

**TECHNOLOGY IN ENHANCING 21ST CENTURY LEARNING SKILLS IN
PUBLIC SECONDARY SCHOOLS IN KENYA**



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Masters of Education in Measurement and Evaluation

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DECLARATION

This project is my original work that has not been presented for a degree in any other University.

Signed.....

Date.....

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E58/71723/2011

This research Project has been submitted for examination with my approval as University Supervisor.

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DEDICATION

I am grateful to almighty God whose power has made me come this far.

My special thanks goes to my loving husband Thomas Mbogo ,my children Lincoln (Kaka), Ryan(Giggs) and Abby (Jiku) who saw me through the entire course with undying love, encouragement, support and patience that boosted my morale.

Special tribute goes to my late dad Johannes Mbaka who kept on encouraging me to love education and to further my studies whenever opportunity arose. Special tribute also goes to my mum Saveria and my siblings who stood by me all through.

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I would also like to thank the Head teachers, teachers and students who took part in the study.

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ABSTRACT

The purpose of this study was to investigate the possibilities of technology in transforming 21st century learning skills in schools. The study sought to fulfil the following objectives: determine whether education system is ICT enabled for integration in schools, determine whether ICTs integration enhances students' development of 21st century learning skills, examine whether the curriculum has incorporated ICT assessments and whether it addresses 21st century skills and to examine whether teachers do adopt new pedagogies that embrace 21st century skills.

The researcher used case study design where the research structure included intensive and in-depth investigation on an issue at hand in a relatively small sample. The researcher used simple random sampling technique with forty teachers participating in the study whereby each school had one teacher involved from their schools. A total of eighty students participated in the study and eighteen head teachers. This study was conducted by the researcher using prepared questionnaires which respondents were school teachers, head teachers and students. Quantitative data was analyzed through descriptive statistics using the statistical package for social sciences (SPSS) version 18.0. the raw data was presented through percentages, mean, standard deviation and frequencies. The results were displayed by use of bar charts graphs and pie charts in prose-form.

The study revealed that education system was not technology enabled. 66% of teachers were in opposition to contribute positively towards the development of 21st century learning skills. As to whether integration of technology enhances students' development of 21st century skills, was too early in the education system to tell. Further curriculum has yet to incorporate IT assessment. This as well mean that curriculum as it is structured, is yet to adopt to address 21st century skills. Teachers are to adopt to modern approaches that incorporate 21st century skills. Study recommended that government should give priority to technology and how it can be adopted to enhance 21st century skills.

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ABBREVIATIONS AND ACRONYMS

ICT	Information Communication Technology
MOE	Ministry of Education
Moest	Ministry of Education Science and Technology
SPSS	Statistical Package for Social Scientist
KESSP	Kenya Education sector Support Programme
CAL	Computer Aided Learning

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

Education systems have undergone major changes worldwide creating a disjuncture between the centuries that have past and the one that is emerging. The educational demand of this new century require a new paradigms shifts of thinking, teaching and learning which will bring authentic connection with learners due to their ability to gather information through technology (Bill Sheskey,2010).Technology has contributed greatly to educational management in schools globally (Zhao and Frank, 2003). Unfortunately, many schools hardly use technology to manage the quality of output, or to raise teacher productivity. This has resulted to a slow rate of adoption of technology despite its promise and potential for use in educational management in schools. ICTs can be valuable for storing and analysing data on education indicators; students ‘assessments, physical and human infrastructure; and cost and finance (Campbell and Sellbum, 2002).

21st Century Learning” has become an integral part of educational discourse. According to (Keengwe, Onchwari &Wachira, 2008; Kozma, 2003; Zhao, 2009) schooling needs to be fundamentally reconfigured to emphasize higher order cognitive processes such as critical thinking, creative problem solving, curiosity, and adaptability these skills can be achieved by use of technology. This is because ICT is observed as modern and relevant to 21stcentury learners. More so, use of computer related technology is particularly helpful to, administrators and policy makers who can construct virtual scenarios around different policy options to determine needs and analyze potential consequences. Each scenario can be analyzed and evaluated systematically, not only in terms of educational desirability, but also in terms of financial afford-ability, feasibility and sustainability over a sufficient period of time to show results.

21st century learning is not a singular “thing” that can be plugged into an existing school environment and used as an easy upgrade to improve existing practice. The education that the past century learners have experienced is no longer appropriate for preparing today’s learner for a global market. For this reason, proponents of 21st century education argue

that the world can no longer seek to reform education; education must be transformed into something entirely different (Berry & Team, 2011; Schlechty, 2011; Jacobs, 2010). Huge social changes, such as growing diversity and population mobility, present educators with new and constantly changing circumstances. As a result, the characteristics which defined the successful education systems of, say, 1975, are unlikely to be those which will define success in the future. “The effect of high stakes assessments has resulted in many school districts shifting focus from resource rich curriculum and best practice instruction to a focus on what is tested, thus diminishing the standards and subject areas that are not assessed.

In many instances, this has led to the narrowing of curriculum and in-depth instruction necessary for meaningful student learning (Marzano (2010). The explosion of knowledge about the brain and the nature of learning, combined with the growing power of technology, create the potential to transform even the most fundamental unit of education -the interaction of the teacher and the learner. Moreover, huge social changes, such as growing diversity and population mobility, present educators with new and constantly changing circumstances. As a result, the characteristics which defined the successful education systems of, say, 1975, are unlikely to be those which will define success in the future. (OECD2003a: 115). For us to achieve the desired learning, there should be new paradigms shift for 21st century skills that includes; curriculum, pedagogies, assessment and policy in ICT implementation in a school organization. In other words teachers and students should not only know how to use technological tools but also how to construct things of significance with those tools.

According to (Abbey, 2004), countries such as Australia and Japan are on the cusp of a combined pedagogical and technological revolution with profound and far-reaching consequences for education and training and the economy and society. This revolution is comparable to the last great pedagogical transition that took shape in the 1500s when printing made an unprecedented era of educational change possible (McClintock, 1992). Seismic advances in ICT and in access to it has enabled the economies of developed countries, including the UK’s, to shift from a basis of material goods and services to one of information and knowledge (Lisbon Council, 2007; Cisco, Intel and Microsoft, 2008).

Whereas the possession of detailed facts and figures was once a passport to a professional job or a university place, there is now much more emphasis on what people can do with the knowledge they can access (Silva, 2009) and on interpersonal skills.

The implementation of ICT as a teaching and learning tool will help to create a Context for new teaching methodologies, helping to illuminate for teachers how the new pedagogy is supported by ICT. To help practitioners integrate skills into the content we must develop a unified, collective vision for learning known as the framework for 21st century learning. This frame work should describe the skills, knowledge and expertise students must master to succeed in work and in life. The partnership of 21st century skills (CISCO) developed a comprehensive framework that identifies specific skills, content knowledge, expertise and literacy's that must be put in place if learning has to be transformed. the partnership identified five critical support systems to ensure students mastery of 21st century skills; 21st century standards, 21st century curriculum and instruction, assessment of 21st century skills ,21st century professional development and 21st century learning environments.

1.2 Statement of the Problem

According to Prensky (2003) for the first time in human history, the young are more confident and more fluent with the dominant technologies of the times than the adults charged to teach them. One of the main obstacles is the enormous resistance to change among educators, policy makers, industry leaders, parents, and even many students. There have been many efforts to create change in our educational system, all fraught with conflict. Some of the current efforts are trying to create change without actually changing they are trying to take attributes of the 21st century and force fit them into the 19th and 20th century ways of designing and delivering education.

The MOE policy is to integrate ICT in education and training in order to prepare learners for the 21st century education and knowledge. According to PISA, school systems are not outstandingly successful in preparing students for the kinds of abilities and skills that build the foundation for lifelong learning. New knowledge and skills necessary for successful adaptation to a changing world are continuously acquired throughout life” (PISA, 2003b),

Learning with ICT is aimed at enabling learners to acquire knowledge and skills that they can use effectively.

Similarly the extent to which ICT has been deployed in secondary school managerial systems needs to be assessed. ICT introduction as outlined in MoEST and KESSP (KESSP 2005-2010), and the Constitution of Kenya emphasizes that the youth should have access to quality and relevant education and training. This study is interested in assessing the possibilities arising as a result of technology in enhancing 21st century learning skills in public secondary schools and if the system is prepared for and can change as desired.

1.3 Purpose of the Study

The purpose of this study was to investigate the possibilities of technology in transforming 21st century learning skills in education in public secondary schools.

1.4 Objectives of the Study

The objectives of this study were to:

- i. Determine whether education system is ICT enabled in schools.
- ii. Determine whether ICTs integration enhances students' development of 21st century skills in schools.
- iii. Examine whether the curriculum has incorporated ICT assessments and if it addresses 21st century skills in schools.
- iv. To examine whether teachers do adopt new pedagogies that embrace 21st century skills in schools.

1.5 Significance of the Study

In order to achieve the desired learning, there should be new paradigms shift for 21st century skills that includes; curriculum, pedagogies, assessment and policy in ICT implementation in a public schools organization. In other words teachers and students should not only know how to use technological tools but also how to construct things of significance with those tools.

This study will therefore be important in devising ways and means of integrating ICT in education and training in order to prepare learners for the 21st century education and knowledge. Therefore, the findings of this study will have a practical implication for the policy of school systems in preparing students for the kinds of abilities and skills that build the foundation for lifelong learning. New knowledge and skills necessary for successful adaptation to a changing world.

1.6 Definition of Key terms

21st century skills: Refers to a broad set of knowledge, skills, work habits, and character traits that are believed by educators, school reformers, college professors, employers, and others to be critically important to success in today's world.

Academic performance: Refers to the student's level of achievement in academics.

Public Schools: School that is maintained at public expense for the education of the children of a community or district and that constitutes a part of a system of free public education commonly including primary and secondary schools

Technology: Is the making, modification, usage, and knowledge of tools, machines, techniques, crafts, systems, and methods of organization, to solve a problem, improve a pre-existing solution to a problem, achieve a goal, or perform a specific function.

Information Communication Technology: Information Communication Technology (ICT) is a generic term used to describe a range of technologies for gathering, storing, retrieving, processing, analyzing, and transmitting information.

Computer aided learning: Computer aided learning (CAL) is a powerful educational innovation that is conceived as a process of individualised learning through use of computer system.

IT: Is the application of computers and telecommunications equipment to store, retrieve, transmit and manipulate data.

CHAPTER TWO

LITERATURE REVIEW

2.1 related studies

Several studies have been carried out, related on possibilities of technology in enhancing 21st century skills in education. One of these was conducted by Sivin-Kachala and Bialo (2000), a study commissioned by the Software and Information Industry Association, they carried out 311 research studies whose objective was on the effectiveness of technology on student achievement. Their findings revealed positive and consistent patterns when students were engaged in technology-rich environments, including significant gains and achievement in all subject areas, increased achievement in preschool through high school for both regular and special needs students, and improved attitudes toward learning and increased self-esteem.

Along with expanded access has come a growing pervasiveness of technology in society. For a generation of young people, technology, particularly the Internet, has assumed a substantial stake in their social and educational lives. A recent survey conducted by the Pew Internet & American Life Project (Hitlin & Rainie, 2005) found that roughly 21 million youth between the ages of 12 through 17—approximately 87 per cent of the entire age bracket—uses the Internet. Of those 21 million online teens, 78 per cent (about 16 million students) say they use the Internet at school. This translates into 68 per cent of all teenagers, up from 47 per cent in 2000. The survey also found that most teens believe that the Internet helps them do better in school (86 per cent of teens, 88 percent of online teens).

Wilson and his colleagues at Queen's University (Wilson, 1999b; Wilson & Shula, 2001), in a four-year research project objective evidence about a student's performance did not in and of itself determine that student's grade. Novice teachers allowed their expectations about how a student might do to affect their judgements about performance. For example, if a student were showing improvement over the term, this would be rewarded with higher grades. While teachers' support for assessment based on observations, done spontaneously and without records, lacks reliability and validity in psychometric terms, it fits well with

their orientation toward a growth model for assessment. A decade ago, access to technology was limited and wiring schools was one of the nation's highest education priorities.

Ten years of substantial investments have vastly improved this picture. According to the Secretary's Fourth Annual Report on Teacher Quality, virtually every school with access to computers has Internet access (99%), compared to only 35 per cent of schools in 1994, according to the National centre for Education Statistics (NCES) (Parsad & Jones, 2005). Public schools have also made consistent progress in expanding Internet access in instructional rooms, according to NCES. In 1994, 3 per cent of public school instructional rooms had Internet access, compared with 93 per cent in 2003. And between 1998 and 2003, the student-to-connected-computer ratio went from 12-to-1 to 4.4-to-1.

Sivin-Kachala and Bialo (2006) improving on a survey carried out by Pew Internet & American Life Project (Hitlin & Rainie, 2005) found that 71 percent of online teens said they relied mostly on Internet sources for the last big project they did for school and 34 percent of online young people ages 12-17 download study aides from the Internet. (Lenhart, Rainie, & Lewis, 2001). The U.S. Bureau of the Census (2003) found that 57 percent of all children in school ages 7-17 use a home computer to complete school assignments. Young people are also taking advantage of new, powerful communications tools. Three-quarters of online teens use instant messaging, representing close to 16 million youth. Of those 16 million, 78 percent say they use instant messaging from time to time to talk about homework, tests, or schoolwork.

Greater emphasis on high stakes testing has prompted greater scrutiny on what's being tested and how it relates to what students need to know to succeed in society, in part fueled by the poor performance of U.S. students on the international assessments, PISA (Stage, 2005) and TIMSS (Mullis, Martin, Gonzalez, & Chrostowski, 2004), and rising concern about the relative competitiveness of the U.S. labor force. Government leaders ranging from Education Secretary Margaret Spellings (Spellings, 2005b) to former Secretary of State Colin Powell (Kagan & Stewart, 2004a) have signaled that today's students are not prepared to compete internationally. Education and business leaders have also begun to

question whether current assessments focus too much on measuring students' ability to recall discrete facts at the cost of not adequately measuring students' ability to think critically and solve problems (Partnership for 21st Century Skills, 2005), which some researchers assert produce, at best, only illusory student gains (Ridgeway, McCusker, Pead, 2004).

A study carried out by Bruce and Levin (1997), looking at ways in which the tools, techniques, and applications of technology can support integrated, inquiry-based learning to "engage children in exploring, thinking, reading, writing, researching, inventing, problem-solving, and experiencing the world." They developed the idea of technology as media with four different focuses: media for inquiry (such as data modeling, spreadsheets, access to online databases, access to online observatories and microscopes, and hypertext), media for communication (such as word processing, e-mail, synchronous conferencing, graphics software, simulations, and tutorials), media for construction (such as robotics, computer-aided design, and control systems), and media for expression (such as interactive video, animation software, and music composition). They found strong evidence that educational technology "complements what a great teacher does naturally," extending their reach and broadening their students' experience beyond the classroom. "With ever-expanding content and technology choices, from video to multimedia to the Internet," Bruce suggests "there's an unprecedented need to understand the recipe for success, which involves the learner, the teacher, the content, and the environment in which technology is used."

In their meta-analysis review of research conducted between 1993 and 2000 on the effectiveness of DES, Murphy et al (2001) found evidence of a positive association between use of DES products and student achievement in reading and mathematics, an association consistent with earlier reviews of the research literature on the effectiveness of computer-based instruction (e.g., Kulik & Kulik, 1991; Kulik, 1994; Fletcher-Flinn & Gravatt, 1995; Ryan, 1991). Students in the early grades, from pre-K to grade 3, and in the middle school grades appear to benefit most from DES applications for reading instruction, as do students with special reading needs.

O'Dwyer, Russell, Bebell, and Tucker-Seeley (2005) found that, while controlling for both prior achievement and socioeconomic status, fourth-grade students who reported greater frequency of technology use at school to edit papers were likely to have higher total English/language arts test scores and higher writing scores on fourth grade test scores on the Massachusetts Comprehensive Assessment System (MCAS) English/Language Arts test.

Michigan's Freedom to Learn (FTL) initiative, an effort to provide middle school students and teachers with access to wireless laptop computers, has been credited with improving grades, motivation and discipline in classrooms across the state, with one exemplary school seeing reading proficiency scores on the Michigan Education Assessment Program (MEAP) test, administered in January 2005, reportedly increasing from 29 percent to 41 percent for seventh graders and from 31 to 63 percent for eighth graders (eSchool News, 2005).

In examining large-scale state and national studies, as well as some innovative smaller studies on newer educational technologies, Schacter (1999) found that students with access to any of a number of technologies (such as computer assisted instruction, integrated learning systems, simulations and software that teaches higher order thinking, collaborative networked technologies, or design and programming technologies) show positive gains in achievement on researcher constructed tests, standardized tests, and national tests.

Cavanaugh's synthesis (2001) of 19 experimental and quasi-experimental studies of the effectiveness of interactive distance education using videoconferencing and telecommunications for K-12 academic achievement found a small positive effect in favor of distance education and more positive effect sizes for interactive distance education programs that combine an individualized approach with traditional classroom instruction.

