FACTORS INFLUENCING INTEGRATION OF COMPUTER-BASED TECHNOLOGIES IN TEACHING IN SECONDARY SCHOOLS IN VIHIGA COUNTY, KENYA

By

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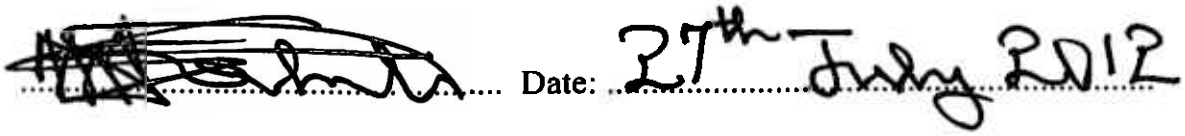
DECLARATION

This project report is my original work and has not been presented for any award in any university.



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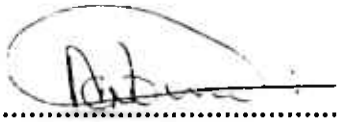
This project report has been submitted for examination with my approval as University Supervisor.



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DEDICATION

I dedicate this work to my wife Janet, and my children; Titus, Allan, Bruce, Imogene and Joy who were a source of encouragement in the realisation of this project.

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LIST OF ABBREVIATIONS AND ACRONYMS

CAI	Computer Assisted Instruction
CBM	Computer-Based multimedia
CBT	Computer-Based Technologies
CCK	Communications Commission of Kenya
CD-ROM	Compact Disk-Read Only Memory
CMC	Computer Mediated Communication
CMI	Computer Managed Instruction
ICT	Information Communication Technology
KIE	Kenya Institute of Education
LCD	Liquid Crystal Display
NEPAD	New Partnership for African Development
SPSS	Statistical Package for Social Sciences
www	World Wide Web

ABSTRACT

This study investigated factors influencing the integration of computer-based technologies in teaching by teachers at Secondary School level. Generally there has been a slow integration of computer-based technologies by teachers in teaching in secondary schools in Kenya. It was critical to study the factors that influenced integration of computer based technologies in teaching. The factors analysed were; attitude, knowledge in ICT, access to ICT tools and subject taught as informed by the literature review. The study employed a survey design using questionnaires and interview guides as the main data collection instruments.

The study used teachers in schools with computers. The schools were purposively sampled and questionnaires administered to teachers in all the school curriculum subjects and to students. The questionnaires and interviews were administered by the researcher and one trained assistant. Data was stored in Microsoft Excel and was analysed using SPSS. Qualitative data was presented using frequencies, tables and percentages.

The level of CBT integration in teaching was found to be low. The study revealed that teachers' skills and experience with ICT and access to ICT tools significantly influenced CBT integration in teaching. Attitude and subject taught were found not to be significant determinants in CBT integration since integration of CBT did not significantly vary across subjects. Teachers' knowledge in ICT and access to ICT tools were found to be a significant factors in integration of CBT in teaching, hence teachers with ICT knowledge and who had access to ICT tools were more likely to integrate CBT in teaching.

The understanding from the research is paramount to the successful implementation of computer-based technologies in the wider secondary school population. It will also help to change pedagogical processes and improve performance outcomes. We have recommended enhanced pre-service and in-service training of teachers on ICT and CBT integration as well as enhanced teacher access to ICT facilities within each school.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Computer-based technologies are increasingly becoming the principal technology in driving instructional delivery. Globally learners at all levels are accessing knowledge through computers and web-based technologies. They interact with each other and their teachers and work on group assignments and share experiences. This has made learning more interesting and effective.

Many schools in developing countries including Kenya are yet to embrace the use of these technologies in classrooms or by distance. Even in schools where pioneer projects have been sponsored by donors and the government, integration is not yet mainstreamed (Ayere, Odera, and Agak, 2010). Most schools use face to face delivery methodologies with print media being the major instructional material. It is necessary for these institutions to rapidly invest in integrating computer-based technologies in education if they are to compete favourably on the international academic arena.

The use of computer-based technologies in the classroom can increase interactivity in the teaching-learning process and facilitate self-paced learning. Students can have access to a wide variety of resources available throughout the world. Virtual learning communities can be formed, in which students and teachers throughout the world can contact each other any time of the day to share observations and information. Currently the technological tools available to the average learner include print materials, radio, television and video.

Computer applications for education fall in to four main categories:

The first is the Computer Assisted Instruction (CAI) in which the computer is used as a self-contained teaching machine to present discrete lessons to achieve specific but limited educational objectives. In CAI computers individualise learning, while giving immediate feedback and reinforcement. There are several CAI models including drill and practice, tutorial simulations and games, and problem solving. The second category is Computer Managed Instruction (CMI) in which the computer's branching, storage and retrieval capabilities are used to organise instruction and track student's records and progress. In this model the instruction need not be delivered thorough the computer, although often CAI which is the instructional component is combined with CMI. The third use of computers is Computer Mediated Communication (CMC) whereby computer applications are used to facilitate communication. These include electronic mail, computer conferencing, and electronic bulletin boards. New CMC applications include Facebook, Twitter, YuTube and Skype. The fourth is computer-based multimedia (CBM) in which various voice, video, graphics and print are integrated into a single, easily accessible delivery system. Interactive video and CD-ROM technologies can be incorporated into computer based instructional units, lessons, and learning environments. The interactive nature maximises learner control.

National, regional and international computer networks increase access to education by linking resources and individuals wherever they might be. Of these the internet is the largest and most powerful computer network in the world, linking millions of computers and people. With access to the internet students can use electronic mail

(email), Facebook, Twitter, bulletin boards such as listservs and Usenet and the world wide web (www). Email is used to exchange messages or other information with people by internet software through the computer network. Feedback from a distant instructor can be received more quickly than messages sent by mail and students can read messages at their convenience and easily store them for later reference.

Setting up a classroom bulletin board for students who are distant from each other can encourage interaction between them. With a class computer conference, individual students can post their questions to the class, and every other individual is free to respond. The conference can also be used to post all modifications to the class schedule, assignments, tests and answers to assignments and tests. It can also be used to engage students in dialogue with other students and teachers.

The www is the front-end of the internet. As quoted in Distance Education at a Glance Guide 6: Computers in Distance Education, the www is described by Hughes (1994) as "... a wide area hypermedia information retrieval initiative aiming to give universal access to a large universe of documents". The www provides internet users with uniform and convenient means of accessing the wide variety of resources in form of graphics, pictures, videos, data and sound available on the internet. Software interfaces such as Mozilla Firefox, Internet Explorer, Google, Ping, Mosaic and Netscape facilitate navigation and use of the www.

The central organising feature of the www is the "home page" that is created by every organisation or individual user. It contains the information each wants to present. A classroom home page can cover information about the syllabus, assignments, exercises, text books and instructors. The hypertext capabilities of the www facilitate linking of

information within the home page and with other home pages on the www. The teacher can provide links to information on the www that can be useful to students in the class. Other links could provide library resources and each student's home page.

According to Intelecom Research Report (2000), as quoted by Gakuu (2006), current and on-going technological developments have the capacity to generate the following benefits particularly in the developing world: First through internet and the www, new and enlarged sources of information and knowledge that offer teachers and students opportunities for self-development as well as benefits when applied to the classroom environment. Second, through email and other internet based methods, greater opportunity to reduce the isolation and time delay associated with distance education. Third, through the extraordinary pace of software development, enriched teaching and learning with enhanced graphics, interaction, animation and visualisation. Fourth, through lowering of telecommunication bandwidth costs, and the emergence of enhanced cable, wireless and satellite systems, greater opportunity for basic access, video conferencing, online interactive learning, and live interaction with the central place of distance education programs. Fifth, this will make the benefits of distance education eventually available to lo wer income people and rural communities.

For effective integration of the internet in the teaching-learning process, all students should have access to computers to ensure equal opportunity for computer interaction and feedback. They should also have basic computer and online communication skills and be made aware and become familiar with the resources available on the internet and the most effective way to use them.

The government of Kenya in collaboration with New Partnership for African Development (NEPAD) in 2005 launched a computer learning project in six schools in Kenya, a school in six of then eight provinces. The participating schools were Maranda Boys (Nyanza Province), Chavakali Boys (Western Province), Menengai High School (Rift Valley Province), Wajir Girls (North Eastern Province), Mumbi Girls (Central Province) and Isiolo Girls (Eastern Province). These schools were to serve as centres of excellence in the integration of ICT, and serve as role models to other schools. They were provided with computers, elearning materials and internet appliances.

Other initiatives include the digitisation of school syllabus and subject content by the Kenya Institute of Education, computer donations and networking by the Kenya telecommunication regulator, Communications Commission of Kenya (CCK), and partnership programmes by the Clinton Global Initiative, Cisco, Intel, Microsoft and USAid. These projects are being regarded as role models for other schools in the country. Individual schools have also initiated computer projects. It is anticipated that the computer-based technologies will enhance efficiency and effectiveness in teaching-learning processes through improved pedagogies, access to information, flexibility in learning and enhanced learner motivation.

Ayere et al (2010) identified significant differences in academic performance of NEPAD and non-NEPAD schools attributed to e-learning. According to the Minister for education Prof. Sam Ongeri in a speech at Kenya Institute of Education (KIE) on launch of an e-learning international conference on 31st March 2010 one thousand five hundred schools in Kenya were equipped with computers by the ministry as at that time. Two hundred and ten additional schools in proposed Constituency Centres of Excellence were

planned to have similar computer projects, while at individual level many other schools continue to purchase computers and e-learning materials. However, limited research has been carried out to establish the extent to which computer-based technologies have been integrated in the teaching-learning process in these schools and the factors that have influenced the integration. If this trend continues a lot of resources are likely to be wasted with minimal gain in terms of efficiency and effectiveness in the use of computer-based technologies in teaching and learning.

According to Allan Davies of Athabasca University (2004) the addition of a new functionality, new content, or new tool sometimes does not add value and is ignored, but in other cases, a simple enhancement can reap great educational and other rewards for all concerned, and sometimes in unanticipated ways. This research sought to establish the factors that have influenced the integration of computer-based technologies in teaching in secondary schools.

1.2 Statement of the Problem

Generally there had been a slow integration of computer-based technologies in teaching in secondary schools in Kenya. Ayere et al (2010) identified significant differences in levels of integration of ICT in curriculum subjects, in the use of e-material in educational research and availability of e-libraries. The study showed that use of computers was more frequent in NEPAD schools as compared to non-NEPAD schools despite the fact that teachers in the later had higher ICT qualifications. It was also noted that students from the NEPAD schools used more elearning and the internet in educational research.

At the time of the study the Ministry of Education had on-gong elearning pilot programmes in various schools. These projects were to act as change agents in the integration of computer-based technologies and ICT in general in the teaching processes in secondary schools in the country.

As these projects were replicated by the wider population of schools it was critical to study the factors that had influenced the integration. This understanding would be paramount to the successful implementation of the technologies in the wider secondary school population since it would bring to the fore the facilitating and impeding factors. This would enable schools make wise decisions in the implementation process.

It is for these reasons that this study aimed at establishing the factors that influenced the integration of computer-based technologies in teaching processes in secondary schools.

