18 illustrates the responses as given by the respondents.

Table 4.17; E-learning during secondary schools

Statements	Response (%)		
	No access	Access on demand	Permanent access
a) Desktop computer without internet access were available	75.8	17.9	6.3
b) Desktop computer with internet access were available	87.4	8.4	4.2
c) Non-internet-connected laptop, tablet PC or note book computer were provided	100.0	0.0	0.0
d) Internet-connected laptop, tablet PC or note book computer were provided	100.0	0.0	0.0
e) E-reader(a device to read books and newspapers on screen) was available	100.0	0.0	0.0
f) Mobile phone was provided by the school	100.0	0.0	0.0
g) Interactive whiteboard were used	100.0	0.0	0.0
h) Digital camera or camcorder was available	100.0	0.0	0.0
i) Computer laboratory was available	61.1	28.4	10.5

Please indicate whether each of the following affected you during your school years?

Table 4.18; How affected during school years

	Response (%)				
	Never	Rarely	Undecided	Often	Very often
a) Cost of Computers too high	4.2	15.8	8.4	47.4	24.
b) Too Busy/Don't have time at home	52.6	29.5	7.4	6.3	4.2
c) Don't know how to use the Computer	8.4	16.8	5.3	35.8	33.7

d) Don't have access to Computer training	5.3	9.5	8.4	41.1	35.8
e) Not interested in technology	28.4	18.9	22.1	22.1	8.4

When you were in the training college, which of the following statements best describes the use of ICT in the college you attended and whether you were trained on each aspect?

Table 4.19; Types of ICT trainings in training college

Statements	YES (%)	NO (%)
Introductory courses on internet use and general applications (word processing, spreadsheets, presentations, databases, etc)	21.1	78.9
Advanced courses on applications(advanced word processing, complex relational databases, virtual learning)	11.6	88.4
Advanced courses on internet use(creating websites/home page, video conferencing, etc)	10.5	89.5
Equipment specific training(interactive whiteboard, laptop etc)	5.3	94.7
Courses on pedagogical use of ICT in teaching and learning	9.5	90.5
Subject-specific training on learning applications(tutorials, simulations)	5.3	94.7
Course on multimedia(using digital video, audio equipment etc)	0.0	100.0
ICT training provided by school staff	8.4	91.6

The findings reveal that indeed there was a very inadequate exposure to ICT and e-learning by the teachers during their years in high schools and training colleges. This is a clear indicator of how ill prepared the teachers are in adoption of e-learning and ICT in secondary schools.

Teacher professional development should have five foci: 1) skills with particular applications; 2) integration into existing curricula; 3) curricular changes related to the use of IT (including changes in instructional design); 4) changes in teacher role(5) underpinning educational theories. Ideally, these should be addressed in pre-service teacher training and built on and enhanced in-service. In some countries, like Singapore, Malaysia, and the United Kingdom, teaching accreditation requirements include training in ICT use. ICTs are swiftly evolving technologies, however, and so even the most ICT

fluent teachers need to continuously upgrade their skills and keep abreast of the latest developments and best practices (TOJET, 2010).

While the first focus—skills with particular applications—is self-evident, the four other foci are of equal, if not ultimately greater, importance. Research on the use of ICTs in different educational settings over the years invariably identify as a barrier to success the inability of teachers to understand why they should use ICTs and how exactly they can use ICTs to help them teach better. Unfortunately, most teacher professional development in ICTs are heavy on "teaching the tools" and light on "using the tools to teach." (TOJET, 2010).

These findings also seem to agree with observations by the TICE project in Burkina Faso which targeted twelve secondary schools and empowered them to a level at which they would be able to integrate ICTs more successfully in their education cycle. This was achieved through awareness raising, by providing capacity development and technical assistance, and through content development. Both teachers and students benefited from their newly acquired IT-skills. Teachers involved in the project developed a website themselves to create a pool of teaching materials that was available online. The project also generated experiences that could be fed into the development of the Education policy of Burkina Faso. The TICE website (www.tice-burkina.bf) won second prize in the national competition for the best website which took place during the National Internet 2007 week in Burkina Faso (IICD, 2004).

CHAPTER FIVE

SUMMARY OF THE FINDINGS, CONCLUSION AND RECOMMENDATION

5.1 Introduction

This chapter covers summary of the findings, discussion of results and conclusions drawn from the study as well as recommendations based on the study findings and suggestions for further studies.

5.2 Summary of the Findings

At the classroom level, teachers can more easily keep student's marks and their personal and academic records permanently up-to-date, as well as produce all required data for school administration and for parents, using preformatted documents. Most importantly, teachers can maintain their subject content (lesson plans, exercises, evaluation) in digital format, making it easy to update, to share with other teachers and to enhance with time. In fact, the many ways tools such as a computer, a handheld device or a portable keyboard (and a network) can help a teacher in administrative tasks is one of the more convincing arguments to make to inexperienced teachers so they will accept training eagerly.

This should be carefully considered during teacher-training planning because before pedagogical use in the classroom, many teachers may prefer to become familiarized first with the technology outside the classroom. This can often be facilitated greatly by starting out with software applications or simple devices such as portable keyboards or handhelds that can be of immediate use. It is relatively easy to learn how to use these machines to store text in a portable keyboard, to construct spreadsheets, or to make use of word processing to record students' marks and records.