Boster, Meyer, Roberto, & Inge (2002) examined the integration of standards-based video clips into lessons developed by classroom teachers and found increases student

achievement. The study of more than 1,400 elementary and middle school students in three Virginia school districts showed an average increase in learning for students exposed to the video clip application compared to students who received traditional instruction alone.

Wenglinsky (1998) noted that for fourth- and eighth-graders technology has "positive benefits" on achievement as measured in NAEP's mathematics test. Interestingly, Wenglinsky found that using computers to teach low order thinking skills, such as drill and practice, had a negative impact on academic achievement, while using computers to solve simulations saw their students' math scores increase significantly. Hiebert (1999) raised a similar point. When students over-practice procedures before they understand them, they have more difficulty making sense of them later; however, they can learn new concepts and skills while they are solving problems. In a study that examined relationship between computer use and students' science achievement based on data from a standardized assessment, Papanastasiou, Zemblyas, & Vrasidas (2003) found it is not the computer use itself that has a positive or negative effect on achievement of students, but the way in which computers are used.

While research linking technology integration, inquiry-based teaching, and emphasis on problem solving with student achievement is emergent, some research exists that suggests a connection. In a 2001 study of Enhancing Missouri's Instructional Networked Teaching Strategies (eMints) program, a statewide technology integration initiative, eMINTS students scored consistently higher on the Missouri Assessment Program (MAP) than non-eMINTS students, including eMINTS students classified as having special needs. The higher MAP results were found to be associated with the instructional practices (Evaluation Team Policy Brief, 2002). The eMINTS program provides teachers with professional development to help integrate technology so that they can use inquiry-based teaching and emphasize critical-thinking and problem-solving skills.

The program has since expanded to not only Missouri schools and districts but also other states as well. Currently, 232 Missouri districts, 10 Utah districts, 56 Maine districts, 2 Nevada districts, and 1 Illinois district, representing 1,000 classrooms and 22,500 students

now take advantage of the eMINTS program offerings. Test results continue to show that, on most state tests, students enrolled in eMINTS classrooms scored higher than students enrolled in non-eMINTS classrooms and that low-income and special education students in eMINTS classes generally score higher than their non-eMINTS peers (eMINTS, 2005). Results from other studies (Perez-Prado and Thirunarayanan 2002; Cooper 2001; Smith, Ferguson and Caris 2001) also suggest that students can benefit from technology-enhanced collaborative learning methods and the interactive learning process.

Roschelle, Pea, Hoadley, Gordin, & Means (2000) identify four fundamental characteristics of how technology can enhance both what and how children learn in the classroom: (1) active engagement, (2) participation in groups, (3) frequent interaction and feedback, and (4) connections to real-world contexts. They also indicate that use of technology is more effective as a learning tool when embedded in a broader education reform movement that includes improvements in teacher training, curriculum, student assessment, and a school's capacity for change.

2.2 Literature of the study

This chapter explores the literature on the possibilities to which technology is used in enhancing the 21st century transformational learning in public secondary schools in regard to students and teachers and entire learning environment. The literature includes ICT integration in educational, assessment in education and challenges, ICT and educational assessment, technology adaptation challenges in Africa and usefulness of technology in assessment practices in schools.

2.2.1 Assessment in education and challenges

Assessment is central for any educational system because it directs learning and may be used to indicate to students which aspects of their learning are valued and will be rewarded (Anderson, 2004). More specifically, assessment is the process of defining, selecting, designing, collecting, analyzing, interpreting, and using information to increase students' learning and development" (Erwin, 1991, p. 14).

Assessment is the process of gathering and discussing information from multiple and diverse sources in order to develop a deep understanding of what students know, understand, and can do with their knowledge as a result of their educational experiences; the process culminates when assessment results are used to improve subsequent learning. (Learner-Centered Assessment on College Campuses: shifting the focus from teaching to learning by Huba and Freed 2000)

Despite the apparent benefits of the use of ICT for educational purpose, and assessment, studies shows that there are challenges that teachers and schools face in assessments. These include;

2.2.1.1 Poor testing techniques

Traditional teaching methods can rely too heavily on cumulative tests. As a result, a student's grade can be affected greatly if he does not do well on the unit test. In addition, instead of breaking down the skills to see if mastery has been achieved, teachers sometimes use tests to wrap up a unit rather than to see if specific skills need to be retaught. Assessment needs to be given throughout the marking period to truly assess progress. Kimbell (1997) has identified and described in great detail the difficulties of atomized assessment. He wrote "the assumption that it is possible to use small, clear discriminators as a means for assessment in design and technology is a snare and a delusion" (p. 37). According to Kimbell, teachers are at their most reliable when assessing holism and at their worst when assessing the bits. 2.5 Adaptation of new pedagogies to transform 21st century literacy learning.

Research indicates that teachers' pedagogical beliefs and knowledge are important factors in their quest for technology integration (Abbott & Farris, 2000; Niess, 2005, 2008; Otero et al., 2005; Russell, Bebell, O'Dwyer, & O'Connor, 2003). Cammack (2003) acknowledges in her review of Alvermann's (2002) edited volume, that differences in technology use and perceptions of value between teachers and students can effectively act to block change in the integration and use of technology in assessment. The demands on teachers to develop a critical disposition toward technology while keeping abreast of current technologies is a challenging task. Learners bring to school a rich and different set

of literacy practices that often go unrecognized and unacknowledged in classrooms. Considine et al (2009) state that teachers not only need to understand what today's media and technology "do" for students but also what students do "with" it is not uncommon for students to know more than teachers about new literacies. Research by Chandler-Olcott & Mahar, (2003) states that increasingly students are coming to school more literate in the new literacies than their teachers. In the future, students' knowledge will be central to curriculum as they collaboratively share and use what they know about technology and literacy to shape classroom literacy practices. In short, learning experiences will need to be managed so that the instructional role of the teacher includes less "sage on the stage" as described by Gordon (2009, p. 61) and more "guide from the side". Teachers are increasingly being called on to be agents of change, technology leaders and facilitators of learning. The teacher will be responsible for organizing the distribution of knowledge. Levy (2000) argues that in such classrooms, everyone knows something, nobody knows everything, and what any one person knows can be tapped by the group as a whole. In such learning environments, students interact with many devices, people and artefacts.

2.2.1.2 Project-Based Assessment

Assessment is the systematic collection, review, and use of information about educational programs undertaken for the purpose of improving student learning and development. (Assessment Essentials: planning, implementing, and improving assessment in higher education by Palomba and Banta 1999) Many teachers lack a clear understanding of the differences between formative and summative assessment, according to a recent study in Assessment in Education. This shaky understanding is one of the challenges teachers face when they try to develop formative assessment tasks for their classrooms, Tests and quizzes represent the majority of assessments given by classroom teachers. Project-based learning offers a way for teachers to assess students and to appeal to their different learning styles. The integration of projects involves time, creativity and a different approach than some teachers are accustomed to using in their classrooms. Teachers need to find new ways to truly assess students.

2.2.1.3 Authentic Assessment

Another challenge of classroom assessment lies in authenticity. If the assessment is not authentic or valid, the student's score is irrelevant. According to Jon Mueller (2008), authentic assessment is a form of assessment in which students are asked to perform authentic real-world task that demonstrate meaningful application of essential knowledge and skills. Wiggins (1993) asserted that traditional methods of student assessment (i.e., forced choice tests such as multiple-choice, true/false test, etc.) fail to elicit complex intellectual performance valued in real life experiences and result in a narrowing of the curriculum to basic skills, including test taking skills. Teachers need to examine test questions by using an item analysis. In other words, teachers need to see how many students answered the question correctly. If more than half of the students answered incorrectly, a new question needs to be made. Some teachers fail to assess their questions to make sure they are valid ones.

2.2.1.4 Attitude

In regard to attitude of teachers, Mandyata (2002) reported that teachers' positive attitudes towards inclusion in testing depended greatly on their teacher education and availability of support, class size and workload. The Clarke-Midura&Dede's(2010) study reminds us "using technology to deliver automated versions of item-based paper-and-pencil tests does not realize the full power of information and communication technologies (ICT) to innovate via providing richer observations of student learning" (p. 309). It is encouraging for the future of assessment that there are innovative attempts being made to create a "breakthrough in the use of technology to improve assessment dramatically beyond the century-old methods in widespread use today" (p. 309). These are some of the challenges faced in meta-assessment, and the future. Tiene (2000) conducted a survey of advantages and disadvantages of online discussions. Unlike Burge's (1994) study, Despite the apparent benefits of the use of ICT for educational purpose, studies shows that in many cases, the learning potential of ICT is deprived as many teachers are still not fully ICT literate and do not use it in their teaching and assessment. Studies on teachers' readiness for ICT generally, suggest that there is still a long way to go before schools in the region will be able to take full advantage of the opportunities provided by 21st century

technology in assessment (Ya'acob et. al., 2005; so & Paula, 2006). Barak (2006) reveals that while teachers exploit ICT for their own learning, they are cautious about integrating advanced technologies in schools. The study also suggests that while teachers recognize the potential of technology in stimulating students' learning and making school studies relevant to real-life contexts, they do not think that ICT is used in assessment

In particular, Becta (2003) pointed out that ICT provide fast and accurate feedback to students, and speed up computations and graphing, thus freeing students to focus on strategies and interpretation. In a study by Jennings and Onwuegbuzie (2001), teachers of younger age were found to be associated with more positive attitudes towards ICT. This is in agreement with the report by the U.S. National Centre for Education Statistics (2000) which indicated that younger teachers score higher on their perception of ICT, and have translated their positive perception into higher degree of ICT use in education. Thus, it was hypothesized that teachers of younger age make more use of ICT in schools, compared to the elderly counterparts. On the other hand, Atan et al. (2002) found that users exhibit greater competence computer when they made frequent use of it. Hence, it was predicted that teachers who make daily use of ICTs are more competent in ICTs compared to those with a lower rate of adoption. Further, Preston (2000) revealed that lack of technical support as a key factor inhibiting the use of ICT in classroom. As pointed out by Bradley and Russell (1997), recurring faults, and the expectation of faults occurring during teaching sessions, reduced the teachers' confidence and caused teachers to avoid using technology.

2.2.1.5 In adequate ICT infrastructure

Tiene (2000) found that while the "body language and facial expressions were important forms of communication" (p. 379), for students only "a tiny majority" considered the loss of visual cues to be a disadvantage. However, a majority of the survey's respondents indicated that they preferred a face-to-face discussion to an online one. Some of the anecdotal comments provided in the survey referred to challenges related to the inconvenience of not having a computer at home, a lack of spontaneity, the volume of messages, difficulties establishing momentum in the discussion, digressions, and the lack of voice and facial expressions.

2.2.1.6 Class Numbers

With class numbers on the rise, teachers need to budget time and cannot always use open-ended assessment. Open-ended responses, or short answer, allow students to explain their point of view and showcase what they have learned. This type of response reveals more about what a student understands than a multiple-choice question. But grading writing takes much more time than objective assessments, and teachers often resort to these less conducive measures to manage large class sizes.

A study by Burge (1994) of Master of Education students enrolled in a web-based distance program identified challenges that related to peer interaction, difficulties associated with handling and managing large quantities of information and discussion fragmentation. Other challenges included the lack of visual and aural cues, working collaboratively, deciding why, when and how to contribute and feeling out of sync with the discussion.

Classrooms are becoming more collaborative communities in which students exchange and share their understandings. Working in isolation and valuing quiet, independent work will be reduced in classrooms where technology and literacy merge. Interactions and the co-construction of knowledge will be vital. Unfortunately, research by Kirkpatrick (2001) concludes that despite calls for fundamental rethinking of pedagogies for the environment, to date our attempts to invent new pedagogies have been limited both by conventional attitudes to teaching and learning and the wider socioeconomic context. Oliver and Shaw's (2003) investigation of strategies for encouraging student participation in discussions identified and explored factors that encouraged and inhibited student participation. In their analysis of the patterns of posting, the authors found that: "students were 'playing the game' of assessment, making the posting that earned them marks but rarely contributing otherwise" (p.64). The authors concluded as well that "contributions were not strongly interactive" (p.56).

The identification of the benefits and challenges experienced by learners in online asynchronous discussions provides insight into their potential contribution to teaching and learning as well as into their limitations and inconveniences. Overcoming the challenges related to this new medium of communication and interaction will support easier and more effective realization of the benefits. For this reason, Teachers need to continue to gain an

understanding of the types of challenges that learners experience when they make use of this medium to communicate and interact. This need to understand the challenges becomes more pressing as distance education offerings continue to rise and online discussions become a more common feature of teaching and learning. There is also a need to investigate these challenges in a variety of contexts and with different learners in order to appreciate the many and complex ways that the challenges may manifest themselves for learners.

2.2.2 Technology and education

ICT education cannot be optional if the country needs to be in the forefront of ICT development to establish a foothold in a knowledge driven economy, reduce the digital divide, and grow the economy, social fabric and administrative efficiency of the country.

According to Kipsoi J. Emmy, Chang'ach John K., Sang Hellen C (2012), Technologies have a great potential for knowledge dissemination, effective learning, and efficient education services. Yet, if the educational policies and strategies are not right, if ICT in education policies are not well thought out, and if the prerequisite conditions for using these technologies are not met concurrently, this potential will not be realized.

There are currently over 4000 public secondary schools in Kenya and the recent massive increase in primary school enrolment is putting pressure on the demand for and access to secondary schools. (Republic of Kenya, 2007) The Ministry of Education Science Technology remains concerned with the quality of secondary education which is characterized by poor performance in core subjects such as Mathematics and Science. There are obvious benefits for integrating computers into secondary schools as students at this age need to focus on subject-specific content, greater critical thinking skills, scientific inquiry, and Mathematics, science and languages. Students will benefit greatly with the analytical, creative, and collaborative power of computers to map out and analyse assumptions, present ideas, and participate in projects with peers from around the country and around the world.

Schools should note that foundation skills should be a stepping-stone to using ICTs to enhance teaching and learning objectives. Both programmes, the assessment criteria should

be made explicit to new users and opportunities to experiment and work with the tools towards achieving these criteria. This will ensure that their new knowledge and skills are conceptualized and more likely retained. Every school has its own unique context or culture. Higgs (1997) states that most reforms in schools fail because of flawed implementation. Teachers and administrators see minimal gains and much loss in changes that are proposed. The difficulty associated with facilitating change in people's values, attitudes, and behaviour is grossly underplayed and often ignored. Siegel (1999) states two reasons why people would want to bring ICTs into schools. The first is the desire of the central planner to the school as modern as the world of tomorrow they conjure into being. Higgs (1997) details how each new development in the popularization of information and entertainment technology (radio, film, television, computers) in society at large brought with it a corresponding insistence that the deployment of this revolutionary machine into schools would, finally, bring the classroom out of the dark ages and unto the modern world. This has not been the case.

According to Siegel (1999) the second impetus has been standardization by modelling schools on factories with the expectation of uniformity of outcome. The weakest link has been found to be the __instructional delivery vehicle__“the teacher who once in the confines of a classroom issues of standardization of curricula, of facilities mean very little. This has been the rationale for educational technologists to produce solutions designed not to aid the teacher but to This has been the rationale for educational technologists to produce solutions designed not to aid the teacher but to recapitulate, or replace the teacher through the introduction of machines or his/her management style. The result is the likelihood that innovations in ICT will not be well received by teachers and managers of schools due to conflict with the firmly entrenched traditions. Venkatesh and David (2000) proposed that change in schools means changing attitudes, norms, beliefs, and values associated with the school culture.

Researchers have found particular cultural norms that can facilitate school management. Norms such as introspection, collegiality, and a shared sense of purpose or vision combine to create a culture that supports innovation in educational management (Tee, 1993). School

managers who had adopted more progressive ICT oriented management styles over time felt that ICTs helped them change, but they do not acknowledge ICTs as the catalyst for change; instead, they cite reflection upon experience, classes taken, and the context or culture of the school (Naidu and Jasen, 2002). For school managers to implement the use of educational technology in a constructivist manner, they must have opportunities to construct pedagogical knowledge in a supportive climate (Taylor and Todd, The Sessional Paper No. 1 of 2005 captures ICT as chapter VIII. The government appreciates and recognizes that “an ICT literate workforce is the foundation on which Kenya can acquire the status of a Knowledge economy” (Republic of Kenya, 2005:79).

Education is seen as the natural platform for equipping the nation with ICT skills .the successful introduction and use of ICT in education and training institutions is seen to play a major role in disseminating skills to the wider society and thus create positive impacts on the economy. In order to change this situation the policy framework states that:-
—Information and communication technology has a direct role to play in education and if appropriately used, ICT can bring many benefits to the classroom as well as education and training processes in general. Its use will provide new opportunities for teaching and learning, including, offering opportunity for more student centred teaching, opportunity to reach more learners, greater opportunity for teacher-to-teacher, and student-to-student communication and collaboration, greater opportunities for multiple technologies delivered by teachers, creating greater enthusiasm for learning amongst students, and offering access to a wider range of courses.. _ ‘ (Republic of Kenya, (2005:80) The Sessional paper notes a number of challenges currently facing access and use of ICT in Kenya which include; _high levels of poverty that hinder access to ICT facilities, limited rural electrification and frequent power disruptions. Where there is electricity, high costs of Internet provision, costs associated with ICT equipment, inadequate infrastructure and support hinder the application of ICT. “ In order to achieve the objectives stated for the period 2005-2010 a number of strategies are proposed among them being to “Work with stakeholders to develop a strategy on ICT that addresses its use in all educational institutions and neighbourhoods, incorporating access, content, training of teachers and supply of ICT to the institutions. The KESSP report further envisages the development of

e-learning materials and an e-curriculum by using experts in the region to develop local digital content. These are indeed bold steps towards technology integration in schools.