1.3 Purpose of the Study

The purpose of this study was to investigate factors that influence integration of computer-based technologies in teaching by secondary school teachers in Vihiga County.

1.4 Research Objectives

The objectives of this research were:

1. To establish the extent to which attitudes of secondary school teachers towards computer-based technology influences integration of computer-based technologies in their teaching in Vihiga County.
2. To determine the extent to which teachers' prior knowledge with ICT has on integration of computer-based technologies in teaching.

3. To establish the extent to which teachers access to ICT tools influences integration of computer-based technologies in teaching.
4. To establish the extent to which the subject taught influences integration of computer-based technologies in teaching in secondary schools in Vihiga County

1.5 Research Hypotheses

1. Attitude of teachers is not a significant predictor of integration of computer-based technologies in their teaching.
2. Teachers' prior Knowledge on ICT is not a significant predictor of integration of computer-based technologies in their teaching.
3. Access to ICT tools by teachers is not a significant predictor of integration of computer-based technologies in their teaching.
4. There is no significant difference in integration of computer-based technologies in teaching between different subjects taught in secondary schools in Vihiga county

1.6 Significance of the Study

Out of this study education administrators at the ministry of Education, its curriculum development and implementation agencies and at school level will be in a position to develop strategies for dealing with factors influencing the integration of computer-based technologies in teaching in secondary schools. School managements will have an understanding of the major issues they need to focus on to enable teachers integrate computer-based technologies in teaching. The study will also enable school administrators to understand the relationship between the teachers' attitudes towards

integration of computer-based technologies in teaching, ICT knowledge as well as subject taught and integration of computer-based technologies in teaching. Without understanding these factors the implementation of computer-based programs in schools would be difficult because teachers are the major stakeholders and their role is critical to the implementation. The study results will be useful to other schools in the region and the country in implementing computer-based learning programs. The study will also be a foundation for other future research studies on matters to do with teachers' integration of computer-based technologies in teaching.

1.7 The Scope of the Study

The study was restricted to the factors that influenced Vihiga County secondary school teachers integration of computer-based technologies in teaching processes, their attitudes towards use of computer based technologies and status of integration across the various groups of subjects taught at secondary school. The study covered schools in the county with computer facilities. The sample population for both the pilot and final study were drawn from the teachers and students in secondary schools when schools were in session. The schools had relatively similar characteristics in terms of geographical location and student and teacher characteristics. These schools can act as change agents in the integration of computer-based technologies in the teaching processes in secondary schools.

1.8 Limitations of the Study

Not all teachers were in the institutions or available when the researcher visited the schools for data collection, therefore questionnaires were left behind with the school

administration and later collected after being filled at times convenient to the teachers. In most schools students were in for mid-year examinations; this was overcome by administering the questionnaires over lunch hour or late afternoon after classes. Some secondary school teachers were not well versed with computer technologies and their use in education and therefore the researcher took time to explain terminologies used. The study was confined to schools in Vihiga County due to financial limitations.

1.9 Assumptions of the Study

The study assumed that:

i. The use of computers in the delivery of instructional content is a viable method that teachers were aware of.

ii. Respondents would honestly report their views on integration of computer-based technologies in teaching.

1.10 Definitions of Significant Terms

Attitude: Beliefs and feelings towards the use of computer-based technologies in teaching.

Computer-Based Technologies: Technologies in which the computer forms a central component in the delivery of educational content.

E-Learning (Electronic Learning): A mode of learning through which learning is delivered by electronic means, that is, by Internet, CD-ROMS and DVD-ROMS.

Integration: Teaching while incorporating computer based tools.

Listservs: Early electronic mailing list software applications, allowing a sender to send one email to the list, and then transparently sending it on to the addresses of the subscribers to the list

LoTi Framework: LoTi stands for Levels of Technology implementation. It is a framework for measuring authentic classroom computer use.

Secondary Schools: The second level in Kenya's education system lasting four years; student age ranges from 13 to 18 years.

Usenet: A messaging system that uses a computer network, especially the Internet, to transfer messages organized in thematic groups.

Table 3.1 Operationalization of Variables

Objective	Variable	Indicator	Measurement Scale	Data Collection Method	Data Analysis	Tool of Analysis
To establish the extent to which attitudes of secondary school teachers towards computer-based technology influences integration of computer-based technologies in their teaching in Vihiga County.	X: Attitude on CBTs Y: Integration of CBTs	Views on CBT use in teaching	Ratio	Questionnaires	Quantitative	t-test
To determine the extent to which teachers' prior knowledge with ICT has on integration of computer-based technologies in teaching.	X: Prior knowledge in ICT Y: Integration of CBT	Knowledge in use of ICT Extent and purpose of CBT use	Ratio	Questionnaires	Quantitative	t-test
To establish the extent to which teachers access to ICT tools influences integration of computer-based technologies in teaching.	X: Access to ICT tools Y: Integration of CBT	Frequency and location of use of CBT Extent and purpose of CBT use	Ratio	Questionnaires	Quantitative	t-test
To establish the extent to which the subject taught influences integration of computer-based technologies in teaching in secondary schools in Vihiga County	X: Subject taught Y: Integration of CBT	Subject taught Integration of CBT	Ratio	Questionnaires	Quantitative	One way ANOVA

1.12 Organisation of the Study

This project report was organised into five chapters, starting with chapter one (Introduction), chapter two (Literature Review), chapter three (Research Methodology), chapter four (Data Analysis, Presentation and Interpretation), chapter five (Summary of findings, Discussions, Conclusions and Recommendations) and, finally, References and Appendices.

Chapter One discussed background to the study, statement of the research problem, purpose of the study, research objectives and hypotheses, significance of the study, limitations, scope, assumptions, definitions of terms and presented the operationalization table.

Chapter two discussed the literature review under introduction, Integration of Computer-based technologies in teaching, attitude towards ICT and integration of computer-based technology in teaching, prior knowledge in ICT and integration of computer-based technologies in teaching, access to ICT tools and integration of computer-based technologies in teaching, theoretical framework and finalyconceptual framework.

Chapter three was organised under introduction, research design, location of the study, target population, sample size and sampling procedure, research instruments, reliability, validity, and data collection and analysis procedures.

Chapter four was organised under introduction, response rate, general characteristics of respondents, teachers' attitude towards CBT and level of integration of

CBT in teaching, teachers prior knowledge on ICT tools use and level of integration of CBT, access to ICT tools and integration of CBT in teaching and finally integration of CBT in teaching.

Chapter five was organised under introduction, summary of findings, discussion, conclusion and recommendations, followed by references and appendices. The appendices constituted letter of introduction, research instruments and list of schools with computers at the time of study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This section deals with available literature on computer-based technology integration in teaching. The chapter covers a general view of diffusion of innovations, attitude and ICT integration, prior knowledge in ICT and related studies on ICT in education.

2.2 Integration of Computer-based technologies in teaching.

Methods of teaching to enhance student learning change with advances in technology. Computer-based technologies are among the most recent innovations that are increasingly being integrated into curriculum delivery, but at varying rates across countries, institutions and among individual teachers. It is therefore necessary to understand how humans have integrated technologies in their lives together with the factors that have influenced the integration.

Decision by teachers to integrate computer-based technologies in teaching would mark a shift from conventional pedagogical skills and methodologies. Gakuu, (2006) outlines the pedagogical forces that have driven the push to incorporate information and communication technologies in teaching-learning processes. The first is Information access: The world wide web (www) has made it possible for all people to access information. Mastery of this tool has become essential in order to gain access to up-to-date knowledge available electronically. The second is the need for new communication skills: employers are expecting graduates to be familiar with ICT tools. Thirdly is the rise in asynchronous learning; this allows institutions to break the barriers of time and

distance in the provision of education. In addition leadership, technology infrastructure and cost, resources and reluctance to change have been documented as additional factors that have influenced the adoption of ICT by teaching staff (Gakuu, 2006).

Studies in Sub-Saharan Africa show that effectively introducing technology into schools is largely dependent upon the availability and accessability of ICT resources (Hennessy, Harrison and Wamakote, 2010). Formulation and implementation of national policies on ICT use, supportive local policies, school leadership and curriculum are additional prerequisites for CBT integration, (Wamakote, Ang'ondu and Onguko, 2010). There is also inadequate skills training, lack of technology located in the classrooms and corresponding concentration on purpose-built computer laboratories. This is a model that countries like the UK, with high penetration of ICT in schools, are now abandoning. The lack of contextually appropriate course content for teachers and learners as well as ICT literacy and confidence among teachers have also affected integration of CBTs (Hennessy et al, 2010).

According to Hennessy et al Anderson (1997) has identified physical and cultural factors that affect CBT integration by teachers, including lack of reliable access to electricity, limited technology infrastructure (especially internet access, bandwidth, hardware and software provision), language of instruction and available software; geographical factors such terrain and communication; demographic factors such as population size, density and dispersion. Poverty, HIV and AIDS, and lack of political will have also exacerbated the problem. Teacher literacy, skills, attitudes, lack of autonomy and lack of knowledge to evaluate the use and role of ICT in teaching have hindered teachers readiness and confidence in using CBTs while Kozma, MacGhee, Quellmalz

and Zelles (2004) identified lack of time available in classes, in teachers schedules and lack of policy on the use of computers as factors affecting integration of CBTs.

Jaber and Moore (1999) record that studies concerning the use of computer-based technology for instruction conducted and reported indicate: (1) training and support is needed if teachers are going to successfully use computer-based technology in their instruction (Honey & Henriquez, 1993; Becker, 1994b; OTA, 1988, 1995); (2) there is inadequate financial support (OTA, 1988; Sheingold & Hadley, 1990; Honey & Henriquez, 1993; Becker, 1994b); (3) teachers lack the time to develop lessons and plans which use the computer (Sheingold & Hadley, 1990; Honey & Henriquez, 1993; Becker, 1994b; OTA, 1995); (4) accessibility, scheduling and availability (e.g., not enough computers or peripherals) are problems for teachers wishing to use computer-based technology (Sheingold & Hadley, 1990; Honey & Henriquez, 1993; Becker, 1994b); and (5) many (almost 1/2) teachers do not use computers for teaching even when they were available (Marcinkiewicz, 1994; OTA, 1988, 1995).

Mumtaz,(2000) cites early studies that have investigated why teachers do not use computers in their teaching. The studies include Rosen and Weil, 1995; Winnans and Brown, 1992; Dupagne and Krendl, 1992; Hadley and Sheingold, 1993). They found lack of the following as inhibitors to use of computers in teaching: teaching experience with ICT, on-site support for teachers using technology, help in supervising children when using computers, ICT specialist teachers to teach students computer skills, computers; time required to successfully integrate technology into the curriculum and financial support.

Cox, et al (1999) investigated the factors which have contributed to the continuing use of ICT by experienced ICT teachers in their teaching. Evidence was collected through a literature search, teacher questionnaires, teachers' reports and interviews. The factors which were found to be most important to these teachers in their teaching were: making the lessons more interesting, easier, more fun for them and their pupils, more diverse, more motivating for the pupils and more enjoyable. Additional more personal factors were improving presentation of materials, allowing greater access to computers for personal use, giving more power to the teacher in the school, giving the teacher more prestige, making the teachers' administration more efficient and providing professional support through the Internet. This study sought to establish the extent to which attitude, prior knowledge, access and subject influenced ICT integration in teaching in schools in Vihiga County.