Although, some research studies have shown that ICT has a huge impact on the ways in which principals work (Yuen, Law & Wong, 2003; Schiller, 2003), the ICT research literature has largely ignored the role of principals as technology leaders (Schiller, 2003; Michael, 1998). This gap in the research literature is rather strange because many research studies related to school improvement, school effectiveness, and change showed that school principals play an important role in creating successful changes in schools (Schiller, 2003). According to Schiller (2003), school leaders are key factors in ICT

implementation in schools. They have to shoulder the heavy responsibility for creating changes in schools through the use of ICT and facilitating the process of making complicated decisions to integrate it in schools (Schiller, 2003).

Although the role of the principal in supporting technology integration is very important, there are a few researches conducted on the role of the principal in ICT implementation. Also, little is known about the use of ICT by principals and the factors that are related to their level of computer use.

5.3 Conclusions

Based on the findings the study made the following conclusions guided by the study objectives;

The first objective was to determine how teachers' perception influences e-learning in secondary schools in Webuye sub-county, Bungoma County. ICT are versatile and powerful tools that can help in this purpose and should therefore be present in every classroom, library and teacher room. Schools should profoundly revise present teaching practices and resources to create more effective learning environments and improve life-long learning skills and habits in their students. It must be said, however, that so far ICT have not provided any large-scale breakthrough in learning improvements. They are still promises with great potential.

The second objective sought to determine how teachers access of ICT influences e-learning in secondary schools in Webuye sub-county, Bungoma County. For teachers, networks provide a medium to establish fluent links among peers from schools worldwide. Teachers can benefit greatly from sharing their experiences, problems and queries with colleagues in same situations. Of similar importance is the growing field of e-learning, with the availability of a large number of training courses for teachers delivered through the Internet, thus providing new means for professional development regardless of the teacher's workplace.

The third objective was formulated to determine the extent to which teachers' preparedness influences e-learning in secondary schools in Webuye sub-county, Bungoma County. Following the ICT experience, it is desirable for an ICT program to

become an initiative with ample participation and with explicit roles for several constituencies, particularly teachers, school owners and administrators, the private sector, parents, universities and politicians. Finally, given the complexities and many problems that will have to be addressed, a gradual approach to the full development of the ICT Program is advisable.

The fourth study objective determined the extent to which teachers' academic background influenced e-learning in secondary schools in Webuye sub-county, Bungoma County. There was inadequate exposure to ICT and e-learning by the teachers during their years in high schools and training colleges. This is a clear indicator of how ill prepared the teachers are in adoption of e-learning and ICT in secondary schools.

5.4 Recommendations

Based on the findings and conclusions the study made the following recommendations; that;

The national and county governments should show more interest in imbibing information communication and technology (ICT) and supply the necessary ICT equipment to all secondary schools through improved funding for the purchase of ICT equipment.

Governments should improve the training of principals, teachers and computer personnel on the use of computers and other ICT equipment through seminars, workshops and in-service training.

Principals should be encouraged to use ICT equipment for the effective management of their schools. This could be done through improved usage of computers and other ICT materials supply to their schools for the storage and retrieval of data on staff and students as well as for data analysis.

To effectively infuse into the schools' culture, and to be considered relevant by teachers and school administrators, a comprehensive ICT policy should be part of an effort towards improving the equity and quality of an educational system. Also, educational initiatives ought to be coordinated through all administrative and

operational levels in order to effectively send coherent messages to teachers, parents and administrators.

Emphasis should be aimed at developing a long term program effective for continuous commitment to training and use of instructional technologies. Teachers and administrators must have clear and positive incentives for participating in ICT in-service. For example, the Ministry of Education (MOE) should provide such incentives as tuition for advanced college coursework (delivered on-site by satellite) or promotion in rank.

Delivery of instruction should be site-based over an extended period of time, so that teachers can develop and use materials and methods with their students. There should be a provision for delivery and support methods through reliable distance delivery and support to local schools. Both hardware and software support at the local level is critical to site based delivery of in-service training.

5.5 Suggested areas for Further Study

i.   The socio-economic factors that influence the uptake of e-learning in public secondary schools.

ii.   The role of e-learning in preparation of adequate skilled manpower to speared the country towards the realization of vision 2030.

iii. ICT adoption in educational institutions has brought gains and losses. A critical analysis of both the gains and losses arising from ICT adoption in institutions.

REFERENCES

Aceto, S., Dondi, C. and Kugemann, W.F. (eds.). (2004). Technologies for the Knowledge Society and Lifelong Learning. Key Findings and Suggestions for Action", POLE project report, MENON Network EEIG, Brussels. http://www.education-observatories.net/eduobs.

Amutabi, N. (2010). Political cost of ICT in learning in Kenya. *Journal of Educational Management*. **133**: 21-32.

Barbieri, M. and Light, P. (2005). Interaction and performance on a computer-based task. *Learning and Instruction*. **2:** 199–213.