According to ministry of education, (2008). The government's policies, strategies and general resolutions are centrally formed and circulated to all schools .The policies, strategies and general resolutions are characterized the hierarchical succession, which is the predominating management style in Kuwait (Welsh & Raven, 2006). Some centrally issued resolutions emanate from the "Ministers Council", after being presented to the Parliament, while some resolutions are directly issued by the Ministry of Education, or from different levels within the Ministry, such as the district general manager. Experts and academics from the University of Kuwait are generally involved in designing such policies, strategies and resolutions. Additionally, other western specialists can also be called upon to enhance the development process. These experts tend to come from England, in the main, due to the strong historic relationship between Kuwait and Britain (Al-Dafiri, 2006). As a result of such centrally developed strategies, there is little real world input and little effective participation from the Kuwaiti educator.

Since the early 1980s, Kuwaiti education has also been influenced by the increased use of technology (Almajdi, 2006). In 1983, a committee was formed to explore the possibility of using computers to serve the teaching and learning needs. By 1985, the "Introduction to computer science" unit was established in all Secondary schools. Currently, all Secondary students are taught two compulsory computer science units (Almajdi, 2006; International Bureau of Education, 2011). Such development represents the strong influence of the government's interest in ICT.

Whitehead, Jensen, and Boschee (2003) are concerned that "the current Movement toward putting the latest technology into classrooms is causing educators to reassess school programs and policies and to examine the impact computers and other data-processing equipment are having on teaching and learning" ..Due to these rapid changes, administrators and other educators globally are compelled to carefully analyze the academic and social needs of their students. Maki (2008) stipulates that ICT plays a vital

role in supporting powerful, efficient management and administration in the education sector: technology can be used from student administration (i.e., students' record) to various resource administrations in an education institution. According to Zainally (2008), "ICT provides several facilities and possibilities for educational administrators to perform their tasks.

Although ICT use in secondary school administration in Kenya appears to be a new concept and a complex change, Fullan (1993) advises that there is an urgent need to unpack the complexity of change to provide guidance for those who must deal with it. Also, Day and Leithwood (2007) remark that this is the 'golden age' of school leadership change. Educators should re-examine their attitudes, perceptions, plans, and implementation of ICT in their daily administrative operations however challenging it might be desired outcomes within 21st century learning frameworks include learning traditional school subject and contemporary content themes in combination with the interdisciplinary 21st Century themes. The core subjects and themes that frame 21st century learning include traditional core subjects while emphasizing civic literacy, global awareness, financial literacy, health literacy, and environmental literacy. There are currently over 4000 public secondary schools in Kenya and the recent massive increase in primary school enrolment is putting pressure on the demand for and access to secondary schools. (Republic of Kenya, 2007).

The Ministry of Education Science Technology remains concerned with the quality of secondary education which is characterized by poor performance in core subjects such as Mathematics and Science. There are obvious benefits for integrating computers into secondary schools as students at this age need to focus on subject-specific content, greater critical thinking skills, scientific inquiry, and Mathematics, science and languages. Students will benefit greatly with the analytical, creative, and collaborative power of computers to map out and analyze assumptions, present ideas, and participate in projects with peers from around the country and around the world.

Schools should note that foundation skills should be a stepping-stone to using ICTs to enhance teaching and learning objectives. The same ICT integration concepts used in the Teachers Training Colleges model can be adapted for secondary school teachers and

students. ICT integration will take teachers and students beyond seeing ICTs as computer studies and computer literacy skills. Although these are important skill sets, they are not sufficient in leveraging the true potential of ICTs to improve creativity, innovation and collaboration –key capacities in the new knowledge economy. In both programs, the assessment criteria should be made explicit to new users and opportunities to experiment and work with the tools towards achieving these criteria. This will ensure that their new knowledge and skills are conceptualized and more likely retained. Every school has its own unique context or culture. Higgs (1997) states that most reforms in schools fail because of flawed implementation.

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Venkatesh and David (2000) proposed that change in schools means changing attitudes, norms, beliefs, and values associated with the school culture. Researchers have found particular cultural norms that can facilitate school management. Norms such as introspection, collegiality, and a shared sense of purpose or vision combine to create a culture that supports innovation in educational management (Tee, 1993). School managers who had adopted more progressive ICT oriented management styles over time felt that ICTs helped them change, but they do not acknowledge ICTs as the catalyst for change; instead, they cite reflection upon experience, classes taken, and the context or culture of the school (Naidu and Jasen, 2002). For school managers to implement the use of educational technology in a constructivist manner, they must have opportunities to construct pedagogical knowledge in a supportive climate (Taylor and Todd, The Sessional Paper No. 1 of 2005 captures ICT as chapter VIII. The government appreciates and recognizes that “an ICT literate workforce is the foundation on which Kenya can acquire the status of a Knowledge economy” (Republic of Kenya, 2005:79). Education is seen as the natural platform for equipping the nation with ICT skills .the successful introduction and use of ICT in education and training institutions is seen to play a major role in disseminating skills to the wider society and thus create positive impacts on the economy. In order to change this situation the policy framework states that:- —Information and communication technology has a direct role to play in education and if appropriately used, ICT can bring many benefits to the classroom as well as education and training processes in general. Its use will provide new opportunities for teaching and learning, including, offering opportunity for more student centered teaching, opportunity to reach more learners, greater opportunity for teacher-to-teacher, and student-to-student communication and collaboration, greater opportunities for multiple technologies delivered by teachers, creating greater enthusiasm for learning amongst students, and offering access to a wider range of courses.. _’ (Republic of Kenya, (2005:80).

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2.2.3 ICTs and educational assessment

Technology education is concerned with developing students' capability. This capability requires students to combine their designing skills with knowledge, skill and understanding in order to design and make products. Kimbell (1997) has defined capability as "that combination of skills, knowledge and motivation that transcends understanding and enables pupils creatively to intervene in the world and 'improve' it" (p. 46). This is quite different from students acquiring a range of separate skills and abilities as achievements in their own right. This is not to deny, however, that capability depends to some extent on the acquisition of appropriate knowledge and skills.

The idea of school-based evaluation is quite appealing because it involves school staff directly, incorporates local knowledge, and potentially, directly shapes school improvement. However, school-based evaluation is not always well aligned with the work of schools. Evaluation tools may be more suited to the needs of policy officials than they are to schools and teachers. Moreover, the skills required for gathering and interpreting school or programmed level data are quite different than those required for classroom assessment (Monsen, 2002; Simmons, 2002; Lander and Ekholm, 1998)

Kimbell (1997) stated that "design and technology activity is so integrative; the approach to the assessment of pupil performance in this era should ideally be holistic" (p. 73). Wilson and Shulha (2001) reported that teachers participating in their research "were adamant that quality assessment requires forming a holistic understanding of students" (p. 8). Kimbell (1997) has identified and described in great detail the difficulties of atomized assessment.

He wrote "the assumption that it is possible to use small, clear discriminators as a means for assessment in design and technology is a snare and a delusion" (p. 37). According to Kimbell, teachers are at their most reliable when assessing holism and at their worst when assessing the bits.

According to. (Hill, 2013) assessment has always been one of the essential tools in the learning process. It requires clear and concrete conceptualizations of what it means to learn something as well as the identification of objective indicators that suggest where students on the path to mastery. Our starting point should be assessment, which is about making a judgment as to the extent to which the student has learnt what we intended them to learn Learning is one of the most complex of things to measure because it cannot be directly observed but must be inferred.

In the U.K., 49% of the children between the ages of 8-17 who use computers have an online profile; 59% use social networks to make new friends (Ofcom, 2008) .Students come into classrooms with new ICT skills and competencies but they are rarely drawn on in the formal curriculum nor are students able to use these skills to collaboratively solve complex, real world problems.

Businesses, entire economies, and society generally have made dramatic changes over the past decades, much of it enabled by the wide spread Use of ICT. But education systems have been slow to respond. For the Most part, curricula, pedagogy, school organization, and assessment are much like they were at the turn of the 20th centuries.

While people outside of school work flexibly in teams, use a variety of digital tools and resources to Solve problems and create new ideas and products, students in schools meet In structured classrooms at specified times; teachers cover the standard content By lecturing in front of the class while students listen; students work individually And reproduce this knowledge on assessments and their use of ICT is limited (Pelgrum, &Plomp, 2008).

Assessment of student skills and knowledge is essential to guide learning and provide feedback to students, teachers, and parents on how well students are achieving set standards. In moving to design assessments to measure 21st century skills, the NEA states that a comprehensive approach to assessment, involving measurements that assess 21st century skills, is necessary to ensure accountability of schools in the 21st century.

Elena Silva (2009), an advocate for the meaningful assessment of 21st century learning states that school systems should be investing in curriculum and professional development, but not forgetting to invest in rethinking traditional forms of student assessment. Silvia argues that the potential exists today to produce assessments that measure thinking skills and are also reliable, valid and comparable between students and schools elements integral to efforts to ensure the accountability and equity mandated both locally and federally. Silvia states that efforts to assess

These 21st century skills are still in their early years and that school districts will have difficulties in developing the ability to deliver these assessments at scale.

Developing creativity and innovation skills is often based on a common misperception that creativity is only for artistic-types and geniuses – that creativity is something one is born with or without (Trilling & Fadel, 2009). Creativity can, Trilling & Fadel argue, be nurtured by teachers and learning environments that encourage questioning, openness to new ideas, and learning from mistakes and failures. Creativity and innovation skills can be developed, like other skills, with practice and over time (Wegerif & Dawes, 2004). Though it is difficult to assess creativity, there are multiple instruments and assessments that have been designed to measure creativity in specific fields such as problem solving and design.

Twenty-first century skills are more challenging to teach and learn, and they are also more difficult to assess. Designing tests that measure lower-order thinking skills, such as memorization, is straightforward in comparison to measuring such skills as creativity, innovation, leadership, and teamwork. In this section, we first explain the two main purposes of assessment and how they relate to teaching and learning 21st century skills. We then highlight several challenging issues that educators and policymakers must consider as

they develop 21st century assessments. Finally, we provide several examples of assessments that measure complex skills and of initiatives that are currently addressing the challenge of assessing 21st century skills. These examples support our conclusion that, though the assessment challenge is substantial, it is not insurmountable.

Students and educators today must have ICT (Information and Communications Technology) literacy and use technology in the context of teaching and learning. The skills they need include such life skills as leadership, ethics, accountability, personal responsibility, self-direction, and more. In addition, an understanding of how to use 21st century assessments, specifically authentic assessments that measure all areas of learning. Students in the 21st century learn in global classrooms not necessarily within four walls. They are more inclined to find information by accessing the internet through cell phones and computers or chatting with friends on a social networking site (Keith More-2005). According to (Ridgeway, McCusker and Pead 2004) educators, business leaders, and policymakers in the U.S. have questioned whether the current design of assessment systems focuses too much on measuring students' ability to recall discrete facts using multiple choice tests at the cost of not adequately measuring a student's ability to engage in and complete complex thinking and problem-solving tasks. Observers of the U.S. school system have been quick to note potential shortcomings, claiming that narrowly focused high-stakes assessment systems produce at best only illusory student gains .

Assessment and its interface with curriculum, teaching and learning has always been a significant component of classroom practice. Research has indicated that typical teachers spend between one-third and one-half of their class time engaged in one or another type of assessment or learning evaluation activity (Stiggins & Conklin, 1992). However, research has also expressed concern that the knowledge that teachers hold about assessment matters has been limited, with scant attention paid to this area in teacher-preparation programs (Christie et al., 1991).

Sternberg (2006), new computer technologies should imply a change on the way human abilities are measured since some of the skills measured by conventional tests of

intelligence have become less important due to technological change. As they note, in past times, the number factor in Thurstone's (1938) theory was mostly measured by tests of arithmetic computation (Thurstone & Thurstone, 1941) and achievement tests, such as the Iowa Tests of Basic Skills, also emphasized arithmetic computation as one of two or three basic skills. Today, such tests represent an anachronism, as handheld calculators and computers rendered arithmetical-computation skills much less important than they were in the past. Thus, other abilities to that conventionally measured by the tests of intelligence are gaining increased importance such as practical or creative abilities (Grigorenko, Jarvin, & Sternberg, 2002; Preiss & Sternberg, 2003; Sternberg, 1985; Sternberg et al., 2000; Sternberg & Horvath, 1999; Wagner & Sternberg, 1985). Sternberg and his collaborators' push for the development of measures of creativity and practical intelligence is compatible to the growing demand for these abilities in an environment whose technological complexity grows day after day.

Twenty-first century teaching learning skills underscore the need to shift from the traditional (conventional) assessment to better and modern methods of assessment.

According to (Haddad and Jurich) In the developed countries, and the urban elites of advanced economies, twenty-first century education integrates technologies, engaging students in ways which were not previously possible, creating new learning and testing possibilities, enhancing achievement and extending interactions with local and global communities. Students live in a world that has seen an information explosion and significant and rapid social and economic change In the developing world, ICTs are used largely to increase access to and improve the relevance and quality of education.

Some authors (Carroll, 2007; Burmack, 2002; Riddle, 2009; Frey & Fisher, 2008; Elkins, 2007; Trilling & Fidel, 2009) and organizations (Partnership for 21st Century Learning; National Science Foundation, Educational Testing Services, NCREL, Metiri Group, etc.) argue that 21st Century Learning Skills, the subject of this literature review, are critical for accomplishing the necessary transformation Traditional education models have often focused on learning identified content for subject areas (i.e. math, science, language arts,

and social studies), and then assessing this content knowledge with quizzes, and tests at the end of a chapter or learning module.

2.2.4 Technology adaptation challenges in Africa

By its very nature the ICT phenomenon is relatively in the developing world. Available data, suggest that the majority of developing countries such as Kenya in sub-Saharan Africa are lagging behind in the information revolution (Zhao and Frank, 2003). Not surprisingly, the quest for adoption of ICT in educational management has been problematic and will require fundamental shifts in the regulatory environment, as well as renewed attention to public-private partnerships and social services. For example, developed countries have 80 per cent of the world's Internet users, while the total international bandwidth for all of Africa is less than that of the city of São Paulo, Brazil (Campbell and Sellbum, 2002). There is little doubt that sub-Saharan Africa's populations are missing out on the boons of information and communication technology (ICT) in educational management (Bigum, 2000). As a region lagging behind in adoption, use and innovation in the ICT sectors, its people are missing out on a better education and well managed education systems and entities. ICT has contributed greatly to educational management in schools worldwide (Zhao and Frank, 2003). However, in Kenya Schools hardly use ICTs to manage the quality of output, or to raise teacher productivity, or to reduce costs through analyzing spending. This is attributed to a myriad of challenges facing most schools in Kenya with regard to adoption of ICTs in educational management.

This has resulted to a slow rate of adoption of technology despite its promise and potential for use in educational management in schools. Most schools in Kenya have only adopted computers as technical subject and not integrated its use in the teaching and learning .The use of ICTs in educational management is greatly under-emphasized. As such, a more holistic approach requires that schools be receptive and open to the changes ICTs may make, and to the ongoing evaluation of these changes for the schools' purposes. Since there is evidence from countries such as Botswana, Namibia and South Africa that investments in ICTs in education management in schools in some countries are now becoming sufficiently significant for systemic impact (Becta, 2004).

Educational managers Studies (Becta, 2003; Yang, 2003) indicate that ICT has played an important role in improving management in educational systems through for example availing data widespread to parents and the public at large through central administration websites and in some cases through direct access to central databases by school personnel. As such, this paper examines the challenges facing introduction of information communication technologies in education management in schools in Kenya. The general public ICT literacy is still very low. What is of concern most is that ICT literacy among school manager is also very low, especially those that live in the rural or remote areas parts of Kenya. (Yang, 2003)Barriers to introduction of ICTs in Schools In order to increase and improve the use of ICTs in the schools, a range of obstacles that prevent school managers and teachers from using ICTs effectively need to be overcome.

The BECTA Report (2003) identifies the key barriers to using computers as:

- Lack of access to appropriate ICT equipment
- Lack of time for training, exploration and preparation
- Lack of models of good practice in ICT
- Negative attitudes towards ICTs in education
- Computer anxiety and a lack of confidence
- Fear of change and a lack of personal change management skills
- Unreliable equipment
- Lack of technical, administrative and institutional support.

This BECTA (2003) report further classifies the barriers into the four factors namely a)resource-related factors b)factors associated with training, skills, knowledge and computer experience c) attitudinal and personality factors, and d) institutional and cultural factors. According to the BECTA (2004) report, barriers identified in the literature can be broadly grouped into two levels: those relating to the institutions (school-level barriers) which are first order barriers and those relating to the individual (manager-level barriers) or second order barriers (Siegel, 1999). Although this may be a useful distinction to make in beginning to address the subject, the literature points to a complex interrelationship between school-level and teacher-level barriers, and between the barriers within those levels(Siegel, 1999).