2.3 Attitude towards ICT and integration of Computer-based technology in teaching

Oscamp and Schultz (2005) have defined attitude as a state of readiness, organised through experience, exerting a directive or dynamic influence upon individuals response to all objects and situations to which it is related. It has also been described as a complex mental state involving beliefs and feelings and values and dispositions to act in certain ways. The Macmillan English Dictionary for Advanced Learners (2002) has defined attitude as someone's opinions or feelings about something, especially as shown by their behaviour. Eagly and Chaiken (1993) as quoted by Oscamp and Schultz (2005) define attitude as a psychological tendency that is expressed by evaluating a particular entity with some degree of favour or disfavour. The situation to which one has an attitude is known as the attitude object.

There are two sides of any particular attitude in psychology; the positive and the negative. A bad or negative attitude indicates a leaning toward negativism with regard to the attitude object, while a positive attitude indicates a leaning towards or liking of the attitude object. A neutral attitude is reflected in people who have not yet formed an opinion on the attitude object.

There are three main components of the term attitude: Cognitive, affective and behavioural (Albarracin, 2005). The cognitive component of attitude is the judgment or perception of a situation. It represents a person's awareness of and knowledge about an object. The affective component refers to the emotional response that a person has to a particular situation. It reflects an individual's general feelings or emotions towards an attitude object. The behavioral component is the verbal response or the behavioral pattern by which the individual responds to a situation.

According to cognitive dissonance theory (Rosenberg, 1958) attitudes have influence on how people behave towards any stimulus. This implies that the attitude a teacher has towards ICT will influence his/her acceptance or rejection of it as a viable mode of curriculum delivery.

Attitudes are temporary. They are formed and changed according to experiences such as persuasive communication. Tesser (1993) as quoted by Petty, et al (1997) argues that hereditary variables may affect attitudes.

A number of theories have been put forward to account for attitude formation and change. For example consistency theories, which imply that people seek to be consistent in their beliefs and values to maintain balance. People therefore develop and change their

attitudes to be consistent to their beliefs and values. The most famous example of such a theory is Dissonance-reduction theory, associated with Festinger (1957).

According to Festinger as presented by Schick (2008) and AECT (2001) people will change attitudes to avoid or limit cognitive dissonance, an uncomfortable feeling occasioned by holding two contradictory ideas at the same time. Thus people have a motivational drive to reduce dissonance by changing their attitudes, beliefs and behaviours or by justifying or rationalising them.

Balance theories postulate that attitudes have an adaptive significance to people who hold them (Suedfield, 1971). When the attitude is no longer useful, a new one will be adapted to help achieve new goals.

The implication of these attitude change theories is that it is possible for teachers to adopt and integrate computer-based technologies in teaching in order to enable them maintain homeostatic balance with evolving pedagogies. An understanding of the attitudes teachers hold towards the integration of computer based technologies would therefore inform attitude change mechanisms that would be employed to enable the appropriate attitudes necessary for the integration of the CBTs in teaching. This study therefore sought to determine the attitudes teachers in Vihiga County held regarding integration of CBTs in teaching.

The most straightforward way of finding out about someone's attitude would be to ask them (Macleod, 2009). One way to measure attitude is to construct Likert scale items to which the subject would respond.

2.4 Prior knowledge in ICT and Integration of Computer-based Technologies in Teaching

Competence in a particular methodology determines its use in teaching; teachers tend to use methods in which they feel competent (Gachenga, 2007). Integration of computer based technologies in teaching is influenced by the prior knowledge a teacher has in it. Teachers with prior training in integration of computer based technologies are presumed to be more likely to integrate it in teaching.

Decisions on which computer-based activities and resources to employ also depend on the availability of guides, know-how and more significantly, relevance to attainment of stated objectives. Teachers accessible to necessary ICT integration guides, know-how and experience on concepts that have virtual manipulation resources, employ ICT-process based teaching and learning activities (Wakhaya, 2010). Such facilities are necessary for enhancing knowledge on ICT. Therefore this study sought to establish the extent to which teachers' prior knowledge on ICT has influenced integration of computer-based technologies in teaching in Vihiga County.

2.5 Access to ICT Tools and integration of Computer-based Technologies in Teaching.

The decision by the teacher to use computer-based technologies in teaching is dependant on accessibility and usefulness. Wakhaya (2010) investigated the relationship between access and use of ICT tools and frequency of use, purpose of use and type of teaching and learning activities in teaching mathematics. The study "revealed a moderately strong correlation between mathematics teachers' access and use of ICT tools" and frequency of

use in teaching mathematics. Teachers with access and use of ICT tools frequently employed computer, LCD or OHP in math lessons; multimedia CD, DVD and Cyber School and Encarta; internet resources for lesson preparation; maths-related computer or internet games or activities; MS PowerPoint simulations or animations to illustrate maths concepts; interactive ICT maths resources as well as data base for maths related records. It was evident that mathematics teachers with planned access and use of ICT infrastructure took time to plan on what and how to integrate technology in teaching.

Ayere, et al (2010) attributed more use of ICT in teaching to availability of internet and other ICT equipment and materials which made integration easier as teachers easily accessed the materials or directed learners to relevant sources. Schools that had more access to the internet and e-libraries recorded more integration of ICT in teaching and learning. The study recommended that a school that has an ICT programme should seek to be connected to the internet and to be in possession of e-content relevant to the curriculum taught. It was also recommended that the government finds a way of exposing more schools to e-learning facilities probably by setting up centralised e-learning centres within specified education localities. It was necessary to find out whether access to ICT tools was a factor in integration of CBTs by teachers in Vihiga County. Therefore this study sought to establish the level of access to ICT tools by teachers in Vihiga County.

2.6 Subject and integration of Computer-based Technologies in Teaching.

Ayere, et al, 2010, compared the application of e-learning in New Partnership for African Development (NEPAD) and non-NEPAD schools in Kenya. The study identified significant differences in levels of integration of ICT in curriculum subjects; surveyed the differences in use of materials in education research; examined availability of e-libraries;

identified significant differences in academic performance of NEPAD and non-NEPAD schools attributed to e-learning. The findings brought out the fact that e-learning produces significantly better results in the teaching-learning outcomes in secondary schools.

The results indicated that use of ICT in teaching other subjects in NEPAD schools was significantly more frequent than in non-NEPAD schools. This was attributed to the availability of the internet and other ICT equipment and materials like LCD projectors, smartboards and e-libraries, which made integration much easier as teachers easily accessed the materials or directed learners to relevant sources. There was a significant difference in the way the NEPAD and non-NEPAD school students used the internet services and e-libraries in education research. This was attributed to the fact that the NEPAD schools had more access to the internet and e-libraries. The NEPAD schools performed relatively better than the non-NEPAD schools, but this could not be attributed directly to e-learning.

Wakhaya, (2010) investigated the influence of the use of ICT on teaching and learning mathematics in secondary schools in Nairobi Province, Kenya. The study sought to explain status and influence of ICT integration in teaching and learning mathematics. The research also sought to establish the influence of computers, scientific calculators and internet connectivity on teaching and learning mathematics, besides computers being taught as an examinable subject. The objective was to assess the influence of experience in ICT tools use; extent of ICT tools access and use in teaching and learning mathematics.

The study records that secondary schools that are equipped with computer technology are at different levels of entrenching ICT integration in teaching and learning mathematics. The level of ICT integration was discovered to be slow with the rate being influenced by capacity of teachers to use the tools for subject teaching. The research indicated that factors of experience and know-how strongly influenced ICT integration in teaching and learning mathematics and that those teachers who are exposed to ICT tools and its use are more likely to integrate ICT in teaching and learning process. In regard to the extent of application of ICT process-based activities in teaching and learning of mathematics the findings and analysis revealed that non-systematic implementation and mainstreaming of ICT tools in teaching and learning mathematics had led to poor integration of ICT-based teaching and learning activities in mathematics and related management of schools. This study was based on urban schools and featured only mathematics. This study sought to establish how the situation compared with rural schools and other curriculum subjects and the role teachers attitudes play in the integration.

2.7 Theoretical Framework

The Theoretical framework used in this study is based on the Systems Theory as presented by Joyce and Weil, (1980). According to this theory an entity that functions as a whole by virtue of the interdependence of its component parts is called a system. The method which aims at discovering how systems are brought about is called the General Systems Theory; it aims at the whole and attempting to establish the relationship among the parts (Mukasa-Simiyu, 2001). In the operation of a system parts depend on each other at any given time.

The independent variable is the one to which different subjects are exposed in different degrees or the variable on which the groups of subjects to be compared are different (Kathuri and Pals, 1993). Thus the independent variable is expected to bring about or account for a difference or change in the dependent variable. In this study the dependent variable is integration of CBT in teaching.

Innovation diffusion models help to understand and explain the ways and stages through which teachers will adapt computer-based technologies in teaching. This will enable education administrators to design, develop and implement projects in ways that will facilitate and enhance the adoption of computer-based technologies in teaching.

Robinson, (2009) in 'A Summary of Diffusion of innovations' presents five qualities that determine the success of an innovation: The first is relative advantage. This is the degree to which an innovation is perceived as better than the previous generation by a particular group of users, measured in terms that matter to them, like economic advantage, personal control, time saving, social prestige, convenience or satisfaction. The greater the perceived relative advantage, the more rapid its rate of adoption is likely to be. The implication is that for teachers to adapt computer-based technologies in teaching the technologies have to be perceived as being of relative advantage to conventional methodologies. The second quality is compatibility; the degree to which an innovation is perceived as being consistent with the values, past experiences, and needs of potential adapters. An innovation that is compatible with their values, norms and practices will be adapted more rapidly as compared to an innovation that is incompatible. Teachers are therefore likely to adapt the use of computer-based technologies if they are perceived as being compatible with their values, past experiences and needs. The third is simplicity of

use; if the innovation is too difficult to use an individual will not likely adopt it. New ideas that are simpler to understand are adapted more rapidly than innovations that require the adapter to develop new skills and understandings. Teachers are therefore likely to adapt computer-based technologies faster if they are perceived as easy to learn and understand. The fourth is trialability. This is the degree to which an innovation can be experimented with on a limited basis. If a user has a hard time using and trying an innovation, the individual will be less likely to adopt it. The implication is that the teacher should have opportunity to try out CBT and that the first experience teachers have on integration of computer-based technologies should be enjoyable and encouraging to enhance the likelihood of integrating the technologies in teaching. The fifth quality is observability; an innovation that is more visible will drive communication among an individual's peers and personal networks and will in turn create more positive or negative reactions. The implication is that for teachers to adapt computer-based technologies they need to be exposed to and share experiences on their use with contemporaries.

Rogers (1995) posits that diffusion of innovations occur in five stages: Awareness, Interest, Evaluation, Trial and Adoption. In awareness the individual is exposed to the innovation but lacks complete information about it. The individual then becomes interested in the new idea and seeks additional information about it. This is followed by an evaluation during which the individual mentally applies the innovation to his present and future situation and then decides whether or not to try it. In the trial stage the individual makes full use of the innovation. This is followed by adoption in which the individual decides to continue the full use of the innovation.