Bartolini, M. G. and Borba, M. C.,(2010). The Role of Resources and Technology Education. ZDM Mathematics Education. 42:1-4.

Baskin, C. and Williams, M. (2006). ICT integration in schools: Where are we now and what comes next? Australasian Journal of Educational Technology, 22(4), 455-473. http://www.ascilite.org.au/ajet/ajet22/baskin.html.

BECTA. (2004). A review of the research literature on barriers to the uptake of ICT by teachers. British Educational Communications and Technology Agency, retrieved September 9, 2007, from http://www.becta.org.uk/page_documents/research/barriers.pdf

Bell, J. (2005). Doing your research project. 4th edn. Berkshire: Open University Press. Best, K. and Kahn, J. (1998). Research in education, 8th edn. Boston: Allyn and Bacon.

Beynon, J. (2007). Computers, dominant boys and invisible girls: Or, 'Hannah, it's not a toaster, it's a computer!. In John Beynon and Hughie Mackay (Eds.), Computers into classrooms: More questions than answers (pp. 160– 189). London: Falmer Press.

Broos, A. (2010). Information and communication technologies (IT) in schools. *Cyber Psychology and Behaviour*. **8 (1):** 21-31.

Brown, C. (2002). Electronic portfolios in education– distinguishing between process and product. In C. Crawford et al. (Eds.), Proceedings of Society for Information

Technology and Teacher Education International Conference 2002 (pp. 539-543). Chesapeake, VA: AACE.

Brownlee, J., Purdie, N. and Boulton-Lewis, G. (2001). Changing epistemological beliefs in teacher education. Teaching in Higher Education. **6**: 247-268.

Bryson, H., Mary, P. and de Castell, S. (2008). Learning to make a difference: New technologies and in/equity. *Mind, Culture, and Activity: An International Journal*. **3:** 119– 135.

Burgelman, J-C and Punie, Y. (2006) Information, Society and Technology, pp. 17-33, in E. Aarts and J-L. Encarnação (Eds.), True Visions: The Emergence of Ambient Intelligence, Springer Verlag: Berlin, Heidelberg, New York.

Cartelli, A. (ed.) (2006) "Teaching in the Knowledge Society: New skills and instruments for teachers", Information Science Publishing: Hershy, USA and London, UK.

Cawthera, A. (2001). *Computers in Secondary Schools in Developing Countries: Costs and Other Issues* (No. 12831): Department for International Development (DFID) (UK).

Centre for Information Technology in School and Teacher Education, CITSTE. (2009). *An integrated approach to bridging the digital divide through supporting the development of e-educational leadership*. Hong Kong: The University of Hong Kong.

Chua, S., Chen, D. and Wong, A.F.L. (2009). Computer anxiety and its correlates: a meta-analysis. Computers in Human Behavior. **15**: 609-623.

Clariana, R.B. and Schultz, C.W. (2011). Content achievement in computer-based instruction. *Journal of Computers and Science Teaching*. **12(3/4)**: 277-288

Coffey, A. and Atkinson, P. (1996). Making sense of qualitative data. Thousand Oaks: Sage Publications.

Colardyn, D. and Bjornavold, J. (2004). Validation of Formal, Non-Formal and Informal Learning: policy and practices in EU Member States. *European Journal of Education*. **39(1)**: 69-89.

Collis, B. and Jung, I.S. (2008). Uses of information and communication technologies in teacher education. In B. Robinson and C. Latchem (Eds.), *Teacher Education through Open and Distance Learning* (pp. 171-192). London: Routeledge Falmer.

Collis, B.A., Kass, H. and Kieren, T. (2009). National trends in computer use among Kenyan tertiary college students: Implications for cross-cultural analyses. *Journal of Research on Computing in Education*. **133**: 77–89.

Cradler, J., Bridgforth, E. and West, Ed. (2002). Recent research on the effects of technology on teaching and learning. Retrieved 25/10/2002, from www.wested.org/techpolicy/research.html.

Cuckle, P., Clarke, S. and Jenkins, I. (2000). Students' information and communications technology skills and their use during teacher training. Journal of Information Technology for Teacher Education. **9**: 9-22.

David, K., Mbowa, A., and Paul, O.R. (2003). Application of ICT in Schools: A Kenyan Experience. Schoolnet Africa. [Online] Available at http://www.schoolnetafrica.org/fileadmin/resources/Application_of_ICTs_in_S chools.pdf (accessed July 19, 2009).

Davies, C. (2008). Digital Technologies: A Review of Research and Projects", Futurelab Report Series No. 13, Bristol: Futurelab. http://www.futurelab.org.uk/.

Davis, F. (1986). A technology acceptance model for empirically testing new end-user information systems: theory and results. Doctoral dissertation, Sloan School of Management, Massachusetts Institute of Technology.

Davis, F., Bagozzi, R. and Warshaw, P. (1989). User acceptance of computer technology: A comparison of two theoretical models. Management Science. **35**: 982-1003.

de Castell, S., Bryson, M. and Jenson, J. (2022). Object lessons: Towards an objective education between teachers and students at online learning.. January 11, 2012. Online at: http://firinformation and technologyonday.org/issues/issue7_1/castell/ index.html.