Infrastructure for online learning is crucial. Many African countries have a very low base from which to implement ICT interventions in education management in schools. It is estimated that less than 1 per cent of people in Africa uses or have access to the Internet (Bigum, 2000). The figure of 139 students per computer is given for World participants. Listed in order of rank, aspects that inhibit schools from acquiring computers are an absence of electricity, lack of funding, insufficient building space, lack of available and trained staff, and poor security. In Malawi, where most technology infrastructure is government controlled, very low levels of infrastructure for and use of ICTs are found and many government departments have themselves not yet acquired computers. In sub-Saharan Africa, the low tele-density and high costs of installing and maintaining lines are major barriers. Wireless technology is seen as a possibility for rural schools (e.g. in Lesotho). Some countries have implemented pilot projects for wireless technology in rural areas, for example School Net Uganda.

Computer access and use is another barrier faced by third world countries .To investigate the factors hindering teachers' readiness and confidence in using ICTs, Tella, et al. (2007) found that inadequate knowledge to evaluate the role of ICT in teaching and learning, lack of skills in the use of ICT equipment and software had resulted in a lack of confidence in utilizing ICT tools. This is consistent with Preston (2000) who concluded that lack of technical support to be key inhibitor to the use of ICT in classroom. As shown by Bradley and Russell (1997), recurring faults, and the expectation of faults occurring during teaching sessions have reduced teachers' confidence and caused teachers to avoid using technology. In addition, obstacles such as access to equipment, time pressures, lack of mentor and opportunities for apprenticeship of observation also have an impact on teachers' ability to use ICT (Slaouti& Barton, 2007). Further, teachers' workload and time management was found to be inhibiting the implementation of computer instruction in classroom (Guha, 2000).

The development of ICTs use in Africa is very uneven. In some countries like South Africa, some sectors of schooling such as management are using computers in education to an extent on par with the developed world, while others are only beginning to explore the possibilities of introducing school networking, for example School Net Malawi. A few are

in the start-up phase and most of the developments have been established since 1997. Time spent on computers in School Net activities in Africa is generally limited and is related to the type of access and use. Students doing computer studies will spend more time working with the technology than other students. While teachers and students in schools that have computers learn basic computer skills such as word processing, the integration of computers across learning areas happens in only a minority of schools.

Budgeting for ICTs in schools is another challenge school across Africa do face. Schools do not budget adequately for maintaining the use of ICTs, and instead dedicates their ICT budgets, where these exist, to the purchase of computers and software. In schools: _the costs of installation, maintenance and expansion remain hidden unlike in the commercial sector where the capital costs of a PC represent only one fifth of the yearly cost of running that PC‘ (Farris, 2001).

Costs include teacher training, and additional advisory and technical staff as support, both in the technological and pedagogical fields. The Internet for Schools Project in Mozambique, for instance, has both technical and pedagogical coordinators. In addition, hardware, software, telecommunications, infrastructure such as phone lines, and content development have to be budgeted for. Fewer than 5 per cent of South African schools with computers budget for teacher training in the use of ICTs (Higgs, 1997). Initial expenditure has to be considered along with the recurrent costs in order to sustain the use of ICTs in education, in particular the investment in the human capability (Ibid.:46). Budgets tend to derive from fees, fundraising and donations, although in some countries such as Nigeria, government funding is provided. Evidence of the cost effectiveness of spending on ICTs rather than, say, libraries has not yet been established (Higgs, 1997:47).1.10. Training in ICT Skills.

The lack of infrastructure may be compensated for by the commitment of the teachers. In some countries projects focus on training for the implementation and sustainability of ICT-based interventions in education. Some see pre-service training as essential, such as the revised national policy on education in Botswana and the aims of School Net Namibia (Bigum, 2000:2) while others consider in-service training the appropriate response. Some

hope that "cascade" models will work, like in the Ministry of Education in Gambia (Bigum, 2000:5). Some claim that it has already done so, as in the case of Ghana (Bigum, 2000:6). Others still rely on volunteers, both young and old, to sustain the intervention. Training goals vary but most are based on training schedules using workshops to cover the various skills. In general, training is seen more in terms of time spent on training than in terms of outcomes such as proficiency in the skills, comfort with the technology or experience in integrating use of the Internet into curricula. Training generally includes basic computer literacy, exposure to the basics of email, search engines, website design and the integration of technology in the classroom, in a concentrated period with groups at various levels of competence

ICTs have clearly made new demands on an already stretched sector while simultaneously offering opportunities in support of current difficulties. The enthusiasm for ICTs may well ultimately be the catalyst for transforming dominant education practices (James, 2001: 29).

Other challenges facing introduction of ICTs in management of secondary schools include Economic Crisis (Bigum, 2000), no wonder the biggest obstacle faced by Indonesia regarding ICT is the economic crisis. This condition forces the government to prioritize on short term programs to help improve the economy of the general population through social security net, aids to poor students to decrease drop-out rate, improvement of teacher's welfare etc. As such the government has to postpone various programs that had been planned including the program to support ICT development, The despondent economy also makes the people's spending capacity shrunk, so they prioritize their spending on primary needs such as food and clothing, so that the need to use ICT to get access to information become the last choice.

2.2.5 Usefulness of technology in assessment practices in schools

Both assessment and ICT hold challenges for many teachers. While well designed assessment can enhance students' learning effectiveness, and all teachers should be 'assessment literate' and capable of using assessment to inform instructional practice (Campbell & Collins, 2007), these expectations are not matched by studies of teachers' assessment knowledge (Brook hart, 2001; Campbell & Evans, 2000).

Technology can be used in the production of portfolios. A successful portfolio can only be achieved by a student who has ownership of his or her portfolio. There is some research to support this idea. For example, Notman (2000) showed that his use of portfolio assessment at the high school level, combined with student-led conferencing, provided his learners "with a high degree of ownership and control [that], in turn, had a positive effect on their learning, motivation, and behavior" (p. 2). Cramer (2009) in his article, "Digital Portfolios: Documenting Student Growth" discusses the Digital portfolio process as a 21st century form of assessment. Prior to beginning the portfolio process, students are trained in basic web design to build and maintain digital portfolios. Cramer argues that this process is not only useful for classroom instruction; but that these skills equip students with tools they will most likely use in college and the professional world.

While there is no conclusive research to prove that student achievement is higher when using ICTs in the education space, either in the developed or developing countries, there is a general consensus among practitioners and academics that integration of ICTs in assessment practices has greatly improved response to the learners. It's understood that in diverse socio-economic and cultural contexts ICTs can be successfully employed to reach out to a greater number of students, including those to whom education was previously not easily accessible, and help in promoting learning, along with exposing students to the technical skills required in assessment. Geographical distance no longer becomes an insurmountable obstacle to obtaining the test results. It is no longer necessary for teachers and students to be physically in proximity, due to innovations of technologies such as teleconferencing and distance learning, which allow for synchronous learning. Victoria L. Tinio (2003).

Brookhart (1999) argued that "classroom assessment must be taught to aspiring teachers in relation to both instruction and classroom management, not simply as decontextualized application of measurement principles" (p. 13). What students learn about assessment in schools should have a direct bearing on teacher education. Each technology is likely to play a different role in students' learning. Rather than trying to describe the impact of all

technologies as if they were the same, researchers need to think about what kind of technologies are being used in the classroom and for what purposes. Two general distinctions can be made. Students can learn "from" computers—where technology used essentially as tutors and serves to increase students basic skills and knowledge; and can learn "with" computers—where technology is used a tool that can be applied to a variety of goals in the learning process and can serve as a resource to help develop higher order thinking, creativity and research skills (Reeves, 1998; Ringstaff& Kelley, 2002).

According to Murphy et al, teachers use DES not only to supplement instruction, as in the past, but also to introduce topics, provide means for self-study, and offer opportunities to learn concepts otherwise inaccessible to students. The software also manifests two key assumptions about how computers can assist learning. First, the user's ability to interact with the software is narrowly defined in ways designed specifically to promote learning with the tools. Second, computers are viewed as a medium for learning, rather than as tools that could support further learning (Murphy et al, 2001).

According to (bloom, Hastings and maddaus (1971) the concept of formative assessment which formally introduced the idea that assessment need not be used solely to make summative evaluations of student performance, arguing that teachers should include episodes of formative assessment following phases of teaching. During these episodes teachers should provide students with feedback and correction as a way to remediate student work and most experts now consider formative assessment as an ongoing part of the teaching and learning process. Formative assessment thus becomes a central element in teaching and learning. One major advantage to digital technology is that the work can become part of a larger, broader conversation. Feedback can then be received from an expanding universe of communities.

Continual feedback between teachers and students generates a way of teaching that is very different from the traditional approach. It becomes more like sailing a ship, with the teacher constantly adjusting course. The goal is set, but the actual path responds to the needs of the

individual students. That is a model for what assessment looks like when it occurs continuously during instruction.

Technology is just a new set of tools, which are useful only if they add value to the learning experience. Oosterhof, Conrad & Ely (2008) in examining the role of technology in assessment; said “Because the technologies associated with online assessment have evolved so quickly, it may appear that new assessment fundamentals are being devised or are rapidly transforming”. However, most of the fundamentals that have historically defined quality assessments are still highly relevant” (p. 2). This seems to be one of the slower-evolving aspects of designing curriculum with much of what has been practiced since its inception, continues without much change. There are new assessment technology tools available offering the ability to provide immediate feedback and scoring information to learners on demand. Hence, it would behoove schools to remember what Buzetto-More & Alade (2006) clarified, when they outlined: “Successful assessment is an ongoing cycle that involves the identification of outcomes, the gathering and analyzing of data, discussion, suggesting improvements, implementing changes, and reflection” and “the assessment process is represented as a continuous cyclical process or, rather, a loop” (p. 255).

In addition, Clarke-Midura & Dede (2010) share one way to gain knowledge of an informal or formal nature by methods of observation. They say, “Advances in technology and statistics are creating new possibilities and promises for assessment. The type of observations and evidence of learning that technology-based assessments allow is unparalleled” (p. 311). That is encouraging for building local and global communities, dependent on a highly educated and skilled workforce who may immerse themselves in OJT activities and simulations.

In addition and relevant to emerging technologies that will allow for this radical change in assessment, “Recent advances in online learning are breathing new life into this instructional methodology, however. In a fully online curriculum, a variety of assessment instruments—and the technical means for instant feedback—can be built into every

instructional activity” (Prineas&Cini, 2011, p. 13). Furthermore, “Online education exists because technology made it possible. Technology is also making possible an increasing ability to track, assess, and respond to the behaviors and mastery levels of students in online courses with far greater depth and rapidity than ever before” (Prineas&Cini, 2011, p. 13). Today learners are quite fortunate to live in a time when there are so many tools at their disposal for increasing the reliability and validity of formative and summative instructional assessment instruments.

Other benefits that have been identified by researchers include opportunities for constructing and negotiating meaning (Lapadat, 2002), engaging students in meaningful online dialogue (Biggs,1999), promoting critical thinking processes (Aviv, Erlich, Ravid, &Geva, 2003; Newman, Johnson, Cochrane & Webb, 1996), and achieving higher levels of abstract cognitive processes than in face-to-face communication (Heckman &Annabi, 2003).

Other benefits include more careful, formal and reflective responses (Heckman &Annabi, 2003) and an increased motivation to participate and to write well due to the presence of a real audience and purpose for communicating (Biesenbach-Lucas, 2003; Lapadat, 2002).

Tiene (2000) conducted a survey of advantages and disadvantages of online discussions. Unlike Burge's (1994) study, Tiene found that while the "body language and facial expressions were important forms of communication" (p. 379), for students only "a tiny majority" considered the loss of visual cues to be a disadvantage. However, a majority of the survey's respondents indicated that they preferred a face-to-face discussion to an online one. Some of the anecdotal comments provided in the survey referred to challenges related to the inconvenience of not having a computer at home, a lack of spontaneity, the volume of messages, difficulties establishing momentum in the discussion, digressions, and the lack of voice and facial expressions.

2.3 Theoretical Framework

This section will be guided by; Blooms assessment model.inductive model of teaching and technology acceptance model.

2.3.1 Blooms and assessment model

The wide spread adoption of technology has resulted in a group of cognitive psychologists, led by Benjamin Bloom (1950) and Lorin Anderson (a former student of Bloom), modernizing Bloom's original taxonomy/hierarchy.

Since questions (items) on quizzes and exams can demand different levels of thinking skills, Benjamin Bloom created this taxonomy for categorizing level of abstraction of questions that commonly occur in educational settings. The taxonomy provides a useful structure in which to categories test questions, since teachers will characteristically ask questions within a particular levels of questions that will appear on the exams. Reflective of the new core competencies associated with the integration of technology into the classroom and workplace, the updated taxonomy places creativity at the highest level of cognitive skill and guides teachers in in development of standardized assessments.

21st Century Assessment will enable students to perform rich real tasks, often collaborative, involving higher order thinking. The tasks will reflect and mirror 21st Century learning. They will be clear and transparent, with the student, their peers and the teacher intimately involved in the marking process. (Bloom's Taxonomy) 21st Century Assessments are focused on both the learning process and the assessment outcome. Linked to assessment is the importance of timely, appropriate, detailed and specific feedback. Feedback as a learning tool is second only to the teaching of thinking skills [Michael Pohl]. As 21st Century teachers, we must provide and facilitate safe and appropriate feedback, developing an environment where students can safely and supportively be provided with.

Allowing students input into the development of the assessment is a key step to achieving student ownership and engagement. Why should our students not have involvement in their own learning? .The process of learning is as important as the end product. We must value the outcomes of our learning and the process of reaching those outcomes. 21st

Century assessments must be inclusive of higher order thinking. Necessary to in higher order thinking are the lower order elements of recall and understanding. To be able to analyze, evaluate or create we must be able to understand, remember and apply.

According to (Bloom) the ability to collaborate is a skill employer's value. Students spend much of their time collaborating and communicating. They are developing fluency in a variety of media; instant messaging, txt with cell phones, chat in embedded chartrooms on their Facebook or bebop pages, twittering and working collaboratively on Google documents; students constantly collaborate.

2.3.2 Inductive model of teaching

The wide spread adoption of technology has resulted in a group of cognitive psychologists, led by (Hilda Taba 1902-1967). In her experimental studies conducted in the central costa school, she provides a teaching strategy to improve the learner's ability to handle information and solve problem. Reflective of the new core competencies associated with the integration of technology into the classroom and workplace, HildaTaba developed three postulates that places creativity at the highest level of cognitive skill .The postulates were as follows:

The first postulate is that thinking can be taught.

Thinking is an active transaction between the individual and the data. The interactive processes is the classroom learning which is facilitated by the teacher who provides instructional materials like computers on which the learner performs certain cognitive operations and organizes facts into concepts and draws certain generalizations to hypothesize, predict and explain unfamiliar phenomena. The teacher can help the students in the process of internalization and conceptualization by use of technology.

The third postulate is that the process of thinking evolves sequential order .The teacher using technology should help the learner to go through certain mental operations which are not visible in order to perform the activity. The teacher is the initiator of phases and thus is the major controller of information.

Growing from this research (Wittrock, 1986, 1978), teaching influences achievement through changing the ways students think about, organize, and process information,

including to how they apply it to their daily lives. Teaching influences achievement by inducing students to construct meaning from the instructions. Also teaching drives the technology rather than technology driving the teaching. Strengths in Pedagogy can and will make up for deficits in technical ability. Whereas the teacher with an understanding of 21st Century pedagogies, who recognizes that these technologies are enablers and motivators for our 21st Century learner, is able to use the learner's own skills and abilities to enhance their learning and the integration of ICT.

2.3.3 Technology Acceptance Model

This is an information systems theory that models how users come to accept and use a technology. The model suggests that when users are presented with a new technology, a number of factors influence their decision about how and when they will use it, notably Perceived usefulness (PU). This was defined by Fred Davis as the degree to which a person believes that using a particular system would enhance his or her job performance". Perceived ease-of-use (PEOU) Davis defined this as "the degree to which a person believes that using a particular system would be free from effort (Davis 1989).