Rogers suggests that five elements interact to influence the adoption of innovations: the characteristic of the innovation itself, the decision making process that occurs when the individual considers adopting an innovation, the characteristics of the individual that make him likely to adopt an innovation, the consequences to the individual and society of adopting an innovation, and communication channels used in the adoption process.

Rogers (1995) in 'Diffusion of innovations' presents five adopter categories of people: The first is Innovators: Brave people who are willing to experience the innovation and pull change. These make up about 2.5% of the population. The second is Early adopters: These are respectable people, opinion leaders who try out new ideas but in a careful way. They make up about 13.5% of the population. The second is Early majority: People who follow after the trail is well charted. These are thoughtful people, careful but accepting change more quickly than the average. They make up about 34% of the population. The third is Late majority: People who normally take fewer risks; they are skeptical and will use new ideas or products only when the majority is using. They make up 34% of the population. The fourth category is Laggards: People who adapt the innovation when they have no alternative. These are traditional people, caring for the 'old ways', are critical towards new ideas and will only accept it if the new idea has become mainstream or even tradition. They make up 16% of the population.

It is presumed that any given teacher will fall under one of these categories of adopters in integrating computer-based technologies in their teaching. It is therefore important to identify the teachers by their category and hence formulate strategies for adoption of computer-based technologies in teaching.

The rate of adoption of innovations describes an S-shaped (sigmoid) curve; the initial stage is slow; the rate then picks up exponentially. In the later stages the rate slows, corresponding to the period when a majority of people who can afford have adopted the innovation. According to Rogers when the number of adopters reaches a critical 5% - 15% the process is probably irreversible.

Moore (1991) in his book 'Crossing the Chasm' posits that there exists cracks between the various categories of adopters, hence each of the categories requires different reasons to make adoption decisions. This will require different marketing strategies for each group. Moore posits that there is a tendency for the adoption of innovations to lose momentum at each point when a new group of adopters needs to come on board. This is particularly pronounced in the transition between early adopters and early majority groups due to their fundamental differences: early adopters view innovation as an opportunity for dramatic change or revolution in their industry or field, while early majority seeks evolutionary ways of improving productivity of their operations. According to Moore, while early adopters are prepared to pay the price of being first and gaining a competitive advantage, putting up with bugs and glitches, the early majority want innovations to "work properly and to integrate appropriately with their existing technological base". Thus the early majority are pragmatists who need to see reliable reference base to make adoption decisions. The implication is that marketing strategies should be identified to make an innovation attractive to the early majority, otherwise it may never complete an innovation cycle, but will level after the first two groups of adopters and never get into mainstream practice.

The importance of this theory to the integration of computer based technologies in teaching is that this venture will succeed if it focuses on satisfying the needs of the teachers.

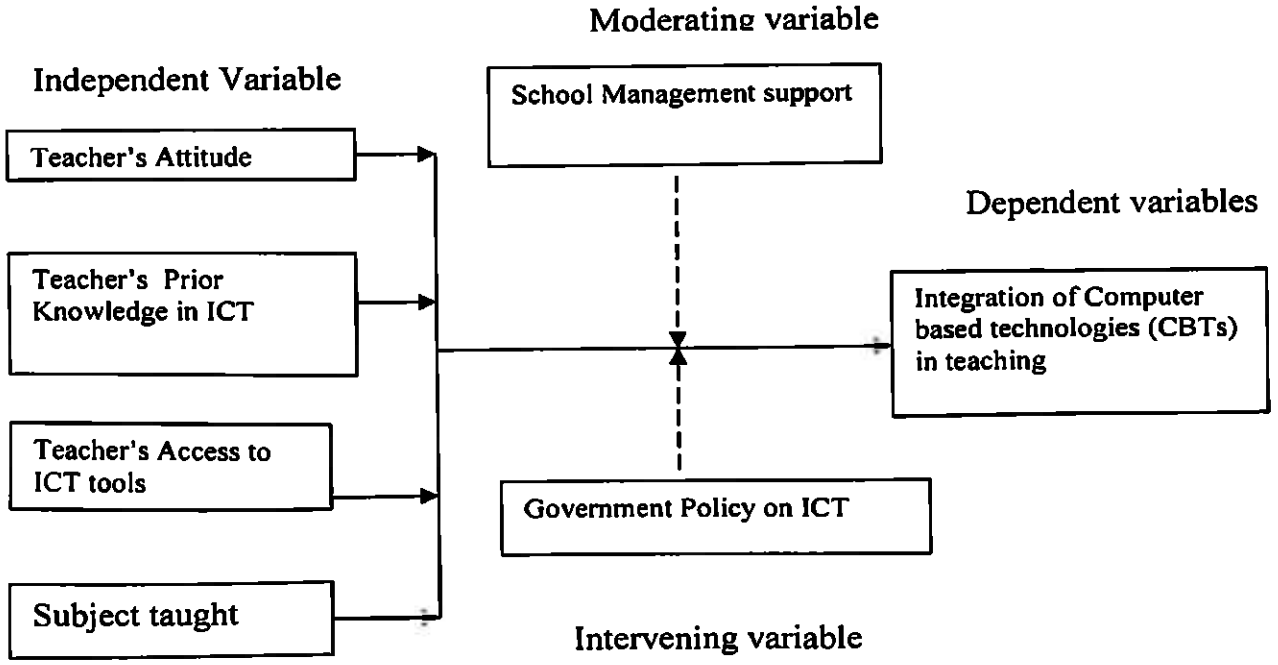
2.8 Conceptual Framework

In this study the dependent variable is integration of computer-based technologies in teaching. The independent variables are the attitude a teacher has towards the technologies as a viable method of curriculum delivery, the teacher's knowledge and skills in **ICT**, availability and access to **ICT** facilities, elearning content and policy guidelines on integration.

The conceptual framework in this study adapted an examination of integration of computer-based technologies as the dependant variable in four aspects: the use of elearning content on CD/DVD-ROMS, educational research using computer based technologies, access to internet resources and elearning libraries.

In the study school management support and government policy on ICT were extraneous variables. According to Kothari (2003) an extraneous variable is a variable that is not related to the purpose of the study but may affect the dependent variable. These were not studied but were assumed to be constant and to affect all respondents uniformly.

Figure 1: Conceptual framework



This study investigated the teachers' attitude in regard to the use of computer-based technologies in teaching, their prior knowledge and skills in ICT, and access to ICT facilities in school as the independent variables. Teachers' level of use of computer-based technologies including content on CD / DVD-ROMS, internet, elearning libraries in teaching were the dependent variable.

2.9 Chapter Summary

Based on previous studies attitude, knowledge and extent of access to ICT tools influence use of computer-based technologies. There existed a gap in knowledge on the influence of the factors in integration of CBT in teaching at secondary school level. Information on the influence of subject taught on integration of CBT was scanty and

inconclusive. It was necessary that the influence be established in order to inform future implementation of CBT in teaching.

The conceptual framework presented the relationship between the independent variables namely; teachers attitude to CBT, teacher's prior knowledge with ICT, and teachers access to ICT tools, and the dependent variable namely, integration of computer-based technologies in teaching.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This section describes the research design, sample size and sampling procedures. Research instruments, validity and reliability, data collection and analysis procedures that were used in the study are also outlined.

3.2 Research Design

The study employed a descriptive survey design. A survey design provides a quantitative or numeric description of trends, attitudes, or opinions of a population by studying a sample of that population (Cresswell, 2003). Survey studies are used to investigate phenomena in their natural setting like classrooms. They allow for the use of a variety of data collection instruments such as questionnaires, observation schedules, interviews, focus group discussions and document analysis. The design used a descriptive approach; the data gathered was used to describe the existing status of integration of computer based technologies in curriculum delivery.

The sample population was drawn from the teachers and students in secondary schools in Vihiga county when schools were in session. Vihiga County had one of the six NEPAD computer project schools in the country at the time. The schools in the county were of relatively similar characteristics in terms of geographical location and student and teacher characteristics.

3.3 Location of the Study

The study was carried out in schools with computer facilities in Vihiga County in Western Province of Kenya. It covers an area of 563 square kilometers. Its neighbouring counties include Kakamega to the North, Kisumu County to the South, Nandi County to the East and Siaya County to the South West. It had a total of 112 schools with an enrolment of 36,400 students.

3.4 Target Population

The target population in this study were two hundred and seventy-seven secondary school teachers and form three students in schools with computers. The form three students were chosen because they had been in the schools long enough to have had an opportunity to experience all the teaching methodologies employed by teachers in the school and they were not as busy as the form four candidate class.

3.5 Sample Size and Sampling procedure

Both random and purposive sampling techniques were used to come up with a representative sample. All the ten schools with computer facilities in the county were purposively sampled to participate in the study. Teachers in all school curriculum subjects offered in each school, excluding those on teaching practice, were purposively sampled for the study. However, if any of the selected schools had more than one teacher for each subject, only one of them was randomly selected for the administration of the questionnaire. Learners' questionnaires were administered to Form Three students only. These understood what CBT integration is all about since they had been in the school for long and had adequate experience of the variety of methodologies employed by the

teachers. A list of secondary schools in Vihiga County with computer facilities was obtained from the local education office. Given that there were only ten such schools all were included in the sample from which teachers and students were randomly sampled and responded to the research instruments.

According to Creative Research Systems, (2003), in order to have confidence that survey results are representative, it is critically important to have a large number of randomly-selected participants. For a 95% confidence level (which means that there is only a 5% chance of sample results differing from the true population average), a good estimate of the margin of error (or confidence interval) is given by $1/\sqrt{N}$, where N is the number of participants or sample size (Niles, 2006). A sample size of 200 would give a 7.1% margin of error, while a 500 sample would give a margin of error of 4.5%.

This study targeted a sample of 163 out of the total teacher population of 277 using a formula by Pennstate Cooperate Extension Program Evaluation Tipsheet No. 60 (2011) according to which for a population of 275, given a +/- 5% margin of error, a sample size of 163 is appropriate for a study. This is based on the formula:

$$N = \frac{\left(\frac{P(1-p)}{\frac{A^2}{Z^2} + \frac{p(1-p)}{N}} \right)}{R}$$

Where:

n = Sample size required

N = Number of people in the population

P = Estimated variance in the population

A = Precision desired

Z = 1.96 (for a 95% confidence level)

R = Estimated response rate

3.6 Research Instruments

Data was gathered using the following research instruments:

3.6.1 Questionnaires

A teachers' questionnaire was administered by the researcher in order to solicit for information on the teacher's background as regards their integration of CBT and training in ICT instructional practices.

A students' questionnaire was administered to a randomly selected sample of students in each Form Three class in each school. The students were asked to indicate the frequency with which they were taught the various curriculum subjects using CBTs.

3.6.2 Interview Guide

The Students Interview Guide was used to corroborate the findings obtained from the students' questionnaire through triangulation.

3.6.3 Observation schedule

An observation Schedule was prepared to record the availability of CBT facilities and equipment including computers, Liquid Crystal Display (LCD) projectors, interactive whiteboards and elearning libraries.