Decosas, L. (2001). Computer attitudes as a function of age, gender and attitude, and developmental status. *Journal of Educational Computing Research.* **25 (4):** 367 -384.

Dey, I. (1993). What is qualitative analysis? Qualitative data analysis: A user friendly guide for social scientists. London: Routledge.

Dhariwal, M.(2010). Developing Mathematical Concepts for E-learning by Engaging Multiple Intelligences: A Proposal for a New Framework – CRIB. Designing for Children –with Focus on 'Play + Learn' http://www.manuj-dhariwal-designingforchildren.ptf 21/9/2010.

Dugdale, S., DeKoven, E. and Mi-Kyung, J. (1998). Computer course enrollment, home computer access, and gender: Relationships to high school students' success with computer spreadsheet use for problem solving in pre-algebra. *Journal of Educational Computing Research*. **18(1):** 49–62.

Ellsworth, E. (1989). Why doesn't this feel empowering? The repressive myths of critical pedagogy. *Harvard Educational Review*. **59 (3):** 279– 324.

ELNORD (2006). eLearning Nordic 2006", Edited by Pedersen, S.G., Malmberg, P., Christensen, A.J., Pedersen, M., Nipper, S., Græm, CD., Norrgård, J. and Ramboll Management. Copenhagen: Ramboll Management. www.ramboll-management.com

Epstein, M. (2002). Using information effectively in education.http://tiger.towson.edu/users/mepstel/researchpaper.htm

Ertmer, P. A., Conklin, D., Lewandowski, J., Osika, E., Selo, M., and Wignall, E. (2003). Increasing preservice teachers' capacity for technology integration through use of electronic models. Teacher Education Quarterly. **30**: 95-112.

Fisher, T., Higgins, C. and Loveless, A. (2011). Teachers Learning with Digital Technologies: A Review of Research and Projects, Futurelab Report Series No. 14, Bristol: Futurelab. http://www.futurelab.org.uk/.

Fraser, J.W. (1986). Perceptions of classroom climate in a communicative computer supported approach in writing instruction. *Journal of Research and Development in Education*. **29**: 32-45.

Galanouli, D. and McNair, V. (2001). Students' perceptions of ICT-related support in teaching placements. *Journal of Computer Assisted Learning*. **17**: 396-408.

Galanouli, D. and McNair, V. (2009). Students' perceptions of ICT-related support in teaching placements. *Journal of Computer Assisted Learning,* **17**: 396-408.

Gareis, K. (2006). Benchmarking lifelong learning and eLearning in Regions: Measuring what really counts", Paper for the eChallenges 2006 Conference, 25-27 October, Barcelona. http://www.euser-eu.org.

Gattiker, U. (2009). Where do we go from here? Directions for future research and managers. In U. Gattiker (Ed.), Women and technology. New York: Walter de Gruyter.

Gaudron, J.P. and Vignoli, E. (2002). Assessing computer anxiety with the interaction model of anxiety: development and validation of the computer anxiety trait subscale. Computers in Human Behavior 18, 315-325.

Georgia, H. (2011). Teens and technology: Preparing for the future. *New Directions for Youth Development.* **111**: 133-140.

Gill, R., and Grint, K. (1995). The gender-technology relation: Contemporary theory and research. Bristol, PA: Taylor and Francis Inc.

Goyal, A. (2001). Women in computing: historical roles, the perpetual glass ceiling, and current opportunities. *IEEE Annals of the History of Computing.* **18(3):** 122-129.

Granger, C., Morbey, H., Owston, R. and Wideman, H. (2002). Factors contributing to teachers' successful implementation of IT. *Journal of Computer Assisted Learning.* 18, 480-488.

Graziadei, W. D. (1993). Virtual Instructional Classroom in Science(VICES). Research, Education, Service and Teaching (REST). http://en.wikipedia.org/wiki/E-learning 21/9/2010

Gredler, M.E. (1997). Learning and instruction: Theory into practice (3rd ed). Upper Saddle River, NJ: Prentice-Hall.

Guha, S. (2007). Are we all technically prepared? Teachers' perspectives on the causes of comfort or discomfort in using computers at elementary grade teaching, *Annual Meeting of the National Association for the Education of Young Children Atlanta*, GA, November 8-11, 2000.

Harrison, A.W., Rainer, R.K., Hochwarter, W.A. (2009). Gender differences in computing activities. *Journal of Social Behavior and Personality.* **12**: 849-868. Retrieved September 17, 2003, from Academic Search Premier database.

Hassana, R.A. and Woodcock, A. (2010). E-Learning and ICT Curriculum in Primary Schools: Differences and Similarities between United Kingdom and Saudi Arabia. http://www.elearning.com/ 21/9/2010.

Heitlinger, A. (2007). Women's equality, demography, and public policies: A comparative perspective. New York: St. Martin's Press.

HELIOS (2005a) "Is eLearning improving access to learning opportunities? HELIOS Thematic Report No. 1, May 2005, MENON Network EEIG, Brussels. http://www.educationobservatories.net/helios.

HELIOS (2005b) "Is eLearning improving employability of European citizens?" Document for the Second HELIOS Seminar, Helsinki, 21.06.05, MENON Network EEIG, Brussels. http://www.education-observatories.net/helios.