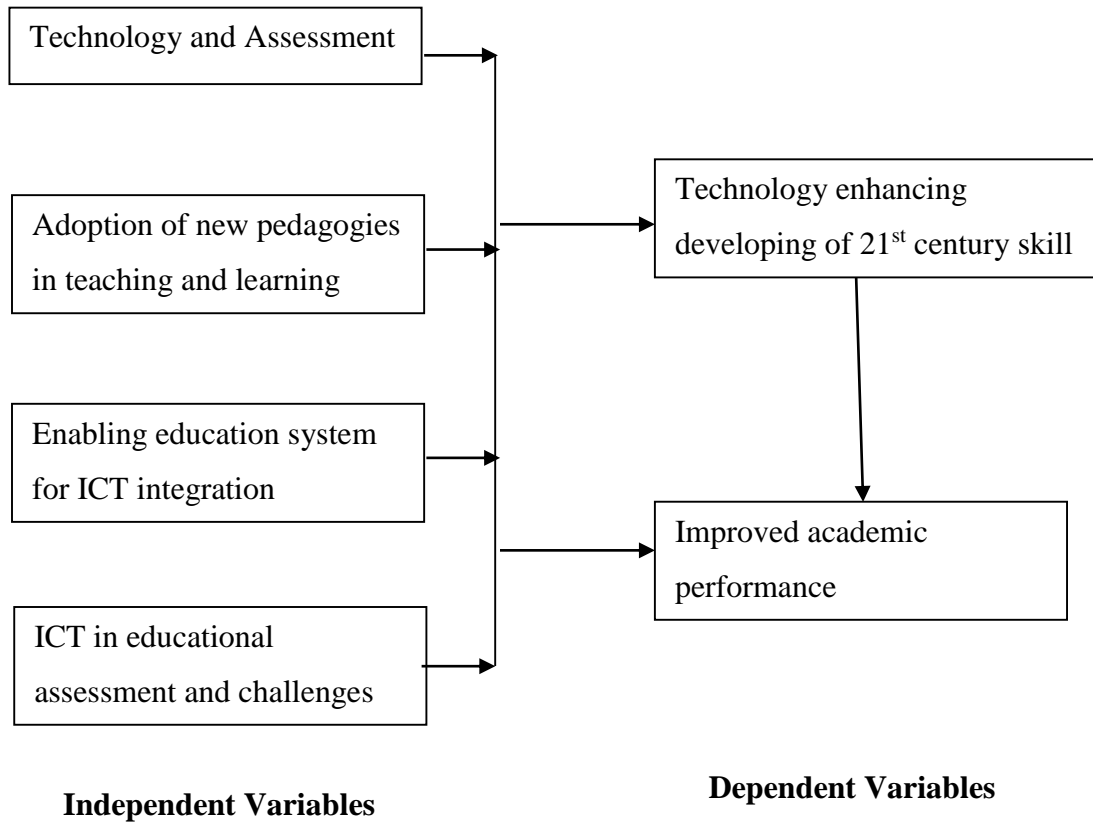
The TAM has been continuously studied and expanded—the two major upgrades being the TAM 2 (Venkatesh & Davis 2000 & Venkatesh 2000) and the Unified Theory of Acceptance and Use of Technology (or UTAUT, Venkatesh et al. 2003). Tested a unified information technology acceptance and use research model, called which aims to explain user intentions to use an information system and subsequent usage behavior.

Learning about ourselves as learners in 21st century also involves thinking about issues of transfer—of learning in ways that allow us to solve novel problems that we may encounter later. The mere memorization of information is usually not sufficient to support transfer. Learning with understanding typically enhances the experience (e.g. NRC 2000). An important goal for transfer is cognitive flexibility (e.g., Spiro, Feltovich, Jackson, & Coulson, 1991). Experts possess cognitive flexibility when they can evaluate problems and other types of cases in their fields of expertise from many conceptual points

of view, seeing multiple possible interpretations and perspectives. Wiggins and McTighe (1997) argue that understanding complex issue involves being able to explain them in more than one way.

2.4 Conceptual Framework

Conceptual Framework on Interrelated Factors on contribution of technology in transforming 21st century learning skills.



CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the research methodology used in the study. The geographical area where the study was conducted, the research design, target population ,sample and sampling procedure, research instrument, instrument validity, instrument reliability ,data collection procedures and data analysis.

3.2 Research Design

The design of the study was through a quantitative approach. According to Burns and Grove (1993:777) quantitative research is a formal, objective, systematic process to describe and test relationships and examine cause and effect interactions among variables. The study was a descriptive case investigating the extent to which technology is used in enhancing 21st century transformational learning in secondary schools in regard to students and teachers and entire learning environment..A survey was used to collect original data for describing a population too large to observe directly (Mouton 1996:232). A survey obtained information from a sample of people by means of self-report, that is, the people respond to a series of questions posed by the investigator (Pollitt & Hungler 1993:148). In this study the information was collected through self-administered questionnaires distributed personally to the subjects by the researcher.

3.3 Target Population

The target population of this study consisted of the teachers, students and head teachers in selected secondary schools in Limuru district. Teachers play a key role in Operational planning on ICT use in teaching and learning. They are in a better position to provide relevant information about ICT use in education. Students were also included because they are the center of interest in the use of ICT in teaching and learning. The study was carried out in Kiambu county Kenya. Comprising of twenty secondary schools Limuru sub-county.

3.4 Sample Size and Sampling Techniques.

It is rarely possible to gather information from the entire population largely because of time, and money coupled with the fact that the entire population may be inaccessible (Moore, 1983). The researcher randomly sampled every school in the population to give equal chances of being included in the sample (Gall et..Al, 1996). 30% of the target population is representative enough to generalize the characteristic being investigated (Mulusa 1990).

3.5 Pilot study

A pilot study was carried out with schools that are outside the population to validate both the study and instruments of data collection. This made the findings from this study more reliable,

3.6 Research Instruments

The instrument that was used for data collection in this study was the questionnaire. This is because according to Dooley (2004), Questionnaire consists of many items which when combined produces more reliable measure of construct than would any single item .The questionnaires for this study contained both open and closed ended questions on the possibility of technology in enhancing the 21st century skills in secondary schools.

3.6.1 Validity of the Instrument.

The term instrument validity indicates the degree which measures the construct under investigation (Borg and Gall, 1989). The study used content validity to measure the degree to which the sample of the test items represented the content they were designed to measure. To enhance validity piloting of the instruments was carried out in 3 secondary schools within Kiambu county. The researcher carried out test retest of the instruments in order to identify items that might have been inadequate for measuring variables and necessary adjustments was made.

3.6.2 Reliability of the Instrument

Reliability is the ability of research instrument to be consistent. Reliability ensures scientific usefulness of any research work (UNESCO, 2004). Reliability is influenced by random error. Error may arise at the time of data collection and may be due to inaccuracy by the investigator or inaccuracy of the instruments (Best and Khan, 2004). For a study to be valid it has to be reliable. Reliability can be affected by the way questions are phrased and presented. The researcher ensured that questions were designed and put across in the simplest way. This was improved further through pre-testing. Pre-testing the questionnaires assisted the researcher in identifying ambiguities and difficulties in terms and phrases that respondents might have encountered.

3.7 Data Collection Procedure

Before data collection, a research permit was obtained from the ministry of education offices to allow for data collection. The researcher used primary data of which the questionnaires were distributed to the randomly selected sample of teachers, students and head teachers. The questionnaires were personally administered to head teachers, teachers and students by the researcher and record responses. The researcher analyzed each questionnaire according to the opinion of respondents. The responses were counted, the frequencies calculated, percentages and mean score obtained. The research was conducted on, and the exercise took three weeks for both delivery and collection of the questionnaires.

3.8 Data Analysis Technique

The results of the study were both qualitative and quantitative. Quantitative data collected using a questionnaire was analyzed by the use of descriptive statistics using the Statistical Package for Social Sciences (SPSS) version (18.0). The raw data was coded and presented through percentages, means, standard deviations and frequencies. The results were displayed by use of bar charts, graphs and pie charts and in prose-form. This was done by tallying up responses, computing percentages of variations in response as well as describing and interpreting the data in line with the study objectives through use of SPSS.

Qualitative data was analyzed using content analysis which is the best suited method of analysis and for this study. Content analysis is defined by Creswell (2003) as a technique for making inferences by systematically and objectively identifying specific characteristic of messages and using the same approach to relate trends.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1 Introduction

This chapter presents the study response rate, analysis of the data and interpretation of the information there in on the possibility of technology in enhancing 21st century skills in education in public secondary schools in Limuru sub-county, Kiambu County, Kenya in regard to students and teachers and entire learning environment. The study was guided by the following objectives:

Determine whether ICTs integration enhances students 'development of 21st century skills in secondary schools.

Determine whether education system is ICT enabled

Examine whether the curriculum has incorporated ICT assessments and whether 21st century skills are addressed in secondary schools.

To examine whether teachers adopt new pedagogies that embrace 21st century skills.

4.2 Response Rate

The researcher used case study design where the research structure included intensive and in-depth investigation on an issue at hand in a relatively small sample. The research was conducted on sample size of 242 respondents including head teachers, teachers and students from public secondary schools in Kiambu county Kenya. sample size of 242 respondents out of which 236 respondents completed and returned the questionnaires duly filled in making a response rate of 100%. Mugenda and Mugenda (1999) stated that a response rate of 50% and above is a good for statistical reporting. Among various categories involved in these study; 50% were male head teachers, 50% female head teachers. 52.4% were female students, 47.6% male students. 60% male teachers while female teachers were 40%.

4.3 Data analysis

The study made use of frequencies (absolute and relative) on single response questions. On multiple response questions, the study used Likert scale in analysing the data whereby a scale of 3 and 5 points were used in computing the means and standard deviations.

These were then presented in tables, graphs and charts as appropriate with explanations being given in prose.

Reliability of the results

Reliability of the results was calculated using Cronbach’s Alpha coefficient.. According to (Cronbach &Shavelson, 2004), if a measurement scale has a Cronbach’s coefficient above 0.50 the results are reliable as an internally consistent scale .A coefficient of reliability of 0.85 and above implies that the research instrument yields data that have a high test-retest reliability, that is the research instrument yields consistent results with every use.

The findings of reliability of the instruments used are presented in Table below

Table 4.1: Reliability of Results

Study variables	Cronbach’s Alpha	Pearson Correlation
ICT assessment in curriculum	0.712	0.872**
New pedagogiesin teaching practices	0.706	0.878**
Technology and education	0.604	0.873**
IT and educational assessment	0.755	0.852**

Source: Field Data, 2014

From the findings, the Cronbach alpha values were higher above 0.5 for all the study variables i.e. innovative ICT assessment in curriculum (CAV=0.712), new pedagogies (CAV=0.706) enabling education system for ICT implementation (CAV=0.604) and educational assessment that enables student develop 21st century skills (CAV=0.755). This was an indication that there was internal consistency among the items/variables (innovative ICT assessment in curriculum, new pedagogies, enabling education system for ICT integration and educational assessment that enables students develop 21st century

skills) in measuring the concept of interest (improved academic performance of learners in public secondary schools in kiambu county. (Frankell&Wallen, 2000; Mugenda & Mugenda, 2008).

In addition, the Pearson coefficient values obtained were greater than 0.85 for the respective variable as seen in Table above. The instrument was therefore accepted since the reliability coefficient was more than 0.70, but the suggestions made by the teachers on words and phrases that were not clear were incorporated in the final instrument.

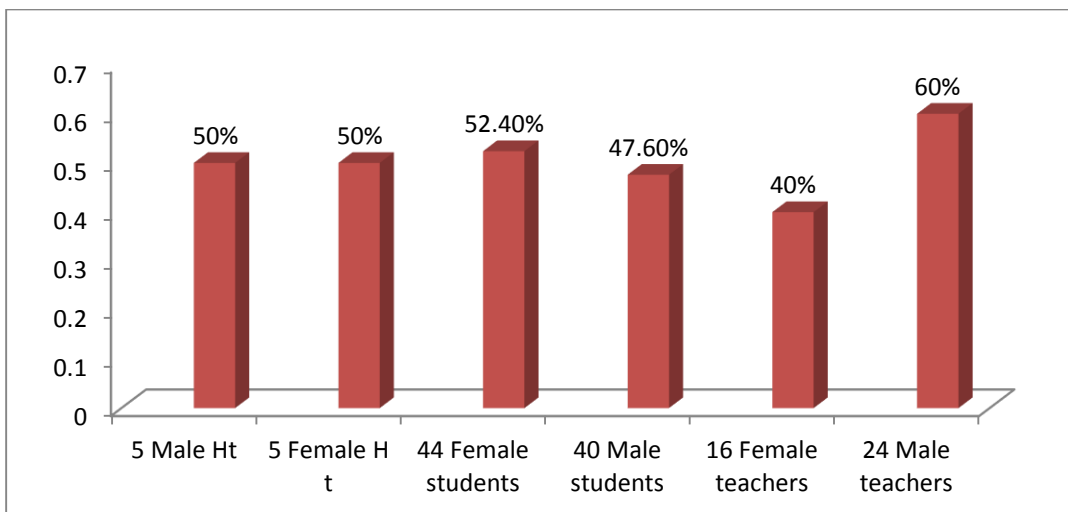
Demographic Information

The study initially sought to inquire information on various aspects of the respondents’ background, i.e. the respondent’s age, gender, education level and length of time of teaching experience. This information aimed at testing the appropriateness of the respondent in answering the questions in regard to the technology in enhancing 21st century learning skills in public secondary schools in Kiambu County, Kenya in regard to students, teachers and entire learning environment.

Respondents gender distribution

The researcher sought to establish the gender of the respondents targeted in these study head teachers, teachers and students and the findings is as shown in the figures below.

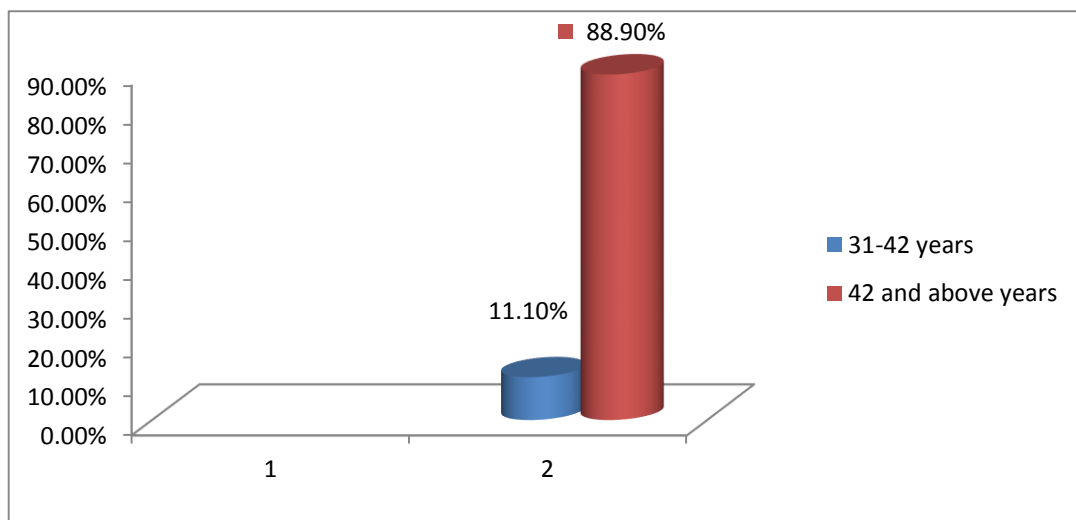
Figure 4.1 Gender of respondents



From the study findings among various categories involved in these study; 50% were male head teachers,50% female head teachers.52.4% were female students,47.6% male students.60% male teachers while female teachers were 40%.these implies that both genders was well represented in these study.

Respondents' distribution by Age

The study sought to establish the age of the respondents and the findings are as shown in **Figure 4.2 Head teachers age distribution**

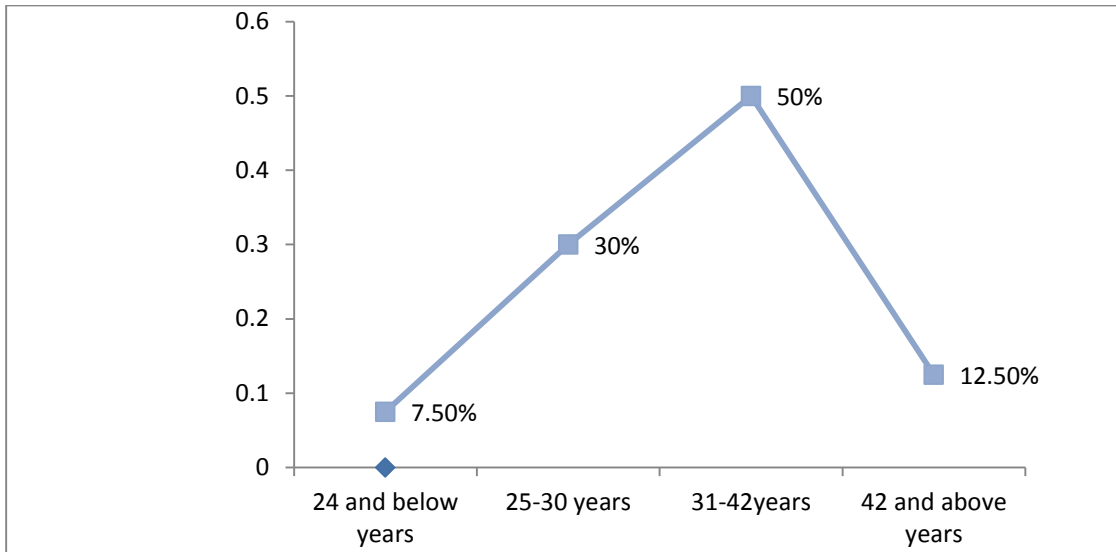


Majority of the head teachers had attained an age of 42 and above (88.9%) while the remaining of head teachers were in age bracket (31-42) years accounting for only (11.1%)

Of the respondents. These depicts majority of the head teachers were advanced in age and thus experience.