3.7 Instrument Reliability

To ascertain reliability of the instruments, they were piloted using teachers in the schools. Four respondents were selected from each of the ten schools selected for the study. These were not used in the final study. Piloting the instruments helped identify and rectify mistakes in the questions, procedure and time allocation for administration of the instruments. The reliability coefficient of the instruments was calculated using the coefficient Alpha as proposed by Cronbach (1951) and Hopkins (1998) as presented by Kothari (2003). According to Fraenkel and Wallen (2000), and Welkowitz, et al (2006) an alpha coefficient of 0.7 and above is considered suitable to make accurate group inferences. The level of reliability of the Teachers' questionnaire was 0.78 and hence reliable for use.

3.8 Instrument Validity

Validity is the degree to which results obtained from the analysis of the data actually represent the phenomenon under study (Mugenda and Mugenda, 2003). The basic validity is content validity which is the extent to which a measuring instrument provides adequate coverage of the topic under study, and its determination is primarily judgemental and intuitive, (Kothari, 2003). The content validity of the questionnaires was assured by subjecting the teachers and students questionnaire to review by experienced

researchers from the Department of Distant Studies of the University of Nairobi. In addition some of the items were adapted from similar questionnaires that had been validated elsewhere.

Triangulation was used to ensure validity between responses given by teachers and students and from observation. In addition the instruments were tailored to Levels of Teaching Innovation (LoTI) Framework (Appendix VI) to ensure construct validity. The LoTi Framework was first conceptualized by Moersch (1994) as a tool to assess authentic classroom technology use. The framework focuses on the delicate balance between instruction, assessment, and the effective use of digital tools and resources to promote higher order thinking, engaged student learning, and authentic assessment practices in the classroom - all vital characteristics of 21st Century teaching and learning.

3.9 Data collection procedures

Prior to the commencement of the study, the researcher obtained an introductory letter to schools from the University of Nairobi. He then visited the sampled schools to establish the workability of the schedule of planned activities. This involved finding out the school calendar of events and piloting of instruments. At the commencement of the study, the teacher's questionnaire was administered to the secondary school teachers while the student's questionnaire was administered to the form three students in the sample schools. Interviews were conducted with a sample of the students in each sample school. The observation schedule was used to record available ICT facilities.

3.10 Data analysis procedure

The data obtained from this study was checked for completeness and edited where necessary. Thereafter it was stored in Microsoft Excel worksheets. The data included scores on teacher's background, attitude, training, subject taught and integration of computer-based technologies in curriculum delivery. The student's questionnaire captured students' frequency of use of elearning facilities across curriculum subjects. This together with the interview with a sample of the students in each school was used to corroborate the findings from the teachers' questionnaire.

Descriptive techniques that included, frequencies, t-Test, tables and percentages were used to report the findings. The data was analysed using the Statistical Package for Social Sciences (SPSS).

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1 Introduction

In this chapter findings from this study are presented, interpreted and discussed. The information includes details on schools, teachers' gender, subject, age, education level, teaching experience and knowledge in the use of CBT. The findings are presented and interpreted in sections based on the research objectives in this study. Discussion of findings are presented based on the study objectives and hypotheses.

4.2 Response Rate

One hundred and fourty-four out of the sample of one hundred and sixty three teachers in ten secondary schools responded to the teacher's questionnaire which was eighty-nine percent (89%) response rate. According to Creative Research Systems (2003) this response rate was acceptable for the research since the worst case scenario is a 50% response.

4.3 General Characteristics of the Respondents

The general information on respondents in this study was obtained using a questionnaire which focused on school, teaching subject, gender, age, educational level, teaching experience and experience on the use of CBT in teaching. This information was found to be important for comparison of findings across groups.

The teachers' gender, age, highest education level and teaching subject were obtained. Responses were analyzed to provide descriptive information and frequencies.

Majority of respondents were male (62.5%), with 37.5% being female. Most (37%) were aged between 31 – 40 years, and 22.9% aged between 26 – 30 years. An

equal number (22.9%) were below 26 years. Most teachers (45.5%) had a teaching experience of less than 5 years, while 21.7% had a teaching experience of between 5 – 9 years. A majority (54.5%) of the teachers had a teaching experience of more than five years. Majority (80.6%) had a Bachelors degree as the highest education level. The highest education level was a Masters degree (8.3%).

4.3.1 Gender of Respondents

Data on the gender of the respondents was analysed and presented in table 4.1 below. Table 4.1 shows the distribution of respondents according to gender.

Table 4.1: Gender of the Respondents

Gender	Frequency	Percent (%)
Male	90	62.5
Female	54	37.5
Total	144	100

Table 4.1 shows that majority of respondents were male (62.5%), with 37.5% being female. Data collected is therefore adequate to provide information representative of both male and female teachers.

4.3.2 Age of the respondents

Table 4.2 shows the age brackets of the respondents at the time of the study.

Table 4.2: Age of the respondents

Age bracket	Frequency	Percent (%)
More than 50	0	0
41 – 50 years	24	16.7
31 – 40 years	54	37.5
26 – 30 years	33	22.9
Less than 26 years	33	22.9
Total	144	100

Table 4.3 shows that most of the respondents were aged between 31 – 40 years (37%), 22.9% were between 26 – 30 years and an equal number (22.9%) were below 26 years. A majority (77.1%) of the respondents were more than 26 years old, hence mature to give reliable information.

4.3.3 Teaching experience of respondents

Table 4.3 shows the teaching experience of the respondents in years.

Table 4.3: Teaching experience of the respondents

Experience	Frequency (f)	Percent (%)
More than 24 years	2	1.4
15 – 24 years	23	16.1
10 – 14 years	22	15.4
5 – 9 years	31	21.7
Less than 5 years	65	45.4
Total	143	100.0

From Table 4.3 it is shown that many teachers (45.5%) had a teaching experience of less than 5 years, while 21.7% had an experience of between 5 – 9 years. It can be deduced that many of the teachers were relatively youthful and most likely abreast with computer technologies. A majority of the respondents (54.5%) had more than five years experience as teachers and therefore provided reliable information on integration of CBT in teaching.

4.3.4 Educational level

The respondents highest level of training at the time of the study is shown in Table 4.4.

Table 4.4: Highest level of education attained by the respondents

Education Level	Frequency (f)	Percent (%)
Masters	12	8.3
Bachelors	116	80.6
Diploma	13	9.0
Others	3	2.1
Total	144	100

Table 4.4 shows that a majority (80.6%) had a Bachelors degree as the highest education level. The highest education level was a Masters (8.3%). The table also shows that a large proportion of the respondents had adequate training in teaching and would provide adequate information on CBT integration. Only small proportion (2.1%) of the teachers had not been trained as teachers and therefore did not significantly influence the findings.

4.3.5 Teaching subjects

The teaching subject groups of the respondents are shown in table 4.5.

Table 4.5: Teaching subject groups of the respondents

Subject group	Frequency (f)	Percent
Technical	26	16.9
Humanities	32	20.8
Languages	42	27.2
Science	36	23.4
Mathematics	18	11.7
Total	154	100

From Table 4.5 it is shown that all the subject groups in secondary school were adequately represented in the study.

4.4 Teachers Attitudes towards CBT and level of integration of CBT in teaching

Information about teachers' attitude towards CBT was obtained using questionnaires and the attitude was measured using four items (8a-8d, Appendix II) that required the teachers to rate some aspects of CBT on a five point rating scale of: strongly agree (4); agree (3); not sure (2); disagree (1) and strongly disagree (0). The scores of each teacher on the four items were summed to obtain a composite score which was used to compute a percentage attitude score.

An overall neutral response of 'Not sure' on the items on attitude on the questionnaire would have earned a 50% score. Therefore the researcher set the standard for attitude such that scores of above 50 indicated a positive attitude while scores of

below 50 indicated a negative attitude. Table 4.6 shows standards set for interpretation of teachers' attitude score towards CBT.

Table 4.6: Attitude score range standards

Attitude score range (%)	Interpretation
50 and above	Positive attitude
Less than 50	Negative attitude

The data obtained was used to compute mean attitude scores and comparisons across groups. The mean percentage attitude score was computed and the results are presented in Table 4.7.

Table 4.7: Mean percentage attitude score

	N	Mean		Std. Deviation
	Statistic	Statistic	Std. Error	Statistic
Percentage attitude score	142	76.7	1.2632	15.0523
Valid N (listwise)	142			

Table 4.7 shows that on overall the teachers' mean attitude toward CBT was above 50 and therefore based on the standards established in this study, the teachers had a positive attitude towards CBT.

4.4.1 Integration of CBT in teaching

Information on the integration of CBT was obtained using questionnaires and the level of CBT integration was measured using 10 items (20a-20j) (Refer Appendix II) that required the teachers to rate some aspects of CBT integration on a four point rating scale

of: very often / daily (3); often / twice or more a week (2); seldom / a few times a month (1) and never (0). The responses for each teacher were summed to obtain a composite score that was used to compute a percentage score for CBT integration. A high score indicated high level of CBT integration while a low score indicated a low level of CBT integration. Table 4.8 shows standards set in this study for the purpose of interpretation of the CBT score.

Table 4.8: Mean integration of CBT score standards

CBT integration score	Interpretation of CBT score
75 and above	High level of CBT integration
50 to 74	Average level of CBT integration
Below 50	Low level of CBT integration

The data obtained was used to compute mean CBT integration scores and comparisons across groups.

The mean percentage CBT integration score was computed and results are presented in Table 4.9.

Table 4.9: Mean percentage CBT integration score

	N	Mean		Std. Deviation
				Statistic
	Statistic	Statistic	Std. Error	
Percentage CBT integration score	142	20.610	1.8023	21.4767
Valid N (list-wise)	142			

The results in Table 4.9 show that the level of CBT integration by teachers was very low with a mean of 20.6.

4.4.2 Influence of teachers' attitude towards CBT on integration of CBT in teaching

To determine the influence of teachers' attitude towards CBT on integration in teaching, simple ordinary least squares regression was conducted on teachers' attitude score against CBT integration score to test the null hypothesis that ***"teachers' attitude towards CBT is not a statistically significant predictor of CBT integration".*** The results are presented in Table 4.10.

Table 4.10: Influence of teachers' attitude on integration of CBT in teaching

Model		Un-standardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	16.946	9.573		1.770	0.079
	Percentage attitude score	0.047	0.122	0.033	0.388	0.698

a. Dependent Variable: Percentage CBT integration score

Table 4.10 shows that teachers' attitude towards CBT score is not a significant predictor of CBT integration score at ($t = 0.388$, $p>0.05$). The null hypothesis is not rejected and in conclusion, teachers' attitude towards CBT is not a determinant of CBT integration. This implies that though teachers have a positive attitude towards CBT there are other underlying variables that hinder them from integrating CBT in their teaching.

4.5 Teachers' prior knowledge on ICT tools use and level of integration of CBT

The second hypothesis sought to determine the influence teachers' prior knowledge in ICT on integration of computer-based technologies in teaching. To address this hypothesis, the teachers' CBT integration score and KSE score were computed.

4.5.1 Teachers knowledge on ICT tools use

Information on teachers' Knowledge was obtained using questionnaires. It was measured using 15 items on the questionnaire (11a-11o) (Refer Appendix II) that required teachers to rate their level of knowledge with some specific computer operation tasks. The teachers rated their knowledge level on a scale of: excellent (4); very good (3); good (2); fair (1) and no capability (0). The scores from each teacher were summed to obtain a composite score that was expressed as a percentage of the teacher's ICT tool use knowledge score. A high score indicated a high level of teacher knowledge while a low score indicated a low level of teacher knowledge.