HELIOS (2006) "HELIOS Yearly Report 2005-2006" edited by Aceto, S., Delrio, C. and Dondi, Cl., MENON Network EEIG, Brussels. http://www.education-observatories.net/helios

Hennessy, S. and Onguko, B. (2012). *Developing use of ICT to enhance teaching and learning in East African schools: a review of the literature*. Cambridge and Dar es Salaam: Faculty of Education, University of Cambridge and Aga Khan University Institute for Educational Development - Eastern Africa.

Huffaker, D. (2003). Reconnecting the Classroom: E-learning Pedagogy in US Public High Schools. Australian Journal of Educational Technology. 19 (3) 356 – 370

Kaino, L.M. (1997). The analysis of gender differences in attitudes towards the study of maths among secondary and high school students in Swaziland. Unpublished Research Report.

Kaino, L.M., and Mazibuko, N.L. (2001). Relationship between instructional practices, classroom discipline and academic performance in Swaziland schools. *UNISWA Research Journal of Agriculture, Science and Technology*. **5(1)**: 14-20.

Kenya SchoolNet. (2009). Preparing a Workforce for the Evolving Information Economy: A Survey on ICT Access and Use in Kenya Secondary Schools. Summit Strategies Limited, Nairobi.

Kerre, M.N. (2006). Secondary Education won't Be Free, says Ps. East African Standard 16th October.

Kidwell, P. A., Ackerberg - hastings, A., and Roberts, D. L., (2008). Tools of American Mathematics Teaching, (1800 – 2000). Baltimore: John Hopkins University Press.

King, J., Bond, T. and Blandford, S. (2002). An investigation of computer anxiety by gender and grade. *Computers in Human behavior*. **18:** 69-84.

Kothari, C.R. (2005). Research methodology: Methods and techniques. Daryaganj, New Delhi: New Age International (P) Ltd.

Leach, J. and Moon, B. (2010). *Globalization, digital societies and school reform: realising the potential of new technologies to enhance the knowledge, understanding and dignity of teachers*. Paper presented at the 2nd European Conference on Information Technologies in Education and Citizenship: A Critical Insight.

Lee, M. (2007). Gender, group composition and peer interaction in computer based cooperative learning. Journal of Educational Research, 9, 549– 577.

Levin, H.M., Glass, G.V. and Meister, G. (2009) Cost-Effectiveness of Four Educational Interventions. Project Report 84 – A111. School of Education, Stanford University. Quoted in Bakia, op cit.

Light, P. (2006). Computers for learning: Psychological perspectives. *Journal of Child Psychology and Psychiatry*. **38(5)**: 497– 504.

Liverpool, L.S.O. (2009). Information and communication technology in teacher education. In *Teacher Education in Nigeria: Past Present and Future - Proceedings of the First Teachers' Summit*. Kaduna: National Teachers' Institute.

Lock, J. (2007). Immigration and integration: ICT in preservice teacher education. Contemporary Issues in Technology and Teacher Education. **7**: 575-589.

May, T. (2001). Social research: issues, methods and process, (3rd ed.). Berkshire: Open University Press.

McMillan, J. and Wergin, J. (2006). Understanding and evaluating educational research. (3rd ed.). Sydney: Pearson.

McNair, V. and Galanouli, D. (2002). Information and communications technology in teacher education: can a reflective portfolio enhance reflective practice? Technology, Pedagogy and Education, **11**: 181-196.

Merriam, S. (1998). Qualitative research and case study applications in education. San Francisco: Jossey-Bass.

Miles, M. and Huberman, A. (1994). Qualitative data analysis. 2nd edn. Thousand Oaks, CA: Sage.

Ministry of Education Science and Technology. (MOEST). (2008). Report of the Task Force on Affordable Secondary Education, Shrand Publishers, Nairobi.

Mishra, P. and Koehler, M. (2006). Technological Pedagogical Content Knowledge: a framework for teacher knowledge. *Teachers College Record*. **108**: 1017–1054.

Mohammad, A. (2003). Education case study, ASPBAE research on information and communication technology (Bangladesh), Asian South Pacific Bureau of Adult Education (ASPBAE), Dhaka Ahsania Mission-2003.

Mugenda, O.M and Mugenda, A.B (1999) *Research Methods-Quantitative and Qualitative Approaches*. Nairobi: Act Press

Naismith, L., Lonsdale, W.R. and Vavoula, G. (2004). Literature Review in Mobile Technologies and Learning", Futurelab Report Series No. 11, Bristol: Futurelab. http://www.futurelab.org.uk/

OECD (2005) "E-learning in Tertiary Education. Where do we stand?" OECD: Paris.

OECD (2006) "Are students ready for a technology-rich world? What PISA studies tell us",
OECD: Paris.

OECD. (2006). Are students ready for a technology-rich world? What PISA studies tell us.
OECD: Paris.

Okwako, K.L. (2006). Teachers discovering computers—integrating technology into the
classroom, Boston, MA: Thomson Course Technology.

Omanga, H. and Davis, F.D. (2009). Perceived usefulness, perceived ease of use and user
acceptance of information technology in Kenya. MIS Quarterly. **13(3)**: 319-339.