The teacher's distribution by age

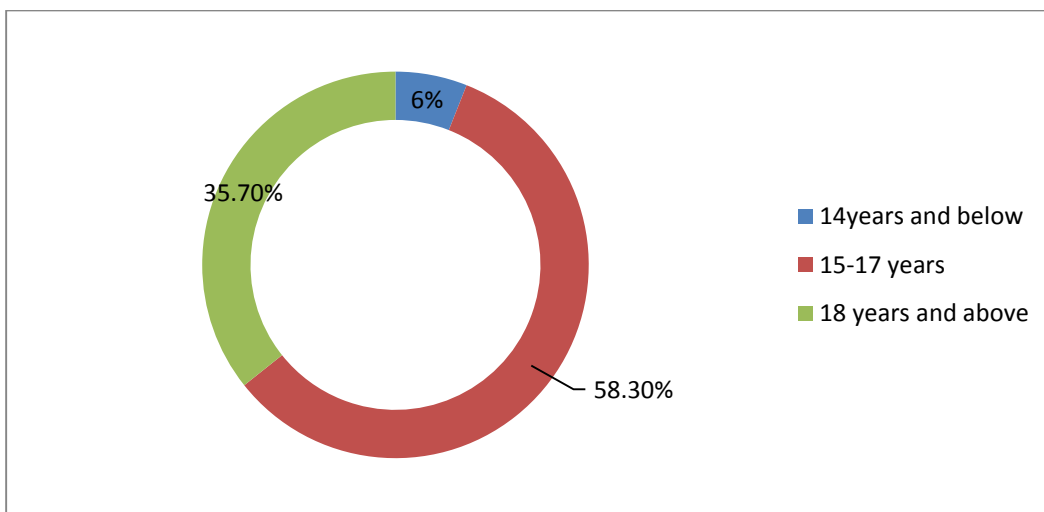
Figure 4.3 The teacher's distribution by age



The study reveals that majority of teachers were in age bracket 31-42 years totalling to 50% of respondents. 30% were in age bracket between 25-30 years of age, while the 12. % being above 42 years of age with the remaining 7.5 being below the age of 24 years. These reveals that majority of the teachers who responded were mature enough

Students' age

Figure 4.4: Students Ages

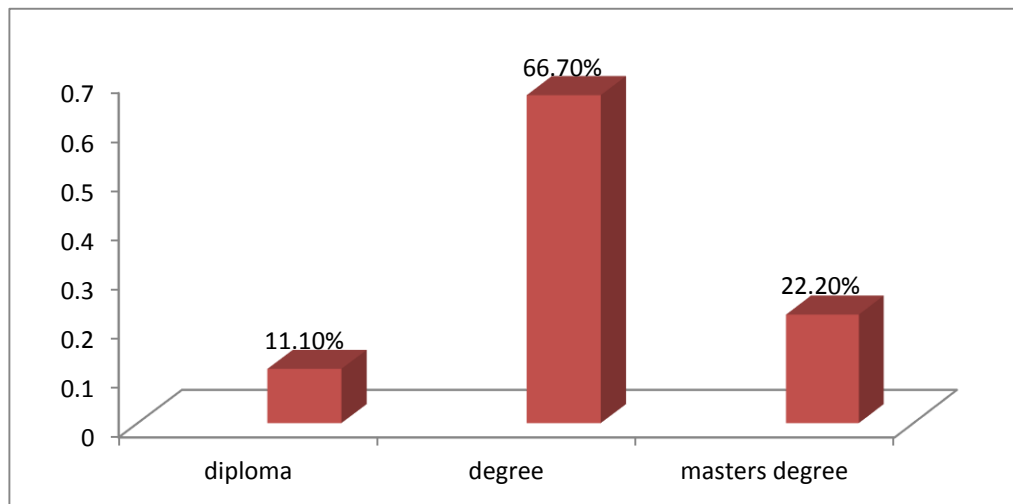


The study revealed majority of the students involved in study were in age bracket 15-17 years accounting for 58.3%.35.7 had attained the age of 18 years and above. Only 6% of respondents were below 14years of age.

Head teachers education level

The study sought to know the highest education level for head teachers and the findings is as shown in the figure below

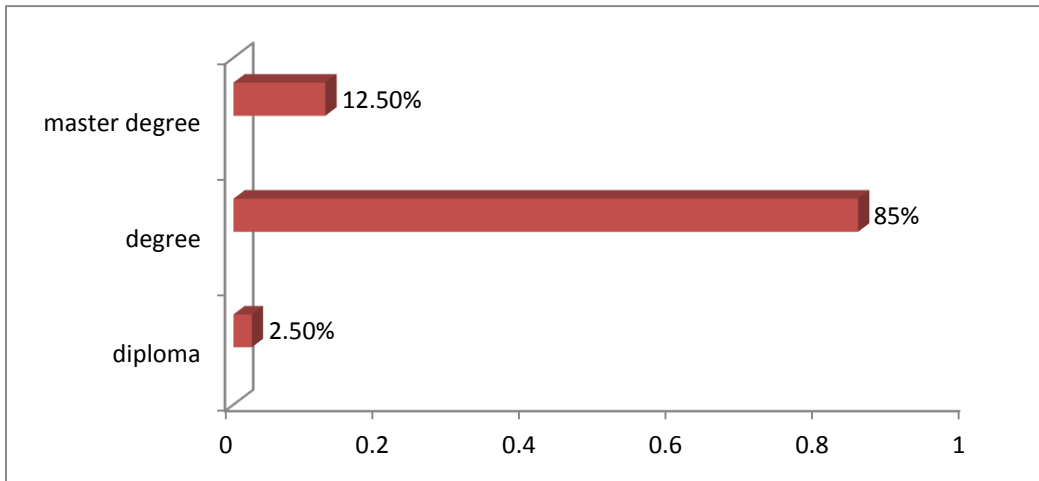
Figure 4.5: Headmasters education level



The figure above head teachers in the study had degree education qualification 66.7%, those had master's degree qualification accounted for 22.2% and only 11.1% having attained diploma level These depicts that head teachers who responded had higher education qualification and therefore better informed in subject matter .

Teacher's education qualification

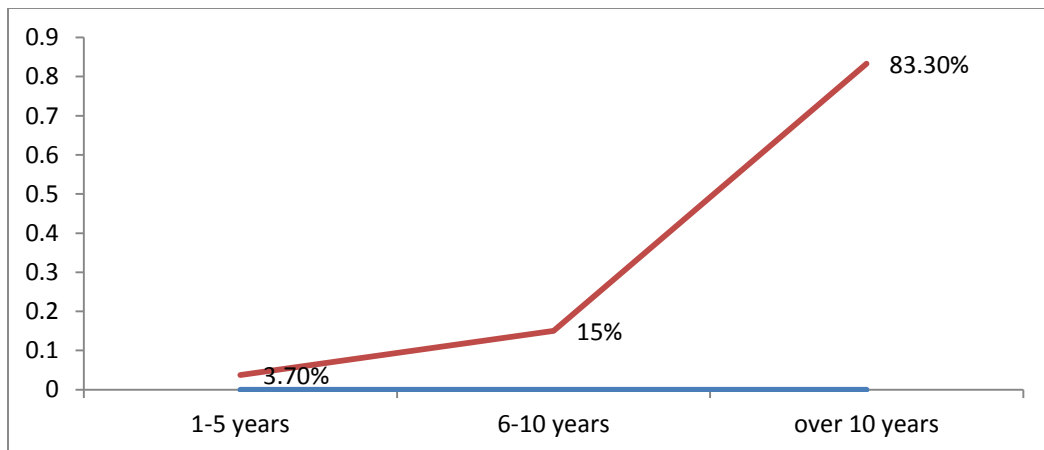
Figure 4.6 Teachers education qualification



The research shows that majority of teachers in these study had attained degree level of education 85%.those with masters degree were 12.5%, while remaining being diploma holders at only 2.5%.the revelation was that fast majority of teachers were in apposition to contribute positively towards the development of 21st century learning skills.

Head teachers teaching experience

Figure 4.7 head teachers teaching experience



The study reveals that majority of the head teachers had teaching experience of over 10 years these is 83.3%,those who had taught for between 6-10 years were 15% with the

remaining 3.7% having taught for only between 1-5 years. The study concludes that majority of head teacher had long teaching experience.

Length of teachers teaching experience

Table 4.2 length of teachers teaching experience

	Frequency	Percent
1-5 years	16	40.0
6-10	9	22.5
over 10 years	15	37.5
Total	40	100.0

From the study findings majority of teachers 40% had taught for a period of between 1-5 years,37.5% had had an experience of over 10 years with the remaining 9teachers having an experience of between 6-10 years at 22.5%.this shows most teachers who responded had minimum teaching experience.

4.3.1 ICT integration in enhancing students ‘development of 21st century skills

This objective sought to know the level of agreement on the ICT integration and enhancement of 21st century skills. The researcher used various questions related to this objective. These were; Likert scale questions, ICT facilities available, accessibility of ICT to teachers in their teaching, if there is ICT policy, ICT policy in assessment, ICT training for teachers and duration, sponsor of teacher ICT training, Internet connection and the speed of internet and management information system for students’ assessment records.

ICT in development of 21st century skills

The responses were rated on a five point likert scale where: 1=very dissatisfied,2=dissatisfied,3=neutral,4= satisfied, 5= very satisfied. The mean and standard deviations were generated from SPSS and are as illustrated in Table 4.6

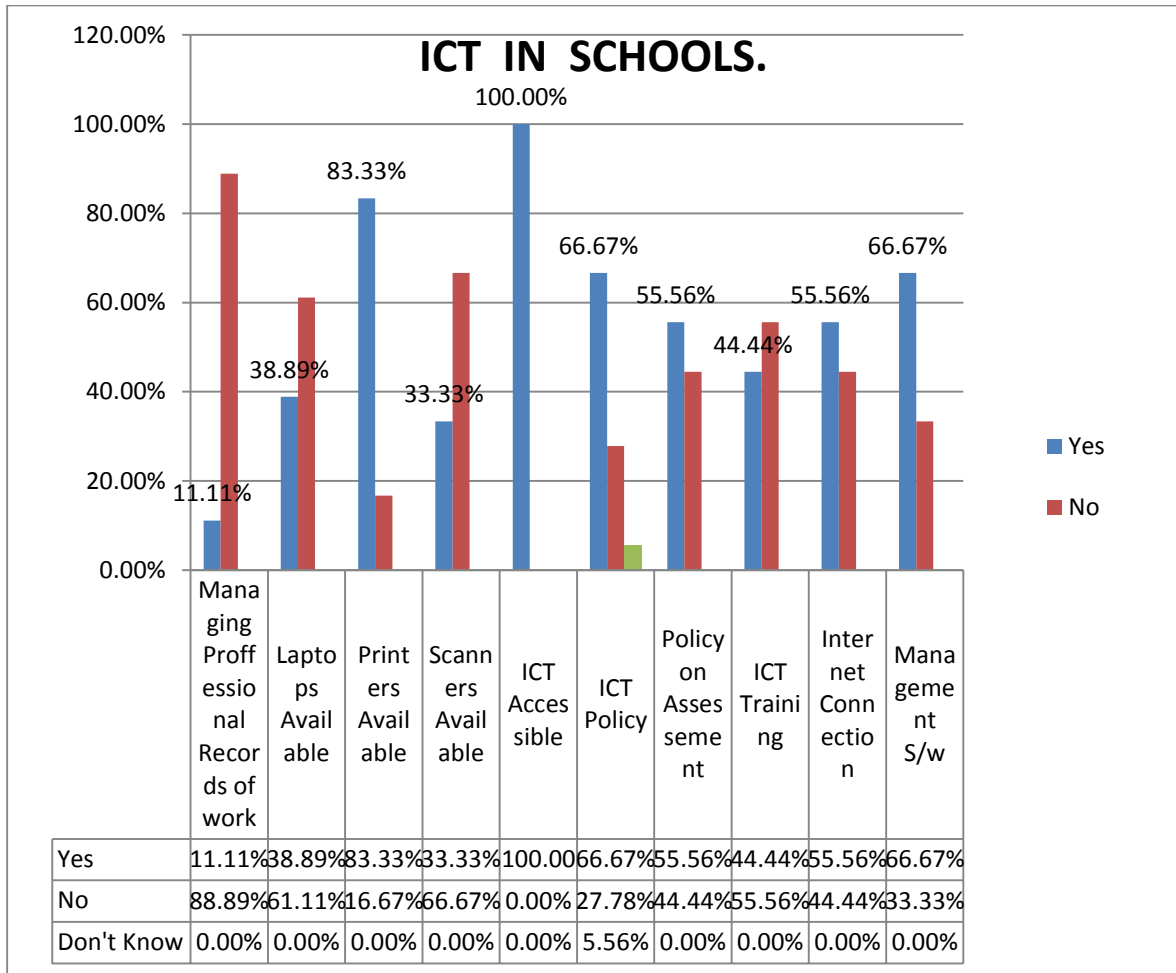
Table 4.3 ICT in development of 21st century skills

ICT integration in development of 21 st century skills	Mean std deviation
The learning skills measured by convectional tests will become less important due to technological change	1.45561.0138
ICT and acceptance by schools will provide unique opportunities to promote education	1.6678
ICT will successfully employed to reach out to a great number of students to reach out to a great number of learners to whom education was previously not accessible	1.0303
I am willing to apply ICT skills I learnt when teaching and assessing students	2.556

From the study findings majority were very satisfied that were willing to apply ICT skills they learnt when assessing students or giving tests at mean=(2.578), Lack of skills in the use of ICT equipment and software does result in lack of confidence in utilizing ICT tools to impact on learning at mean =(2.5345), am willing to apply skills learnt when teaching at mean =(2.456), ICT will be succe3ssful employed to reach out to a greater number of students, including those to whom education was previously not easily accessible at mean=(2.344)respectively. ICT integration into assessment is necessary in assessing learners in a better manner. At mean=(2.000), Information and communication technologies (ICT)and their increasing acceptance and adoption by schools/society will provide unique opportunities to promote education mean=(1.667) and The learning skills measured by conventional tests will become less important due to technological change mean =(1.455) consented to statement but were not very satisfied.

ICT facilities availability

Figure 4.8 ICT facilities availability



From the study findings majority of head teachers agreed their schools do not use ICT to manage professional records of work, 88.89%. with only 11.11% reporting to use ICT in the Management of professional records. This indicates that many schools have no infrastructure that embraces ICT in management of records.

The research also revealed that schools had laptops, printers and scanners at 38.89%, 83.33%

And 33.3% respectively. Likewise 61.11%, 16.67% and 66.67% respectively do not have the above mentioned ICT facilities. These indicate that most of the schools involved in this study have the ICT facilities.

Accessibility of ICT to teachers in teaching activities

Research found that ICT facilities were available to all teachers in the sampled school for their teaching activities at response rate of 100%. None of the schools had no facilities for teaching activities.

ICT policy

Majority of head teachers reported that they have ICT policy in their schools at 66.67%, those who do not have ICT policy accounted for 27.78% of the respondents. The remaining 5.56% did not know whether they had policy or not.

ICT policy in assessment

The study found that majority of respondents consented they had ICT policy included in their Assessment 55.56% with remaining 44.44% indicating they had not included ICT policy in their assessment. This depicts that majority of the schools had ICT policy in their assessments.

Management information systems (MIS) for students record assessment

Management

The research ascertained that majority of the institution in this study 66.67% had management information systems (MIS) for students records management. The remaining 33.33% of the respondents had no management information systems. This reveals that most institution in the study had ICT enabling environment.

Internet connection

The study revealed that majority of schools in the study 55.56% had internet connection in the institution. Only 44.44% had no internet connection in their institution. This reveals that most schools in the area of study could access internet for facilitating ICT learning.