Table 4.11 shows standards set in this study for interpretation of the level of teachers' CBT knowledge score.

Table 4.11: Teacher ICT knowledge score standards

Teacher ICT knowledge score	Interpretation of teacher ICT knowledge score
75 and above	High level of knowledge
50 to 74	Average level of knowledge
Below 50	Low level of knowledge

Data obtained was used to compute mean teacher ICT tools use knowledge score and comparisons were made across groups.

The data was used to compute mean Teacher ICT tools' use knowledge score and results are presented in Table 4.12

Table 4.12: Teacher ICT knowledge score

	N	Mean		Std. Deviation
	Statistic	Statistic	Std. Error	Statistic
Percentage Teacher CBT Knowledge Score	143	41.457	2.0759	24.8240
Valid N (list-wise)	143			

Results in Table 4.12 show that teacher knowledge in ICT tools use was low (41.457) based on standards of interpretation set in this study. Low knowledge in ICT could mean that teachers are unlikely to integrate CBT effectively in their teaching.

4.5.2 Influence of Teachers' Knowledge on ICT tools on CBT integration in teaching

To determine whether teachers' knowledge on ICT tools use had an influence on CBT integration in teaching, simple ordinary least square regression was conducted to test the null hypothesis that ***"teachers' knowledge on ICT tools use is not a statistically significant predictor of CBT integration in teaching"***. The results are presented in Table 4.13.

Table 4.13 Percentage teachers' ICT tools knowledge on CBT integration in teaching

Model		Un-standardized Coefficients		Standardized Coefficients			Adjusted R Square
		B	Std. Error	Beta	t	Sig.	
1	(Constant)	3.894	3.157		1.233	0.219	0.205
	Percentage Teacher ICT tools' use Knowledge Score	0.397	0.065	0.459	6.098	0.000	

a. Dependent Variable: Percentage CBT integration score

The results in Table 4.13 show that teachers' knowledge in ICT use was a statistically significant predictor of CBT integration in teaching at ($t = 6.098$, $p < 0.05$) with a strong model fit ($R^2=0.205$) which implies that teachers knowledge in ICT can contribute up to 20.5% of CBT integration in teaching. The null hypothesis is rejected and it can be concluded that ICT knowledge is a significant factor affecting CBT integration in teaching in secondary schools.

4.6 Access to ICT tools and Integration of CBT in Teaching

To find out the influence of access to ICT tools on teachers' integration of CBT in teaching, the integration of CBT score and access to ICT tools were computed and comparisons were made across groups.

4.6.1 Access to ICT tools

The information on access to ICT tools was obtained using the teachers questionnaire and 8 items (12-19) (Refer Appendix II) were used to measure the level of teachers' access to ICT tools. The items focused on the physical location of ICT tools and frequency of teacher access to these tools. The physical location of ICT tools was

considered an important factor in teacher access to these tools. Therefore the location of ICT tools in order of preference was rated as follows: school (4), home (3), commercial places / cyber cafes (2), others (1) and none (0). The frequency of computer use in a school within a week was also graduated on a five point scale of 4-0 as follows: more than five times (4); three to four times (3); one to two times (2); less than one time (1) and none (0). The scores of individual teacher on access to ICT tools was summed and used to compute percentage score of access to ICT tools. A high score indicated high access to ICT tools while a low score indicated low access to ICT tools. Table 4.14 shows standards set in this study for interpretation of access to ICT tools score.

Table 4.14: Interpretation of access to ICT tools score standards

Access to ICT tools score	Interpretation of access to ICT tools score
75 and above	High level of access to ICT tools
50 to 74	Average level of access to ICT tools
Below 50	Low level of access to ICT tools

Obtained data was used to compute mean percentage score of access to ICT tools and results are presented in Table 4.15.

Table 4.15: Access to ICT tools score

	N	Mean		Std. Deviation
	Statistic	Statistic	Std. Error	Statistic
Percentage access to ICT score	143	46.3217	1.38681	16.58380
Valid N (listwise)	143			

The results in Table 4.15 show that teachers' access to ICT tools was low (46.3) based on standards of interpretation set for this study.

4.6.2 Influence of access to ICT tools on level of ICT integration

To determine the influence of teachers' access to ICT tools on level of ICT integration, simple ordinary least squares regression was conducted on access to ICT tools score against CBT integration score to test the null hypothesis that ***"access to ICT is not a statistically significant predictor of CBT integration"***. The results are presented in Table 4.16.

Table 4.16: Influence of access to ICT tools on level of ICT integration

Model		Un-standardized Coefficients		Standardized Coefficients	t	Sig.	Adjusted R Square
		B	Std. Error	Beta			
1	(Constant)	-0.921	5.026		-0.183	0.855	0.125
	Percentage access ICT score	0.467	0.102	0.362	4.581	0.000	

a. Dependent Variable: Percentage CBT integration score

The results in Table 4.16 show that access to ICT tools score was a statistically significant predictor of CBT integration score at ($t=4.581$, $p<0.05$) with moderately strong model fit of 0.125 which implies that access to ICT tools can contribute up to 12.5% of CBT integration in teaching. The null hypothesis is rejected and in conclusion access to ICT tools is a significant factor that contributes to integration of CBT in teaching.

4.7 Integration of CBT and Teaching Subjects

The fourth objective in this study sought to establish whether there is a significant difference in integration of computer-based technologies in teaching between the different subjects taught in secondary schools in Vihiga County. The 16 subjects that were the focus of this study, in alphabetical order, were: Agriculture, Art and Design, Biology, Business Studies, Chemistry, Computer Studies, CRE, English, French, Geography, History & Government, Home Science, Kiswahili, Mathematics, Music and Physics. For the purpose of data analysis, these subjects were clustered into five groups as classified by the Kenya Institute of Education as follows: Mathematics, Sciences (Biology, Chemistry, Physics), Languages (English, French, Kiswahili), Humanities (Christian Religious Education, Geography, History and Government) and Technical and Applied Subjects (Agriculture, Art and Design, Business Studies, Computer Studies, Music). To establish whether there were significant mean differences between subjects on the integration of CBT in teaching, One Way ANOVA was conducted to test the null hypothesis that ***"there is no significant mean differences in integration of CBT in teaching between subjects"***. The results are presented in Table 4.17

Table 4.17: Comparison of variance between and within groups of subjects

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	1690.002	4	422.500	0.913	0.458
Within Groups	62918.194	136	462.634		
Total	64608.195	140			

Table 4.17 shows that there was no statistically significant difference in mean CBT integration score between the five categories of subjects at [F=0.913, df(4,136),

$p>0.05$]. The null hypothesis is accepted and in conclusion, the subject taught at Secondary School is not a determinant of the level of CBT integration in teaching.

4.8 Chapter Summary

From the data that was analysed the level of CBT integration by teachers was very low. The teachers had a positive attitude towards computer-based technologies hence the first null hypothesis is not rejected. In conclusion teacher's attitude towards CBT is not a determinant of CBT integration. From the data analysed teachers knowledge in ICT tools use was low based on the standards of interpretation set in this study. Results of regression analysis carried out show that teachers' knowledge in ICT use was a statistically significant predictor of CBT integration in teaching and can contribute up to 20.5% of CBT integration in teaching. The second null hypothesis is rejected and it is concluded that ICT knowledge is one of the main factors that affect CBT integration in teaching. The results of regression analysis show that access to ICT tools score was a statistically significant predictor of CBT integration score at ($t=4.581$, $p<0.05$) with moderately strong model fit of 0.125 which implies that access to ICT tools can contribute up to 12.5% of CBT integration in teaching. The null hypothesis is rejected and in it is concluded that access to ICT tools is a major factor that contributes to integration of CBT in teaching.

Analysis of Variance showed that there was no statistically significant difference in mean CBT integration score between the five categories of subjects at [$F=0.913$, $df(4,136)$, $p>0.05$]. The fourth null hypothesis was therefore accepted and it is concluded that the subject taught at Secondary School is not a determinant of the level of CBT integration in teaching.

CHAPTER FIVE

SUMMARY OF FINDINGS, DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents summary of findings, discussion, conclusions and recommendations based on the study. The research sought to investigate the factors that influence integration of computer-based technologies in teaching by secondary school teachers. This understanding is important to the successful implementation of the technologies in secondary school population. It focused on secondary schools that are equipped with computer technologies in Vihiga County.

5.2 Summary of Findings

The purpose of this study was to investigate factors that influence integration of computer-based technologies in teaching by secondary school teachers in Vihiga County. Four hypotheses were constructed to guide the analysis and interpretation of data. These concerned the attitude of teachers, teachers' prior knowledge, access to ICT tools by teachers as predictor of integration of computer-based technologies in their teaching, and influence of subject taught on integration of computer-based technologies in teaching.

From the data that was analysed it was evident that the level of CBT integration by teachers was low. The teachers had a positive attitude towards computer-based technologies hence the researcher failed to reject the first null hypothesis. It was concluded that teachers' attitude towards CBT is not a significant determinant of CBT integration in secondary schools.

It was also evident from the data analysed that teachers knowledge in ICT tools use was low based on the standards of interpretation set in this study. Results of analysis carried out showed that teachers' knowledge in ICT use was a statistically significant predictor of CBT integration in teaching and can contribute up to 20.5% of CBT integration in teaching. The second null hypothesis was therefore rejected and it is concluded that ICT knowledge is one of the significant factors that affect CBT integration in teaching in secondary schools in Vihiga County.

The results of analysis show that access to ICT tools was a statistically significant predictor of CBT integration in that it can contribute up to 12.5% of CBT integration in teaching. The third null hypothesis was therefore rejected and it was concluded that access to ICT tools is a significant factor that contributes to integration of CBT in teaching in secondary schools.

Analysis of Variance showed that there was no statistically significant difference in mean CBT integration score between the five categories of subjects at [$F=0.913$, $df(4,136)$, $p>0.05$]. The fourth null hypothesis was therefore accepted and it is concluded that the subject taught at Secondary School is not a significant determinant of the level of CBT integration in teaching in secondary schools.

5.3 Discussion of findings

Discussion has been done based on the four objectives of the study. The discussions have been organized under; attitude of teachers to CBTs, Knowledge, skills and experience of teachers with ICT, access to ICT facilities and subject taught and CBT integration.

5.3.1 Teachers' Attitude Towards CBT

The focus was on the secondary school teachers' attitude on the use of computer-based technologies in teaching. Bingimlas, (2008) recorded a number of studies indicating that attitudes and inherent resistance to change were significant barriers to integration of ICT into education by teachers: Cox, et al, 1999a; Watson, 1999; Earle, 2002; Becta, 2004; Gomes, 2005; Schoepp, 2005; Cavas, et al (2009) also found that attitudes of teachers towards ICT play a role in integration of technology in education. This study showed that most teachers in secondary schools in Vihiga County had a positive attitude towards CBT integration in teaching. They agreed that the use of computer-based technologies is an acceptable and effective way of teaching and that it enhances teaching and learning.