Ottesen, E. (2006). Learning to teach with technology: authoring practiced identities.
Technology. *Pedagogy and Education*. **15**: 275-290.

Oxford English Dictionary Online (2007). Oxford University Press. Retrieved August 20,
2007.

Pelgrum, L.P. (2011). Assessing the Impact of Technology in Teaching and Learning: A
Sourcebook for Evaluators (edited by Jerome Johnston, University of Michigan,
and Linda Toms Barker, Berkeley Policy Associates), Institute for Social
Research at the University of Michigan, January 2011,
http://www.dlrn.org/star/sourcebook.html.

Prensky, M. (2001). Digital natives, digital immigrants. *On the Horizon*. **9**: 1-6.

Punie, Y. and Cabrero, M. (2006). The Future of ICT and Learning in the Knowledge
Society." Report on a Joint DG JRC/IPTS-DG EAC Workshop held in Sevilla,
20-21 October 2005, DG JRC-IPTS, European Communities, March 2006.
http://www.jrc.es.

Ramboll Management (2005). The use of ICT for learning and teaching in initial Vocational
Education and Training. Study for the European Commission DG Education
and Culture, November 2005.

Ramboll Management (2005). The use of ICT for learning and teaching in initial Vocational
Education and Training", Study for the European Commission DG Education
and Culture, 2005.
http://ec.europa.eu/programmes/elearning/doc/studies/ict_in_vocational_en.pdf.

Reform-based and Traditional Mathematics Textbook. The journal of Special
Education,41:145-157

Ridgway, J.; Mc Cusker, S. and Pead, D. (2004). Literature Review of E-Assessment",
Futurelab Report Series No. 10, Bristol: Futurelab. http://www.futurelab.org.uk/

Rubens, W. and Heinze, O. (2010). Portfolio as a tool for academic education and professional development: problems and challenges", IVLOS Institute of Education, Utrecht University. http://www.teLearning.nl/papereportfoliocambridge.rtf.

Shiundu, P.A. and Omulando, K.L. (1992). Financing secondary education programme in Kenya. Retrieved http://www.clickafrique.com.24th July 2002.

Silverman, D. (2006). Interpreting qualitative data. (3rd ed.). London: Sage Publications.

Sime, D. and Priestley, M. (2005). Student teachers' first reflections on information and communications technology and classroom learning: implications for initial teacher education. *Journal of Computer Assisted Learning*. **21**: 130-142.

Smarkola, C. (2007). Technology acceptance predictors among student teachers and experienced classroom teachers. *Journal of Educational Computing Research*. **37**: 65-82.

Sood, S., and Jitendra, A. K. (2007). A Comparative Analysis of Number Sense Instruction in

Steketee, C. (2005). Integrating ICT as an integral teaching and learning tool into teacher training courses. Issues in Educational Research, 15(1), 101-113. Retrieved October 20, 2007, from http://www.iier.org.au/iier15/steketee.html

Stephenson, B., and Fisher, H. (1995). Women into trades and technology: A training profile. Ontario: Ministry of Colleges and Universities.

Stockley, D (2006). Implementing e-learning – an "how to". El Magazine 2(7). http://derekstockley.com.au/e-learning-definition.html 21/9/2010

Sutton, R. (2007). Equity and computers in the schools: A decade of research. *Review of Educational Research*. **61**: 475–503.

Taylor, L. (2004). How student teachers develop their understanding of teaching using ICT. *Journal of Education for Teaching*. **30**: 43-56.

Thompson, J. (2007). Is education 1.0 ready for web 2.0 students? Innovate: Journal of Online Education.

Wang, Y. (2002). When technology meets beliefs: Preservice teachers' perceptions of the teachers role in the classroom with computers. *Journal of Research on Technology in Education*. **35**: 150–161.

Ward, L. (2003). Teacher practice and the integration of ICT: Why aren't our secondary school teachers using computers in their classrooms? Paper presented at NZARE/AARE 2003, 1- 13.

Wetzel, D. R., (2009) Mathematics Teaching Strategy that Challenges Students. http://www.suite101.com/ 21/9/2010

Wikipedia (2010). E-Learning. http://en.wikipedia.org/wiki/E-learning 21/9/2010.

Wozney, L., Venkatesh, V. and Abrami, P. (2006). Implementing Computer Technologies: Teachers' Perceptions and Practices. *Journal of Technology and Teacher Education*. **14**: 173-207.

Zhiting, Z. and Hanbing, Y. (2001). ICT and teacher education: Towards an integrated approach. Paper presented at the UNESCO-ACEID International Conference on Education: Using ICT for quality teaching, learning and effective management, Bangkok, Thailand. Retrieved October 20, 2007, from http://www2.unescobkk.org/elib/publications//ICTPreservice.pdf.

APPENDICES

A: INTRODUCTION LETTER

<div align="right">

SHIHUNDU LORNA NYAKOWA

P.O. BOX,

WEBUYE.