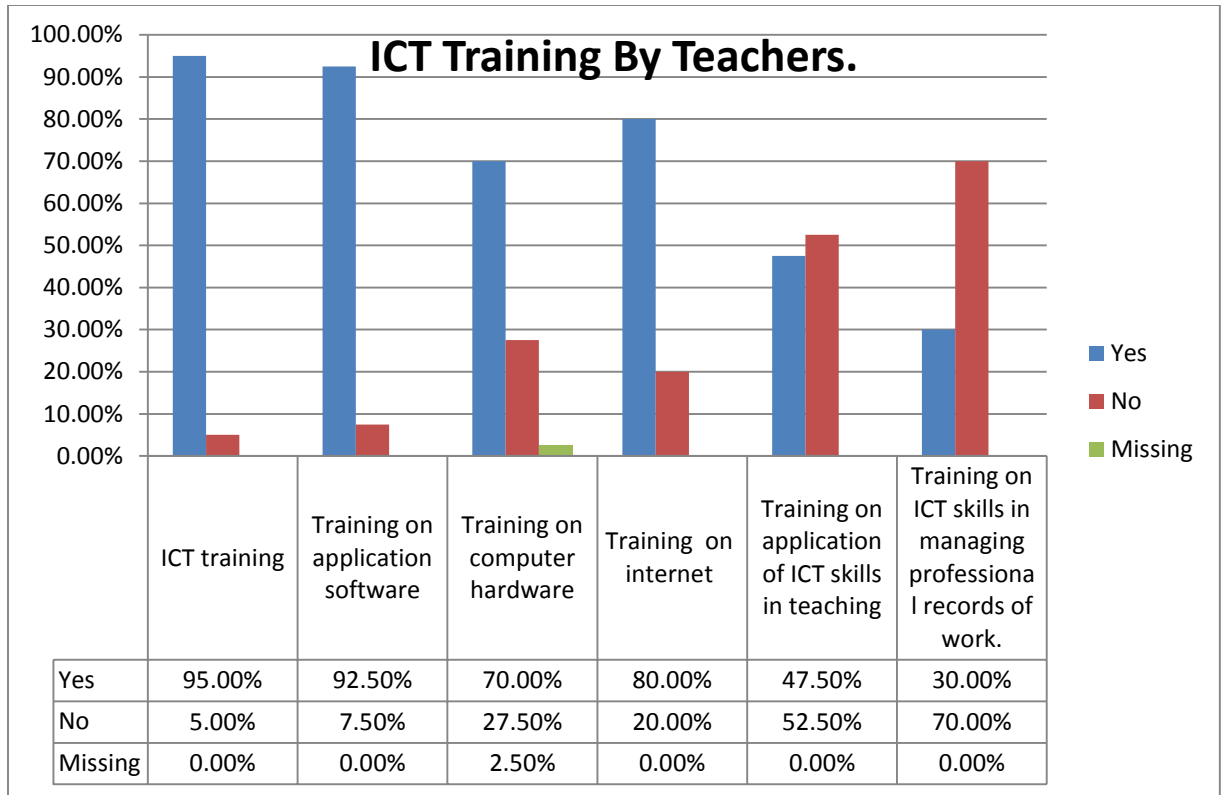
The speed of logging to access information

Table 4.4 speed of logging to access information

	Frequency	Percent
fast enough	14	35
not fast enough	6	15
slow	20	50
Total	40	100.0

The study reveals that the speed of logging to access information is slow to majority of the institution ie 50%, the speed was fast enough for 35% of the institution in the study. ICT Training by teachers.

Figure 4.9 ICT training by teachers



From the study findings majority of the teachers 95% had received training on ICT, with the remaining minority only 5% having no training on ICT. These depicts that teachers were knowledgeable on ICT skills and thus better placed to deliver on 21st century learning skills.

Majority of teachers had training on computer software 92.5% with only 7.5% having no formal training on software application. This reveals that teachers are equipped to impact on the learners.

These study is revealing that majority of the teachers have training on computer hardware 70% ,the remaining 27.5% with no training on computer hardware and only 2.5% not sure whether they have knowledge on software or hard ware. Majority of the teachers 80% had attained training on internet application with only 20% of teachers in these study not trained on internet. These means that majority of teachers could train learners on internet use.

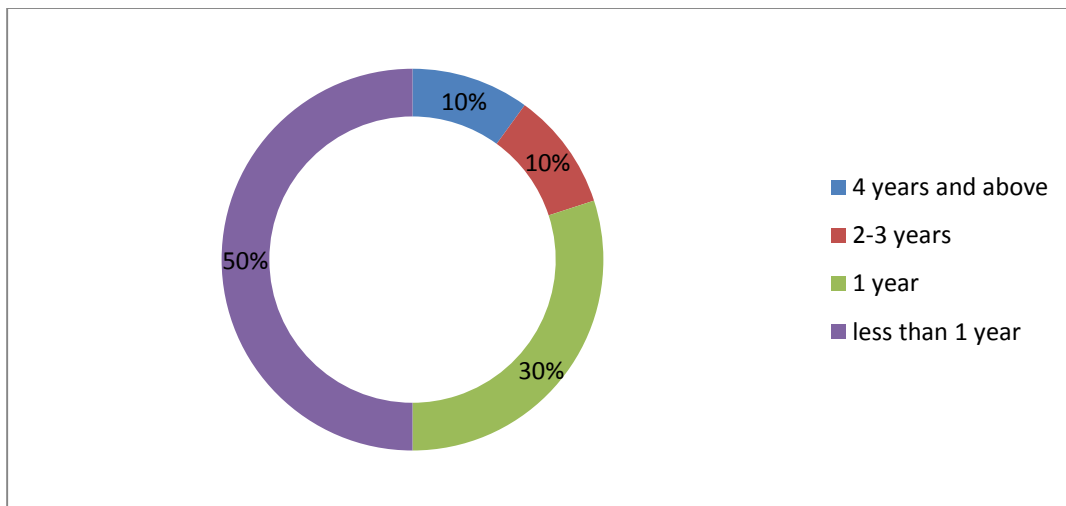
The researcher established that only 47.50% of the teachers applied ICT skills in teaching and majority of the teachers 52.5% did not apply ICT in training. This reveals that fast

majority did not apply ICT skills in teaching and this could derail the transformation of 21st century learning skills.

The study further revealed that fast majority of the teachers did not use ICT skills in managing professional records of work and student's records, only 30% minority managed professional records and students records via ICT skills. This shows that majority of the teachers are not prepared to embrace technology.

ICT training duration for teachers

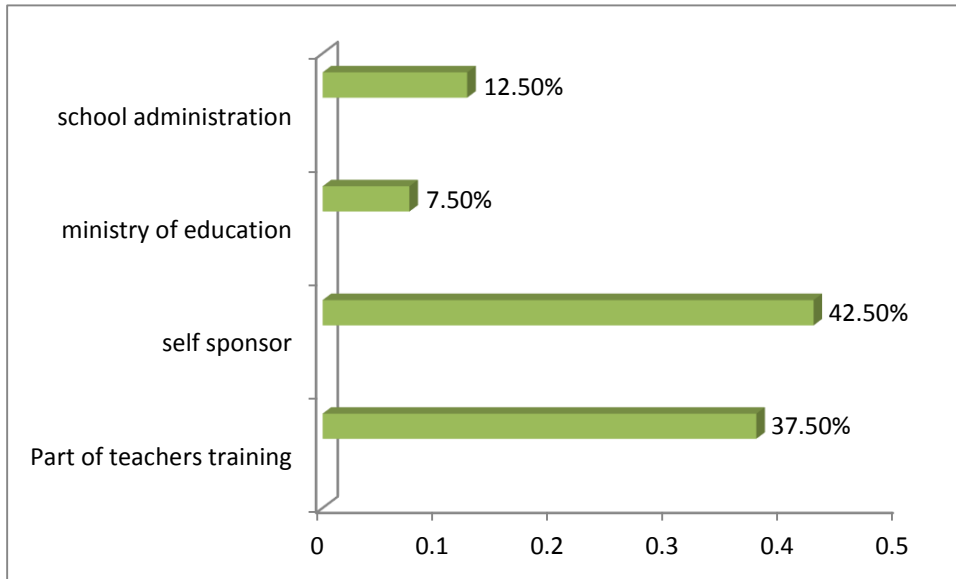
Figure 4.10 ICT training duration for teachers.



The study revealed that majority of the teachers 50% had training for less than one year,30% had trained for one year duration, the remaining teachers had trained for 2-3 years and 4 years and above, these accounted for 10% in both cases. This depicts that teachers need more training to become more equipped for 21st century ICT transformation. it also shows that some teachers are slow in accepting the change.

Teachers training sponsor

Figure 4.11 Teachers training sponsor



From the research findings majority of teachers were self sponsored 42.5%, 37.5% were trained through teachers training provision, 12.5% were trained by school administration, the remaining 7.5% were trained through ministry of education. This reveals that the sponsoring of teachers for ICT skills is below average.

4.3.2 ICT integration in secondary schools

Table 4.5 ICT integration in secondary schools

ICT integration in secondary schools	Mean	Std. Deviation
ICT skills have made me an effective teacher	1.6364	.90214
I believe ICT have demonstrated potential to increase the options ,access ,participation, and achievement for all learners to a large extent	1.4545	.67098
The use of ICT in assessment can increase efficiency in the doing and administrating of exams	1.4091	.50324
Use of ICT in education would promote deep learning, and allows schools to respond better to the varying needs of the students	1.4091	.59033

The study findings shows that majority of respondents strongly agree that ICT skills can make a teacher effective in his teaching practices .at mean =(1.636), they believed ICT have demonstrated potential to increase the options ,access ,participation, and achievement for all learners to a large extent MEAN =(1.445), Use of ICT in education would promote deep learning, and allows schools to respond better to the varying needs of the students and The use of ICT in assessment can increase efficiency in the doing and administrating of exams

At mean = (1.4091) respectively.

Computer at home

The study sought to know whether the teachers had a computer at home the findings are as shown in the table below 4.8

Table 4.6 whether teachers had computers at home

	Frequency	Percent
Yes	31	77.5
NO	9	22.5
Total	40	100.0

The findings show that majority of the teachers in the study had computers at their homes 77.2%, the remaining 22.5% doesn't have computers at their homes. These depicts that most teachers had access to ICT infrastructure.

Whether teachers have assigned computers for their teaching activities

The researcher sought to find out whether the teachers had their computers assigned to them for their teaching activities. The findings are shown below 4.8

Table 4.7 assigned computers for teachers use

	Frequency	Percent
Yes	20	50.0
NO	20	50.0
Total	40	100.0

The findings revealed that half of the respondents 50% indicated that they have been allocated computer for their teaching activities. While the remaining 50% said they have not been assigned computers for their daily use. This being the case then transformation of learning in 21st century may not take effect as conceptualized.

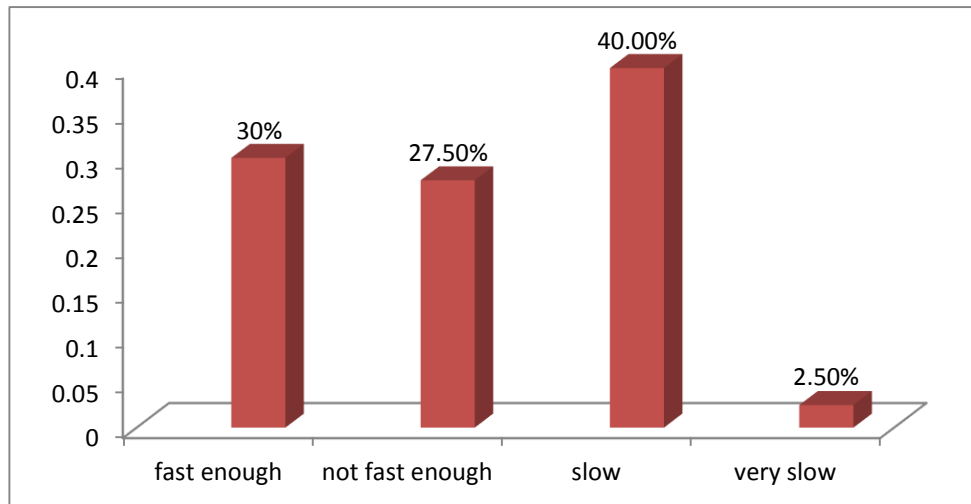
Whether the teachers have access to internet in their work station

Table 4.8 internet accesses to work station

	Frequency	Percent
Yes	22	55.0
NO	18	45.0
Total	40	100.0

The study found that majority of respondents 55% had the internet access in their work station in school, 45% indicated that no internet access to their work station at school.

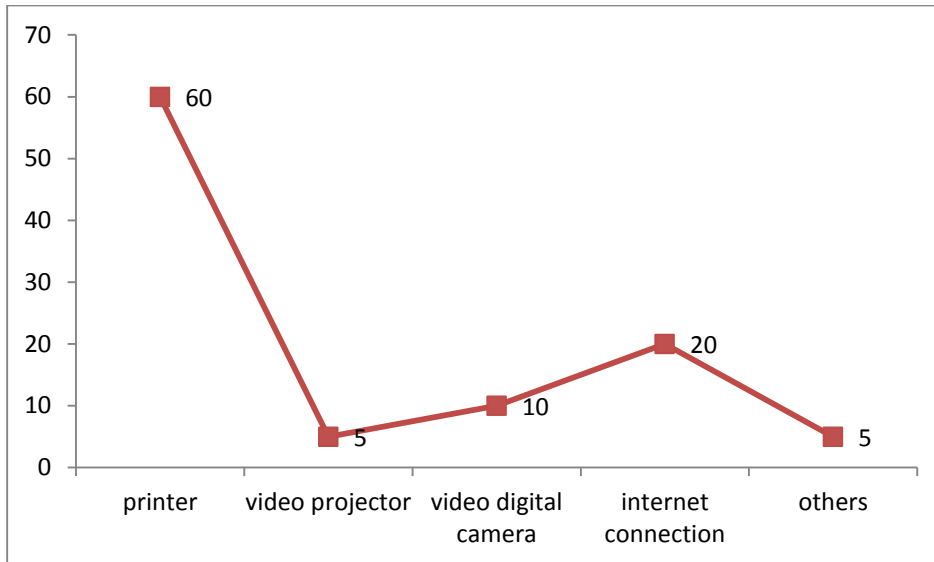
Figure 4.12 logging on speed



The research findings revealed that majority of teachers 40% had slow internet when logging to access information at their work station, 30% indicated that their internet was very fast when logging in, 27.5% had internet not fast enough to log in. 2.50% of respondents had internet connectivity being very slow. This implies that internet connectivity when logging in is generally low implicating that many teachers and students may hesitate to use technology especially those who are impatient and time factor.

ICT infrastructure accessible for professional use

Figure 4.13 ICT infrastructures accessible for professional use



The study found that majority of the respondents 60% used printer as an ICT infrastructure accessible for use in professional task in their school. 20% indicated they use internet connection, 10% uses video digital cameras, the rest of respondents 5% uses video projectors and others. This implies that printer was the only ICT infrastructure accessible for professional use in schools implicating that many schools have not incorporated technology in teaching and learning.

The product of a successful use of application of ICT as conceptualized

The study sought to know the level of agreement on the product of a successful use and application of ICT and enriching learning. The responses were rated on a three point likert scale where: 1 to great extent; 2 to some extent; 3 not at all. The mean and standard deviations were generated from SPSS and are as illustrated in Table 4.4

The study informed that the majority of the respondents agreed to great extent that Learners in the developing world are no longer solely dependent on physical media such as printed textbooks mean = (2.778), Learners bring to school a rich and different set of literacy practices that often go unrecognized and unacknowledged in classroom mean = (2.556), The use of various multimedia devices such as television, videos and computer application offers more challenging and engaging learning environment for students mean =(2.444)

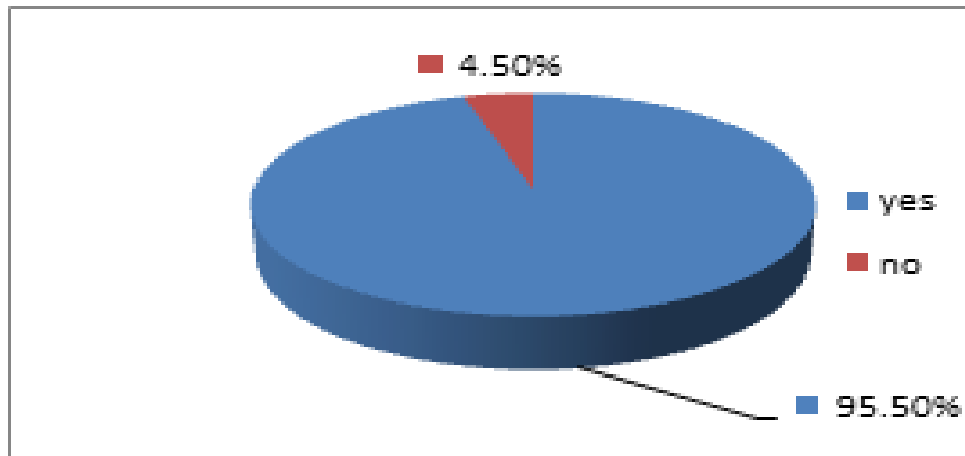
respectively. To some extent head teachers Use of ICT in education can promote deep learning mean =(1.778), Interactive multimedia software motivates students and leads to improved performance mean=(1.556) and that ICT have demonstrated potential to increase the options, access, participation, and achievement for all students mean =(1.334) respectively.

Table 4.91: Success of integration of ICT in infrastructure.