According to the Innovation Diffusion models as presented in the literature review to this study the teachers appear to have achieved the first of the five diffusion of innovation stages: awareness, interest, evaluation, trial and adoption (Rogers, 1995). In addition at least the first three of five qualities that determine the success of an innovation, namely relative advantage, compatibility, simplicity of use, trialability and observability (Robinson, 2009) appear to hold true for the teachers with respect to integration of CBTs in teaching. The teachers indicated that it is advantageous to use CBTs, the technologies are compatible with their work and are simple to use.

It is observable that since 2005 the Ministry of Education initiated projects to sensitise teachers on ICT integration in teaching. These include NEPAD (2005), CCK (2006), and SMASSE (2007). Seminars, workshops and activities on ICT and elearning were also held by organisations including Kenya Institute of Education, Intel, Microsoft,

Computers for Schools and CyberSchool on integration of ICT in teaching and learning. It is likely that these activities helped teachers to develop positive attitudes towards integration of CBT in teaching.

However the results of the study showed that the level of CBT integration was very low; there was limited use of CBTs in lesson presentation, multimedia content delivery, internet, gaming, simulations and animations, tests and exams as well as databases. Regression analysis showed that attitude towards CBT was not a significant predictor of CBT integration in teaching. This implies that though teachers have a positive attitude towards CBT there are other underlying factors that hinder them from integrating CBT in their teaching.

5.3.2 Teachers' Prior Knowledge in ICT

The second objective sought to determine the influence of teachers' prior knowledge with ICT on integration of computer-based technologies in teaching. It was argued in the literature review that knowledge in a particular methodology determines its use in teaching and that teachers tend to use methods in which they feel competent (Gachenga, 2007).

Results of data analysed indicated that teachers' knowledge in ICT use was low. The relationship between teachers' prior knowledge in ICT and integration of CBT in teaching was considered by simple ordinary least squares regression analysis. The results showed that teachers' knowledge in ICT use was a statistically significant predictor of CBT integration in teaching and could contribute up to 20.5% of CBT integration in teaching. ICT knowledge is therefore one of the factors that significantly affect CBT

integration in teaching in secondary schools. It was evident that teachers proficient in ICT were more likely to use word processing tools, spreadsheets, presentation tools, e-mail and internet facilities in preparation and presentation of their lessons. They were also more likely to use statistical tools, computer graphics, database tools, animations and simulations, multimedia facilities and interactive whiteboards, among other CBTs in teaching.

This agrees with findings by Gakuu (2006) that knowledge in the use of ICT is a most critical variable in integration of CBT in teaching. The implication is that training of teachers on the integration of CBT in teaching is critical to success in the endeavour. The trainings on ICT carried out by the ministry of education and other bodies appear not to have imparted adequate knowledge and skills to enable secondary school teachers confidently integrate CBT in teaching. This could be due to the fact that the trainings carried out were basically a few day demonstrations by computer experts on the use of CBTs and did not feature adequate hands-on practice by the teachers. In addition pre-service training of teachers does not feature adequate practical application of ICT. The ministry should therefore consider enhancing the pre-service and in-service teacher training on ICT integration in teaching.

5.3.3 Access to ICT Tools

The study investigated the influence of access to ICT tools on secondary school teachers' integration of CBTs in teaching. The physical location of ICT tools was considered an important factor in teachers' access to these tools. ICT tools within the

school to which teachers had easy reach were considered to be more accessible than those in commercial and other places.

Results of data analysed showed that access to ICT tools was low. The nature of the relationship between access to ICT tools and integration of CBT in teaching was determined using simple ordinary least squares regression analysis. Results showed that access to ICT tools was a statistically significant predictor of CBT integration and could contribute up to 12.5% of CBT integration in teaching. The conclusion is that access to ICT tools is a significant factor that contributes to ICT integration. Integration of CBT in teaching was more likely where the ICT tools were most accessible. The ICT tools in the school were considered to be more accessible than those at home and in commercial places.

As presented in the literature review, Robinson (2009) argues that five qualities determine the success of an innovation: relative advantage, compatibility, simplicity of use, trialability and observability. It is likely that the more accessible the ICT tools are the higher their trialability and observability to the teacher, enhancing integration of CBTs in teaching. Late majority and laggards as presented by Rogers (1995) easily pick on the technology as they witness early adopter and early majority peers integrate CBTs in teaching.

It was observed that generally all the school computer facilities were located in a central computer laboratory or room; very few were found in places more accessible to the teacher such as staffrooms and classrooms. The implication of the study findings is that if ICT tools are located within easy physical reach of the teachers it would enhance observability and trialability as the late adapters and laggards will have opportunity to

watch and interact with early majority and adapter colleagues as they integrate CBTs in teaching. It was observed that computer facilities in secondary schools are generally confined to closely guarded computer rooms to which teachers have controlled and limited access. This could be negatively impacting integration of CBT in teaching.

5.3.4 Subject taught and CBT integration

The fourth objective in this study sought to establish whether the subjects taught at secondary school were significant determinants of CBT integration in teaching. The 16 subjects that were the focus of this study, in alphabetical order, were: Agriculture, Art and Design, Biology, Business Studies, Chemistry, Computer Studies, CRE, English, French, Geography, History & Government, Home Science, Kiswahili, Mathematics, Music and Physics.

For the purpose of data analysis, these subjects were clustered into five groups as classified by the Kenya Institute of Education (2002) as follows: Mathematics, Sciences (Biology, Chemistry, Physics), Languages (English, French, Kiswahili), Humanities (Christian Religious Education, Geography, History and Government) and Technical and Applied Subjects (Agriculture, Art and Design, Business Studies, Computer Studies, Music). To establish whether there were significant mean differences between subjects on the integration of CBT in teaching, analysis was conducted to test the null hypothesis that "there is no significant mean differences in integration of CBT in teaching between subjects".

The results showed that there is no statistically significant difference in mean CBT integration between the five categories of subjects. The conclusion is that the

subject taught was not a determinant of the level of CBT integration in teaching. These findings differ with those of Ayere, et al (2010) who recorded that integration of ICT in teaching differed across the subjects.

5.4 Conclusions

The purpose of this study was to determine the factors influencing integration of CBT in teaching by secondary school teachers in Vihiga County. The study investigated four factors: attitude, ICT knowledge, access to ICT tools and subject taught. Data collected was subjected to statistical analysis.

From the findings it was concluded that teachers' attitude towards CBTs is not a significant factor in the integration of CBTs in teaching. Many teachers have a positive attitude towards CBTs. It was also concluded that the subject taught by a teacher was not a significant factor in determining integration of CBTs in teaching since integration of CBT did not significantly vary across the subjects.

Teachers' knowledge in ICT is among the major factors that contribute to integration of CBT in teaching and can account for up to 20.5% of the integration. Similarly access to ICT tools is a significant factor that contributes to the integration of CBT in teaching, accounting for up to 12.5% of the integration. Teacher knowledge in ICT and access to CBT tools together accounted for 33% of ICT integration in teaching. The implication is that other variables in addition to knowledge and access are at play in determining integration of CBTs in teaching by secondary school teachers in Vihiga County.

5.5 Recommendations

The study identified two crucial factors that determine integration of CBT in teaching by secondary school teachers: ICT knowledge and access to ICT tools. It is therefore recommended that:

1. Secondary school teachers be afforded adequate in-service training on ICT tools and CBT integration to enhance their capacity for integration of CBTs in teaching.
2. The ministry should entrench the training on CBT integration in teaching in the teacher training curricula at pre-service level
3. Mechanisms and policies should be put in place by the Ministry of Education and school administrations to enhance teacher access to ICT facilities available in order to enhance integration of CBT in teaching. This should include locating the CBT facilities in relatively more accessible areas within the school such as staffrooms and classrooms.

5.6 Suggestions for further Research

This study identified only two factors accounting for a combined total of 33% of CBT integration in secondary schools in Vihiga county. The researcher recommends that further research be conducted in the following areas:

1. The effect of Teacher support on CBT integration in teaching
2. The effect of Learner support in the integration of CBT in teaching

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UNIVERSITY OF NAIROBI
COLLEGE OF EDUCATION AND EXTERNAL STUDIES
SCHOOL OF CONTINUING AND DISTANCE EDUCATION

Telegram: "CEES'
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P.O. Box 30197, NAIROBI
or P.O. Box 92,
KIKUYU, Kenya

Our Ref:

6th July 2011

TO WHOM IT MAY CONCERN

RE: **Humprey Kaiuli Nengo – L45/70437/2008**

The above named person is a registered student in the School of Continuing and Distance Education, College of Education and External Studies, University of Nairobi where he is pursuing a master's degree in Distance Education.

He is currently carrying out a research project entitled:

"Factors influencing intergration of computer based technology in teaching secondary schools in vihiga County, Kenya

The student has identified your organization for data collection. The information given will be treated with strict confidentiality and will only be used for academic purposes.

Any assistance given to him will be appreciated.

Yours faithfully,

DEPARTMENT OF DISTANCE STUDIES

PROF. D. MACHARIA, EBS
CHAIRMAN,
DEPARTMENT OF DISTANCE STUDIES

DM/fkm

APPENDIX II: Teachers' Questionaire

Dear Respondent,

This questionnaire gives you an opportunity to express your ideas on integration of computer-based technologies in teaching in your school. The information provided will be treated with utmost confidentiality and used ONLY for enhancing pedagogical integration of computer-based technologies in teaching.

Instructions:
This questionnaire consists of Section A to E. All are multiple choices with some sub-sections of structured items. Read each question carefully and answer by ticking [√] or write your response/choice on this same questionnaire. Do not write your name.

SECTION A:

1) What is your gender?
   [ ] Female
   [ ] Male

2) What is your age bracket?
   [ ] Above 50
   [ ] 41 - 50
   [ ] 31 - 40
   [ ] 26 - 30
   [ ] 25 and below.

3) What is your teaching experience in years?
   [ ] More than 24
   [ ] 15 - 24
   [ ] 10 - 14
   [ ] 5 - 9
   [ ] Below 5

4) What is your highest education level?
   [ ] Masters Degree
   [ ] Bachelors Degree
   [ ] Diploma
   [ ] Other.

5) Which is your major teaching subject/s? .....

6) How long is your experience in using computers?
   [ ] More than 5years
   [ ] 3 - 4years
   [ ] 1 - 2years
   [ ] Less than one year
   [ ] None.

7) How long have you been using the Internet?

[ ] More than 5years
[ ] 3 - 4 years
[ ] 1 - 2years
[ ] Less than one year
[ ] None.

B: ATTITUDE

8. To what extent do you agree with the following statements regarding the use of computer based technologies in teaching.

	Factor	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
a)	The use of Computer-based technologies is an acceptable and effective mode of teaching					
b)	The use of CBTs enhances teaching					
c)	The use of CBTs enhances learning					
d)	It does not take a lot of time for a teacher to plan a CBT lesson					

SECTION C: TRAINING AND EXPERIENCE IN USE OF CBTS

9. Did you receive any training on using computers in teaching?

[ ] Yes
[ ] No

10. Did you receive any training on using internet in teaching?

[ ] Yes
[ ] No

11. Please rate your extent of know-how in the use of the following ICT tools.

	ICT tool	Excellent	Very Good	Good	Fair	No Capability
a)	Word processor (Ms Word)					
b)	Spreadsheets(Ms Excel)					
c)	Presentation tool; Ms PowerPoint, LCD Projector					
d)	E –mailing					
e)	Internet browser or Web page access.					
f)	Statistical tool					
g)	Computer Graphics					
h)	Computer programming					
i)	Database management e.g. Ms Access					
j)	Animation or simulation use					
k)	Multimedia CD, DVD, Flash disk.					
l)	Digital Camera					
m)	Interactive white – boards					
n)	Computer games					
o)	Printers and scanners.					