</div>

Dear Sir/Madam,

RE: RESEARCH QUESTIONNAIRE

I am a Master of Arts student at the University of Nairobi specializing in Project Planning and Management. My research project title is *"Factors influencing ICT adoption among public secondary school teachers: A case of Webuye Sub-county, Bungoma County, Kenya".*

In order to gather data for the research, I have prepared a questionnaire to be filled by the teachers in secondary schools within Webuye Sub-county. I kindly request your assistance in this academic endeavour by filling this questionnaire. I would like to emphasize that your responses are extremely valuable to me and I would greatly appreciate you answering all the questions.

I assure you that the information provided here will be held in confidence.

Thank you in advance for your cooperation.

Thank you.

SHIHUNDU LORNA NYAKOWA

B: QUESTIONNAIRE FOR TEACHERS

SECTION A: PERSONAL INFORMATION

In this section, you are kindly requested to provide your personal information by ticking(√) where appropriate.

A1. What is your gender?

1) ☐   Female   2) ☐   Male

A2. How old are you?

1) ☐   30 years or less

2) ☐   31-35

3) ☐   36-45

4) ☐   46-55

5) ☐   More than 55

A3. Name of school...

A4. For how long have been teaching since you left college (teaching experience)?

1. ☐   Less than 1 year

2. ☐   1-3 years

3. ☐   4-7 years

4. ☐   8-10 years

5. ☐   More than 10

A6. Which subject(s) do you teach the target class? (Tick where applicable)

1. ☐   Languages (English or Kiswahili)

2. ☐   Mathematics

3. ☐   Sciences (Biology, Physics or Chemistry)

4. ☐   Technical subjects (woodwork, metalwork etc)

5. ☐   Computer Studies

6. ☐   Other, specify..

SECTION B: TEACHERS PERCEPTION IN ICT ADOPTION

In this section, you are kindly requested to give your response about your perception of e-learning in secondary schools by ticking(√) where appropriate.

B1. Do you consider that ICT use during lessons has a positive impact on the following

aspects?

Aspect	Please tick (√) appropriately			
	Strongly disagree	Disagree	Agree	Strongly agree
a) Students concentrate more on their learning	☐	☐	☐	☐
b) Students feel more autonomous in their learning	☐	☐	☐	☐
c) Students understand more easily what they learn	☐	☐	☐	☐
d) Students remember more easily what they've learnt	☐	☐	☐	☐
e) ICT facilitates collaborative work between students	☐	☐	☐	☐
f) ICT improves the class climate (students more engaged, less disturbing)	☐	☐	☐	☐

B2. To what extend do you disagree or agree with each of the following statements about the use of ICT at school? (Tick where applicable)

Statements	Please tick (√) appropriately			
	Strongly agree	Agree	Disagree	Strongly disagree
ICT should be used by students to;				
▪ Do exercises and practice	☐	☐	☐	☐
▪ Retrieve information	☐	☐	☐	☐
▪ Work in a collaborative way	☐	☐	☐	☐
▪ Learn in a autonomous way	☐	☐	☐	☐
ICT use in teaching and learning positively impacts on students;	☐	☐	☐	☐
▪ Motivation	☐	☐	☐	☐
▪ Achievement	☐	☐	☐	☐
▪ Higher order thinking skills(critical thinking , analysis, problem solving)	☐	☐	☐	☐
▪ Competence in transversal skills (learning to learn, social competences etc)	☐	☐	☐	☐
ICT use in teaching and learning is essential to prepare students to live and work in the 21st century.	☐	☐	☐	☐
For ICT to be fully exploited for teaching and learning, radical changes in schools are needed.	☐	☐	☐	☐

SECTION C: LEVEL OF ACCESS TO ICT

In this section, you are kindly requested to give your response concerning the level of access to ICT by both teachers and students (Tick (√) where appropriate).

C1. When you use computers and/or internet during class teaching in front of the students, which equipment is available? *Tick yes or no for each*

Statements	Please tick (√) appropriately	
	YES	NO
Students are equipped with computers and/or internet	☐	☐
Only the teacher use a computer and/or internet	☐	☐
Both, teacher and students, use computers and/or internet.	☐	☐
Has the school provided you with a laptop or tablet PC for your own use this school year?	☐	☐
ICT use in teaching and learning positively impacts on students;	☐	☐

C2. Under which conditions do you have access to the following in lessons in your class?

Statements	Please tick (√) appropriately			
	No access	Access on demand	Permanent access	Other
Desktop computer <u>without</u> internet access	☐	☐	☐	☐
Desktop computer <u>with</u> internet access	☐	☐	☐	☐
Non-internet-connected laptop, tablet PC or note book computer	☐	☐	☐	☐
Internet-connected laptop, tablet PC or note book computer	☐	☐	☐	☐
E-reader(a device to read books and newspapers on screen)	☐	☐	☐	☐
Mobile phone provided by the school	☐	☐	☐	☐

Interactive whiteboard	☐	☐	☐	☐
Digital camera or camcorder	☐	☐	☐	☐
Computer laboratory	☐	☐	☐	☐

SECTION D: LEVEL OF THE TEACHERS' PREPAREDNESS

In this section, you are kindly requested to give your response concerning the level of preparedness, skills, experience and professional development in e-learning(Tick (√) where appropriate).