Success on integration of ICT infrastructure	Mean	Std. Deviation
Interactive multimedia software motivates students and leads to improved	1.5556	1.01379
Use of ICT in education can promote deep learning	1.7778	0.83333
The use of various multimedia devices such as television, videos and computer application offers more challenging and engaging learning environment for students	2.4444	0.76810
Learners bring to school a rich and different set of literacy practices that often go unrecognised and un acknowledged in classroom	2.5556	0.77620
Learners in the developing world are no longer solely dependent on physical media such as printed textbooks	2.7778	0.78730
ICT have demonstrated potential to increase the options, access	1.3335	1.13009

Ways in which ICT integration has influenced Students performance

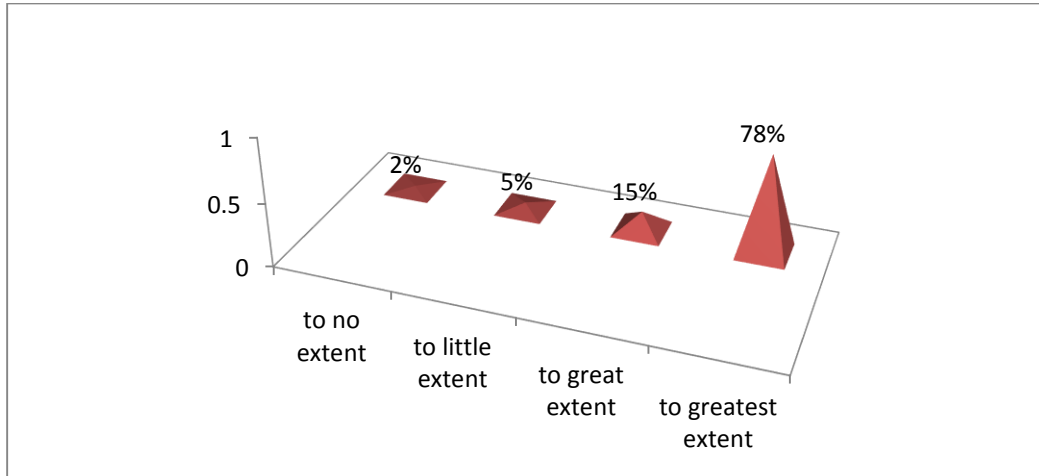
Figure 4.14 ICT and academic performance



From the findings fast majority of the students 95.5% indicated they strongly believe ICT contributes in improving academic performance, only 4.5% of the students objected that ICT improves academic performance. These concludes that ICT affects academic performance directly. Reasons given by students are that with ICT there is reduction in paper work, creation of boarder i.e. they could interact with other students without physical meeting but via online, students could submit their work/assignment via email, reduced paper work good for job management and reduced cost involved in paper works.

4.3.3 Technology and educational assessment of 21st century skills

Figure 4.15 Misperception to creativity and innovation



The study revealed that fast majority of respondents 78% agreed to the greatest extent that lack of attention to developing creativity and innovation skills is often based on a common misperception that creativity is for artistic-types. 15% also agreed to great extent on the above statement. Only 2% objected to the above statement that creativity is only for artistic-types.

According to the study it implies that innovativeness and creativity can be improved with time as long as there is an enabling environment.

Table 4.9 Technology and Educational Assessment of 21st century skills

	Mean	Std. Deviation
Learning is one of the most complexes of things to measure because it cannot be directly observed but must be inferred	2.545	0.595
Efforts to assess the 21 st century skills are still in their early years and that schools(in countries, wards, constituency) will have difficulties in developing the ability to deliver these assessments at scale	3.000	0.590
Creativity and innovation skills can be developed like other skills with practice and over time	1.536	0.726
Twenty –first skills of creativity and innovation are more challenging to teach and learn, and they are also more difficult to assess.	1.636	0.581

From the study findings majority of teachers were very satisfied that Efforts to assess the 21st century skills are still in their early years and that schools (in countries, wards, constituency) will have difficulties in developing the ability to deliver these assessments at scale at mean =(3.000) , Learning is one of the most complexes of things to measure because it cannot be directly observed but must be inferred mean=2.545) respectively. However some respondents were mere satisfied that Twenty –first skills of creativity and innovation are more challenging to teach and learn, and they are also more difficult to assess mean =(1.636) and that Creativity and innovation skills can be developed like other skills with practice and over time mean= (1.536) respectively.

4.3.4 New pedagogies and 21st century literacy

Table 4.10: New pedagogies and 21st century literacy

New pedagogies and 21st century learning	Mean	Std. Deviation
Differences in technology use and perception of value between teachers and students can effectively act to block change in the integration and use technology in literacy pedagogy	4.4111	0.6667
The demands on teachers to develop a critical disposition towards technology while keeping abreast of current technologies is a challenging task	2.8889	0.45409
Attempts to invest new pedagogies have been limited both by conventional attitude to teaching and learning and the wider socioeconomic context	2.1111	0.16667
Teachers pedagogical beliefs and knowledge are important factors in their quest for technology integration	1.0778	1.09291

From the findings majority of the findings were satisfied that Differences in technology use and perception of value between teachers and students can effectively act to block change in the integration and use technology in literacy pedagogy mean =(4.411) , The demands on teachers to develop a critical disposition towards technology while keeping abreast of current technologies is a challenging task mean =(2.889) , Attempts to invest new pedagogies have been limited both by conventional attitude to teaching and learning and the wider socioeconomic context mean =2.111), and Teachers pedagogical beliefs and knowledge are important factors in their quest for technology integration, mean =(1.0778)

Table 4.4 Contributing factors to success of ICT and enriching learning

Success of new pedagogies and 21 st century literacy learning	Mean	Std. Deviation
Teachers pedagogical belief and knowledge are important factors in their quest for technology integration	1.5556	1.01379
Differences in technology use and perceptions of value between teachers and students can effectively act to block change in the integration and use of technology in literacy pedagogy	1.7778	0.83333
The demands on teachers to develop a critical disposition toward technology while keeping abreast of current technologies is a challenging task	2.4444	1.13039
Attempts to invest new pedagogies have been limited both by conventional attitudes to teaching and learning and the wider social economic context	2.5556	1.01379

From the research findings majority of the respondents agreed to great extent Attempts to invest new pedagogies have been limited both by conventional attitudes to teaching and learning and the wider social economic context mean =(2.556), The demands on teachers to develop a critical disposition toward technology while keeping abreast of current technologies is a challenging task mean =(2.444) respectively. To some extent respondents agreed that differences in technology use and perceptions of value between teachers and students can effectively act to block change in the integration and use of technology in literacy pedagogy mean =(1.778) and Teachers pedagogical belief and knowledge are important factors in their quest for technology integration mean =(1.556) respectively.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter gives a summary of the findings, draws conclusions and makes recommendations and suggestions for further research. The main focus of the study was to investigate the possibility of technology in enhancing development of 21st century learning skills in public secondary schools in Limuru sub-county Kiambu county Kenya in regard to students and teachers and entire learning environment.

5.2 Summary of the study

5.2.1 ICT in development of 21st century skills

According to the results, majority of the Head teachers agreed that schools do not have enough ICT to manage professional records of work, 88.89%.with only 11.11% reporting to use ICT in the management of professional records. This indicates that many schools have no infrastructure that embraces ICT in management of records. The research also revealed that schools had laptops, printers and scanners at 38.89%, 83.33% and 33.3% respectively. Likewise 61.11%, 16.67% and 66.67% respectively does not have the above mentioned ICT facilities.

From the study findings majority were very satisfied that were willing to apply ICT skills they learnt when assessing students or giving tests at mean = (2.578).

Studies also showed that respondents were satisfied that ICT can do the following;

- ICT will be successful employed to reach out to a greater number of students, including those to whom education was previously not easily accessible at mean= (2.344) respectively.
- Information and communication technologies (ICT)and their increasing acceptance and adoption by schools/society will provide unique opportunities to promote education mean=(1.667)
- The learning skills measured by conventional tests will become less important due to technological change mean = (1.455) consented to statement but were not very satisfied.

However this was found to be curtailed by Lack of skills in the use of ICT equipment and software which results in lack of confidence in utilizing ICT tools to impact on learning .Tella, et al. (2007) found that inadequate knowledge to evaluate the role of ICT in teaching and learning, lack of skills in the use of ICT equipment and software had resulted in a lack of confidence in utilizing ICT tools.

5.2.2 ICT integration in education in secondary schools.

From the study the results shows that ICT facilities are available like computers (56.6%) in schools, internet connection, 52.2% and scanners at 64.4%. however, the study shows that these facilities are not used as intended because from the findings majority of teachers agreed that they do not use ICT in management of professional records of work and students assessment of records.

Studies also showed that there is ICT policy 66.6% put in place for ICT use and assessment. However majority of head teachers reported that they hardly support teachers in training (12.5).Majority of the teachers either are self sponsored or they studied a unit in college. This is a clear indication that teachers lack technical support hence they are not motivated to embrace technology. This is consistent with Preston (2000) who concluded that lack of technical support to be key inhibitor to the use of ICT in classroom. The results of the findings also showed that even if there was internet connection (55.56%) the speed (66%) of logging in to access information was very slow. This is clear cut information of teachers not embracing technology especially those who are impatient.

Therefore, schools should invest heavily on infrastructure that embraces ICT in management of records. Also ministry of education together with school management needs to make arrangement for ICT training for their teachers.

From the findings fast majority of the students 95.5% indicated they strongly believe ICT contributes in improving academic performance, only 4.5% of the students objected that ICT improves academic performance. These conclude that ICT affects academic performance directly. Reasons given by students are that with ICT there is reduction in paper work, creation of boarder i.e. they could interact with other students without physical meeting but via online, students could submit their work/assignment via email, reduced

paper work good for job management and reduced cost involved in paper works. This is in line with Kipsoi J. Emmy, Chang'ach John K., Sang Hellen C (2012), who pointed out that Technologies have a great potential for knowledge dissemination, effective learning, and efficient education services. Also Biggs(1999) noted that ICT provides new opportunities for teaching and learning and besides it can engage students and promote critical thinking . Yet, if the educational policies and strategies are not right, if ICT in education policies are not well thought out, and if the prerequisite conditions for using these technologies are not met concurrently, this potential will not be realized.

5.2.3 Technology and educational assessment of 21st century skills

From the study findings majority of teachers were very satisfied that Efforts to assess the 21st century skills are still in their early years and that schools (in countries, wards, constituency) will have difficulties in developing the ability to deliver these assessments at scale at mean =(3.000) , 21st century skill is one of the most complexes of things to measure because it cannot be directly observed but must be inferred mean=2.545) respectively. Both assessment and ICT hold challenges for many teachers. While well designed assessment can enhance students' learning effectiveness, and all teachers should be 'assessment literate' and capable of using assessment to inform instructional practice (Campbell & Collins, 2007), these expectations are not matched by studies of teachers' assessment knowledge (Brook hart, 2001; Campbell & Evans, 2000). However, teachers were in agreement that those skills like creativity and innovation can be developed with practice and overtime.

To achieve all this skills, computer studies should be made mandatory to all students right from primary level. Also technology should be introduced as a unit for all courses at the university.

5.2.4 New pedagogies and 21st century literacy learning

from the findings majority of the respondents were satisfied that Differences in technology use and perception of value between teachers and students can effectively act to block change in the integration and use technology in literacy pedagogy, mean =(4.411) , The demands on teachers to develop a critical disposition towards technology while keeping abreast of current technologies is a challenging task mean =(2.889) , Attempts to invest new pedagogies have been limited both by conventional attitude to teaching and learning and the wider socioeconomic context mean =2.111), and Teachers pedagogical beliefs and knowledge are important factors in their quest for technology integration mean =(1.0778) respectively. The result is the likelihood that innovations in ICT will not be well received by teachers and managers of schools due to conflict with the firmly entrenched traditions. Venkatesh and David (2000) proposed that change in schools means changing attitudes, norms, beliefs, and values associated with the school culture.

As shown by Bradley and Russell (1997), recurring faults, and the expectation of faults occurring during teaching sessions have reduced teachers' confidence and caused teachers to avoid using technology. In addition, obstacles such as access to equipment, time pressures, lack of mentor and opportunities for apprenticeship of observation also have an impact on teachers' ability to use ICT (Slaouti& Barton, 2007). The studies found that teachers lack basic skills in the use of ICT equipment and software which results in lack of confidence in utilizing ICT tools to impact on learning. Studies found that they also lacked adequate knowledge to evaluate the role of ICT in teaching and learning. To achieve all this skills, computer studies should be made mandatory to all students' right from primary level. Also technology should be introduced as a unit for all courses at the university. This will greatly improve adoption of ICT hence improved academic performance.

5.3 Conclusion

The study sort to find the possibilities of technology in enhancing 21st century learning skills. The results show that schools are yet to be IT enabled. As to whether integration of technology enhances students' development of 21st century skills, is too early in the education system to tell. Further curriculum has yet to incorporate IT assessment. This

well mean that curriculum as it is structured, is yet to adopt to address 21st century skills. Teachers are to adopt to modern approaches that incorporate 21st century skills. Therefore, the government should give priority to technology and how it can be adopted to enhance 21st century skills.

5.4 Recommendations

The study recommends the following

Ministry of education together with school management needs to make arrangement for ICT training for their teachers to provide ICT enabled environment.

Educational policies and strategies should be put right, should be well thought of and prerequisite conditions for using these technologies should be met concurrently, to enable students development of 21st century skills.

Computer studies should be made mandatory from primary level to create a technology enabling environment which in turn yields transformational 21st century skills.

Schools need to invest heavily on infrastructure that embraces ICT in management of records

5.5 Suggestions for Further Research

Based on the findings and the scope of this study, the researcher recommends further studies to be carried out in the following areas:

- A replica of the study should be carried out within other public primary schools and in other counties to investigate the possibility of technology in enhancing 21st century learning skills in public secondary schools in regard to students and teachers and entire learning environment.
- Contribution of technology in assessment of 21st century skills.
- Technology in transforming a 21st century learner.

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APPENDICES

APPENDIX 1: Research Instrument

TEACHERS questionnaire

Section 1: Personal Details

1. Gender

(a). Male (b). Female

2. What is your age?

a) 24 years and below

b) 25 – 30 years

c) 31 - 42 years

d) 42 years and above

3. What is your highest level of education?

a) Diploma

b) Degree

c) Masters degree

e) Other (please specify)

4. Length of time of teaching experience?

a) 1 -5 years (b) 6- 10 years (c) over 10 years

SECTION 2:

I. Teacher's perception in the use of ICTs and 21st century perspective

5.) a). Have you ever received any ICT training? Yes No

(b) If yes, in (a) above how long was the duration of the training?

4 years and Above 2 – 3 years 1 years less than 1 year

6.(c) Who sponsored you for the ICT training?

Part of teacher training Self- sponsor Ministry of Education

School administration

Others specify _____

d. Which areas of ICT did the training cover?

Accessibility of ICT infrastructure _

8. Do you have a computer at home?

9. Do you have a computer in your place of work assigned for your use in teaching activities?

10 (a). Do you have access to the internet in your work station in school?

(b). If yes) how fast are you able to log in so as to access information?

Fast enough [] Not fast enough []

Slow [] very slow []

11. Identify the ICT infrastructure accessible to you for use in your professional tasks

12. To what extent do you agree on the following statement on ICT innovative assessments:

Lack of attention to developing creativity and innovation skills is often based on a common misperception that creativity is only for artistic-types and geniuses (artists and fashion designers)

a) To no extent () c) To great extent

d) To greatest extent b) To little extent

13. Suggest conditions required in the following_

- a. Sustainable use of ICT in schools
- b. Sustainable use of ICT in teaching and learning process
- c. Sustainable use in administration in class in ordering learners
- d. Sustained use of ICTs in assessment

Appendix II: Students questionnaire

Section 1: Personal Details

1. Gender

(a). Male (b). Female

2.a) 14 years and below b) 15-17 years

c) 18 years and above

SECTION 2:

3. Do you believe ICTs contribute in improving academic performance?

Give reasons.....

4. Do you have a computer at home?

5 .Do you have a computer in your school of doing the work assigned for your use in learning activities?

6.a) Do you have access to the internet in your school?

b) If yes , how fast are you able to log in so as to access information?

Fast enough Not fast enough Slow Very slow

6. Has ICT engagement resulted in better engagement in your learning?

7 (a) Has it (ICT) influenced your performance?

(b) To what extent? Great extent To some extent Not at all

(c) In what way has it influenced your performance.....

8. Has use of ICT motivated you to learn? Yes No To some extent

9 (a).Is ICT use in school worth it?

Yes No

(b) What has been worthwhile for you?

APPENDIX 1II: Research Instrument

Head teachers Questionnaire

Section 1

PERSONAL INFORMATION

1. 1. Gender

(a). Male [] (b). Female []

2. What is your age?

a) 24 years and below []

b) 25 – 30 years []

c) 31 - 42 years []

d) 42 years and above []

3. . What is your highest level of education?

a) Diploma []

b) Degree []

c) Masters degree []

e) Other (please specify)

4. Length of time of teaching experience?

a) 1 -5 years [] (b) 6- 10 Years [] (c) over 10 year

Section 2

5. What ICT facilities does the school have?

Computers [] laptops [] printers [] scanners []

Any other specify

6. Are they accessible to the teachers for use in their teaching activities?

7. Does the school have an ICT policy?

8. Does the school ICT policy conform to that of Ministry of Education?

9. Do the elements in the school ICT policy include assessment?

10. Have you arranged for ICT trainings for your teachers?

11. How often are the ICT trainings planned and implemented?

Weekly [] Monthly [] Termly [] Yearly []

12. What measures has the administration put in place in order to ensure teachers get required technical support?....

13. What is your view on use of ICT in assessment practices in your school?

Very important [] important [] least important [] not important []

15. Do you have internet connection in the institution?

16. Do you log in fast enough to get information from the internet?

17. Does the institution have a management information system (MIS) to manage students' assessment records?

18. Is the ICT used for any assessment process?