SECTION D: ACCESS TO CBT TOOLS

12. Where do you use computers in school? You can choose more than one.

[ ] Teachers' staffroom
[ ] Personal office
[ ] Classrooms
[ ] Computer laboratory
[ ] Library
[ ] Other.

13.How many hours per week are your school computers accessible to you?

[ ] More than five 5
[ ] 3 - 4
[ ] 1 - 2
[ ] Less than one
[ ] None.

14.If you have access to internet, how often do you use it per week in the school?

[ ] More than 5
[ ] 3 - 4
[ ] 1 - 2
[ ] 1 - 2
[ ] Less than one
[ ] None

15. Do you use computers outside school hours?

[ ] Yes
[ ] None

16. If you have access to computers outside school hours, where do you often use it? You can choose more than one.

[ ] School
[ ] At home
[ ] Commercial places (cyber café)
[ ] Other places
[ ] None

17. If you have access to internet outside school hours, where do you often use it? You can choose more than one.

[ ] School
[ ] At home
[ ] Commercial place (Cyber café)
[ ] All the above
[ ] Other places
[ ] None

18. Do you maintain a web page as a subject teaching tool?

[ ] Yes
[ ] No

19. Do you plan to continue using ICT tools for teaching?

[ ] Yes, but even more effectively
[ ] No, its time consuming and unnecessary

SECTION E: CBT INTEGRATION IN TEACHING

20.How often do you use the following CBT tools in teaching?

	ICT tool	Very often (Daily)	Often(twice or more a week)	Seldom(A few times a month)	Never
a.	Computer, LCD OR OH-projector for lesson presentation				
b.	Multimedia CD,DVD for content delivery, e.g. KIE, Cyber School or Student Encarta				
c.	Internet related educational resources/web pages during lessons preparation				
d.	Educational computer/internet games or activities				
e.	E-mail for communicating assignments				
f.	Ms PowerPoint simulations or animations to illustrate concepts				
g.	Ms Word processed worksheet for student activities, tests and exams				
h.	Ms Excel processed worksheet for student activities.				
i.	Databases for subject-related records, statistics /data and calculations				
j.	Interactive ICT resources on computer or internet				

21.How often do you use computers and the internet for purposes described below?

	Purpose	Very often (Daily)	Often (Twice or more a week)	Seldom (a few times in a month)	Never
a.	Prepare for lessons				
b.	Access teaching or learning resources				
c.	Download lesson plans from the internet				
d.	Implement lessons				
e.	Enhance existing methods of teaching				
f.	Subject enrichment exercises and information gathering assignments for students towards a				

	variety of thinking skills.				
g.	Solve real life problems using digital tools and resources				
h.	Computation activities for students				
i.	Constant use of and access to advanced digital tools and resources (information queries, creative problem-resolving, student reflection).				
j.	Process test scores				
k.	Prepare subject reports.				
l.	Access e-mail on subject related mails				
m.	Communicate with students on assignments				
n.	Communicate with other teachers				
o.	Other				

22. To what extent do you do the following teaching and learning activities when using computer tools in your school? Indicate your opinion

	Teaching and learning activity	Very great	Great	Little	Very little	Not at all
a.	Student individual or group quizzes on the internet					
b.	Students individual or group activities on digital resources e.g. Encarta					
c.	Listening to PowerPoint or OHP presentations in class					
d.	Student discovery activities on computer–based lessons or internet					
e.	Question and answer activities					
f.	Problem solving activities.					
g.	Observe and discuss animations in power point activities					
h.	Observe illustrative simulations such as Cyber school subject activities.					

APPENDIX III: Students Questionnaire

Instructions:
This questionnaire consists of sections A to D. They are multiple choices and some sub-sections are structured. Read each question/statement carefully and tick [√] or write your response on this same questionnaire. Use the given rating scale in each case. Do not write your name.

SCHOOL.....CLASS.....

1) What is your gender?
   [ ] Female
   [ ] Male

2) What is your age bracket in years?
   [ ] 17 and above
   [ ] 15 - 15
   [ ] 13 - 24
   [ ] 11 - 12
   [ ] 10 and above

3) How long have you been using computers?
   [ ] More than 5 years
   [ ] 3 - 4years
   [ ] 1 - 2years
   [ ] Less than one year
   [ ] None

4) How long have you been using the internet?
   [ ] More than 5years
   [ ] 3 - 4years
   [ ] 1 - 2years
   [ ] Less than one year
   [ ] None

5) Where do you use computers in school?
   [ ] classroom
   [ ] computer laboratory
   [ ] library
   [ ] Other places
   [ ] None

6) How many hours per week are your school computers accessible to you?

[ ] more than 5
[ ] 3-4
[ ] 1-2
[ ] less than one
[ ] None

7) If you access to internet outside school hours, how often do you use it?
[ ] Everyday
[ ] Several times a week
[ ] Once a month
[ ] Never

8) Do you use computers outside school hours?
[ ] Yes
[ ] No

9) If you have access to computers outside school hours, where do you often use them?
[ ] At school
[ ] At home
[ ] Commercial places (Cyber café)
[ ] All the above
[ ] Other places
[ ] None

10) If you have access to internet outside school hours, where do you often use it?
[ ] School
[ ] At home
[ ] Commercial places (cyber café)
[ ] All the above
[ ] Other places
[ ] None

11) Do you plan to continue using Computers for learning?
[ ] Yes, but even more effectively
[ ] No, its time consuming and unnecessary

SECTION C: USE OF CBTs IN LEARNING

12) How often do you use the following ICT tools in learning?

Rating scale:[3] Very often (Daily)[2]Often (Twice or more a week) [1] Seldom (A few times a month) [0] Never

	ICT tool	Very often (Daily)	Often (Twice or more a week)	Seldom (A few times a month)	Never
a.	Computer, LCD or OH-projector during lessons				
b.	Multimedia CD,DVD for subject content, e.g. KIE, Cyber School or student Encarta				
c.	Subject resources from internet /web pages during lessons e.g. subject enrichment exercises, information gathering assignments both individual or group work				
d.	Educational computer / internet games or activities				
e.	e-mail for communicating assignments to or from teachers				
f.	Ms Power Point simulations or animations to illustrate subject concepts				
g.	Ms Word processed worksheet for class activities, tests and exams				
h.	Ms Excel processed worksheets for class activities.				
i.	Solving real life subject problems using either computer or internet				
j.	Other				

13. In which of the following subjects does your teacher use computers to teach you? How often?

Rating Scale:

[ ] Very often
[ ] Often (Twice or more)
[ ] Seldom(A few times a month)
[ ] Never

	Subject	Very often	Often (Twice or more)	Seldom(A few times a month)	Never
a)	Mathematics				
b)	English				
c)	Kiswahili				
d)	Chemistry				
e)	Physics				
f)	Biology				
g)	History				
h)	Geography				
i)	CRE/IRE				
j)	Computer Studies				
k)	Business Education				
l)	Agriculture				
m)					

APPENDIX IV: Students Interview Guide

This interview gives you an opportunity to express your ideas on use of Computer based t4echnologies in learning. The answers you provide will be treated confidentially and used only for this research. There is no right or wrong answer and thus express your opinion openly and freely.

Instructions to data collector: Administer the interview face to face with students. Randomly selected two students from each class (form 3 and 4), consider gender balance, interview each separately.

SCHOOL.....CLASS.....NAME OF RESEARCHER.....

1) What is your gender?
   [ ] Female
   [ ] Male

2) What is your age bracket in years?
   [ ] 17and above
   [ ] 15-16
   [ ] 13-14
   [ ] 11-12
   [ ] 10 and below.

3) How long have you been using computer?
   [ ] More than 5 years
   [ ] 3-4 years
   [ ] 1-2 years
   [ ] Less than one year
   [ ] None

4) How long have you been using the internet
   [ ] More than 5years
   [ ] 3-4 years
   [ ] 1-2 years
   [ ] less than one year
   [ ] None

5) Have you been trained o how to use a computer?
   [ ] Yes
   [ ] No

6) Have you been trained on how to use the internet?

[ ] Yes
[ ] No

7. Where do you use computers in the school?

[ ] Classrooms
[ ] computer laboratory
[ ] library
[ ] others
[ ] None

8. How many hours per week are your school computers accessible to you?

[ ] More than 5
[ ] 3-4
[ ] 1-2
[ ] less than one
[ ] None

9. Do you have access to the internet in the school, and how often do you use it?

[ ] Everyday
[ ] Several times a week
[ ] Once a week
[ ] Once a month
[ ] None

10. Do you use computers outside school hours?

[ ] Yes
[ ] No

10. If you have access to internet outside school hours, where do you often use it?

[ ] School
[ ] At home
[ ] Commercial places (cyber café)
[ ] All above
[ ] Other places

11. Which ICT tools do you use in learning? How often

Rating Scale:

[3] Very often
[2] Often (Twice or more)
[1] Seldom(A few times a month)
[0] Never

	ICT tool	[3]	[2]	[1]	[0]
a.	Computer ,LCD or OH-projector during subject lesson				
b.	Multimedia CD,DVD for subject content, eg cyber school or student Encarta				
c.	Subject resources from Internet /web pages during lessons e.g , subject enrichment exercise, information gathering assignment both individual or group work.				
d.	Subject computer /internet games or activities				
e.	E –mail for communicating subject assignments to or from teachers				
f.	Ms PowerPoint simulations or animation to illustrate subject concepts				
g.	Ms Word processed worksheet for class activities, tests and exams				
h.	Ms Excel processed worksheet for class activities				
i.	Solve real life subject problems using either computer or internet				
j.	Other				

12. In which of the following subjects does your teacher use computers to teach you? How often?
    Rating Scale:
    [3] Very often
    [2] Often (Twice or more)
    [1] Seldom(A few times a month)
    [0] Never

	Subject	[3]	[2]	[1]	[0]
n)	Mathematics				
o)	English				
p)	Kiswahili				
q)	Chemistry				
r)	Physics				
s)	Biology				
t)	History				
u)	Geography				
v)	CRE/IRE				
w)	Computer Studies				
x)	Business Education				
y)	Agriculture				
z)					

APPENDIX V: Observation Schedule

	ICT tool	Available (√)
1.	Computers	
2.	LCD or OH-projector	
3.	Internet connectivity	
4.	Multimedia CDs, DVDs for subject content	
5.	Subject computer /internet games or activities	
6.	Student E –mails	
7.	Interactive Whiteboards	

APPENDIX VII: Schools with ICT Facilities in Vihiga County at the Time of Study

	School
1.	Keveye Girls Secondary School
2.	Igunga Girls Secondary School
3.	Viyalo Mixed Secondary School
4.	Mbale Boys High School
5.	St. Claire's Girls Secondary School
6.	Chango Mixed Secondary School
7.	Vihiga Boys High School
8.	Tigoi Girls Secondary School
9.	Nyangori Boys High School
10.	Vokoli Girls High School