D1. Is participation in ICT training compulsory for a teacher in your subject? *Tick yes or no*
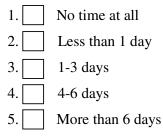
1. ☐ YES

2. ☐ NO

D2. In the past two school years, have you undertaken professional development in the following areas? *Tick yes or no for each*

Statements	Please tick (√) appropriately	
	YES	NO
Introductory courses on internet use and general applications (word processing, spreadsheets, presentations, databases, etc)	☐	☐
Advanced courses on applications(advanced word processing, complex relational databases, virtual learning environment etc)	☐	☐
Advanced courses on internet use(creating websites/home page, video conferencing, etc)	☐	☐
Equipment specific training(interactive whiteboard, laptop etc)	☐	☐
Courses on pedagogical use of ICT in teaching and learning	☐	☐
Subject-specific training on learning applications(tutorials, simulations, etc)	☐	☐
Course on multimedia(using digital video, audio equipment etc)	☐	☐

ICT training provided by school staff	☐	☐
Personal learning about ICT in your own time	☐	☐
Other professional development opportunities related to ICT	☐	☐

D3. In total, how much time have been involved during the past two school years in the above professional development opportunities? *Tick one box only*

1. ☐   No time at all
2. ☐   Less than 1 day
3. ☐   1-3 days
4. ☐   4-6 days
5. ☐   More than 6 days

D4. What type of support do the following provide you when you use ICT in lessons?

Statements	Please tick (√) appropriately			
	Rarely/ never used	**Mostly technical support**	**Mostly pedagogical support**	**Both technical and pedagogical support**
A more experienced/knowledgeable teacher	☐	☐	☐	☐
School ICT/technology coordinator	☐	☐	☐	☐
Other school staff	☐	☐	☐	☐
Experts from outside the school	☐	☐	☐	☐
An online help desk, community or website	☐	☐	☐	☐

D5. Do you share with your colleagues, the school head and other staff, the same vision about integrating ICT in teaching and learning at your school? *Tick yes or no*

1. ☐   YES

2. ☐   NO

SECTION E: TEACHERS ACADEMIC BACKGROUND

In this section, you are kindly requested to give your response concerning your academic background (Tick (√) where appropriate).

E1. When you were in high/secondary school, which of the following statements best describes the use of ICT in the school you attended?

Statements	Please tick (√) appropriately			
	No access	Access on demand	Permanent access	Other
Desktop computer <u>without</u> internet access were available	☐	☐	☐	☐
Desktop computer <u>with</u> internet access were available	☐	☐	☐	☐
Non-internet-connected laptop, tablet PC or note book computer were provided	☐	☐	☐	☐
Internet-connected laptop, tablet PC or note book computer were provided	☐	☐	☐	☐
E-reader(a device to read books and newspapers on screen) was available	☐	☐	☐	☐
Mobile phone was provided by the school	☐	☐	☐	☐
Interactive whiteboard were used	☐	☐	☐	☐
Digital camera or camcorder was available	☐	☐	☐	☐
Computer laboratory was available	☐	☐	☐	☐

E2. Please indicate whether each of the following affected you during your school years? Please tick as many as apply

5 =Very often, 4=Often, 3=Undecided, 2= Rarely,1=Never

Aspect	Please tick (√) appropriately				
	5	4	3	2	1

a) Cost of Computers too high				
b) Too Busy/Don't have time at home				
c) Don't know how to use the Computer				
d) Don't have access to Computer training				
e) Not interested in technology				

E3. When you were in the training college, which of the following statements best describes the use of ICT in the college you attended and whether you were trained on each aspect?

Statements	Please tick (√) appropriately	
	YES	NO
Introductory courses on internet use and general applications (word processing, spreadsheets, presentations, databases, etc)	☐	☐
Advanced courses on applications(advanced word processing, complex relational databases, virtual learning environment etc)	☐	☐
Advanced courses on internet use(creating websites/home page, video conferencing, etc)	☐	☐
Equipment specific training(interactive whiteboard, laptop etc)	☐	☐
Courses on pedagogical use of ICT in teaching and learning	☐	☐
Subject-specific training on learning applications(tutorials, simulations, etc)	☐	☐
Course on multimedia(using digital video, audio equipment etc)	☐	☐
ICT training provided by school staff	☐	☐

Thank You Very Much For Participating In This Study

God Bless You

C: INTERVIEW SCHEDULE FOR PRINCIPALS AND EDUCATION OFFICERS

1. Do you consider that ICT use during lessons has a positive impact on the overall teaching in secondary schools?

2. What is your comment on the use of e-learning and the general attitude of teachers in using e-learning?

3. Which ICT equipment is available for the use in e-learning in your schools?

4. Are there conditions that affect access to various ICT equipments during lessons in class?

5. Is participation in ICT training compulsory for teachers in your schedule?

6. In the past two school years, have teachers undertaken professional development in various aspects of e-learning?

7. In total, how much time have teachers in your school been involved during the past two school years in various professional development opportunities?

8. Do you share with your colleagues, the school head and other staff, the same vision about integrating ICT in teaching and learning at your school?

9. In your opinion, are teacher training colleges adequately preparing teachers to use e-learning in their practice afterwards?