UNDERSTANDING TEACHERS’ AND ADMINISTRATORS’ PERCEPTIONS AND EXPERIENCES TOWARDS COMPUTER USE IN KENYAN CLASSROOMS: A CASE STUDY OF TWO SCHOOLS

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This dissertation entitled

UNDERSTANDING TEACHERS’ AND ADMINISTRATORS’
PERCEPTIONS AND EXPERIENCES TOWARDS COMPUTER USE IN
KENYAN CLASSROOMS: A CASE STUDY OF TWO SCHOOLS

BY

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This study investigated and analyzed the teachers’ and administrators’ perceptions and experiences towards computer use in Kenyan classrooms. While technology has penetrated many sectors including banking, transportation, communications, medical services and so on, the Kenyan educational system seems to lag behind. Research indicates that computer use in Kenyan classrooms is still at its infancy stage (Kiboss, 2000). The use of computers in only a small percentage of the nation’s classrooms is attributed to barriers such as heavy duties on imported hardware and software, and shortage of qualified personnel (Odhiambo, 1991; Hawkridge, 1990).

In spite of computer proliferation, the mere presence of technology in schools or classrooms is not a guarantee that it will be used effectively. Therefore, this study is important because teachers and administrators play a significant role in determining how technology is integrated into the curriculum. According to Woodrow (1991), the success of any educational innovation on computer technology depends upon the support, attitudes and perceptions of the teachers and administrators involved. Therefore, understanding their perceptions and experiences will be useful in designing teacher preparation and staff development programs.

Data were collected from 27 people including computer-using teachers, non-computer-using teachers, and school and Ministry of Education administrators. Results
from the in-depth interviews, participant observation and document analysis revealed a
great deal about how teachers and administrators view computer use in Kenyan schools.
The primary findings of the study were: 1) both teachers and administrators viewed the
use computers in Kenyan classrooms as a worthwhile experience and computers were
basically used to teach computer science and computer literacy, 2) barriers that hindered
the effective use of computers included shortage of hardware and software, limited time,
shortage of power, and lack of quality training for teachers and administrators, 3)
computer-using teachers and administrators were enthusiastic and spoke positively about
computer use, whereas the non computer-users felt left behind technologically, 4)
teachers and administrators reported feeling unprepared by the teacher training colleges
to use computers in the classrooms, 5) teachers and administrators expressed the need to
provide both practicing and pre-service teachers with professional development
opportunities in technology.

All in all, the study suggests that teachers’ and administrators’ perceptions and
experiences play a significant role in the use of computers in Kenyan classrooms and
hence the need to provide preservice and inservice training programs to enable them
successfully teach using computers in the classrooms. The findings of this study suggest
the need for the Kenyan government and MOE to review not only teacher preparation and
staff development programs but also, to develop a revised national plan to implement ICT
in schools nationwide over time.

Approved: Sandra Turner

Professor of Instructional Technology
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CHAPTER ONE

Introduction

Background of the Study

Kenya, like other African countries, is making efforts to harness the potential of Information and Communication Technologies especially in the educational sector. This is evident in the country’s introduction of computers in the secondary school curriculum and hence the development of the computer syllabus. As much as computer knowledge and skills are important in today’s technological age, computer use in Kenyan classrooms is still at its initial stage. In fact, studies indicate that most of the new technological innovations including computers have found a significant place in only a small percentage of the nation’s classrooms (Kiboss, 2000; Makau & Wray, 1987). The limited computer use in Kenyan classrooms is largely attributed to barriers such as heavy duties on imported hardware and software, and shortage of qualified personnel (Hawkridge, 1990; Odhiambo, 1991).

Despite this, studies indicate that schools and other educational institutions can no longer resist the “irresistible force”– information technology (Mehlinger, 1996). These views are shared by Braun (as cited in Collis, 1988, p. 2) who reflects that “computers will move into our homes and schools whether or not someone does anything to ensure their effective use” (p. 2). Studies also indicate that there are various emerging technologies including computers, printers, VCRs, CD-ROMs, cable network links, telephones, modems, and video technologies such as television, videodisk players, camcorders and so on that are steadily increasing their presence in the classrooms (Knapp & Glenn, 1996). However, this technology proliferation seems more prevalent in schools
in the developed countries than in schools in developing countries such as many of those in Africa.

Africa, which is the second largest continent yet the least computerized, remains behind in issues related to Information and Communication Technology (Odedra, Lawrie & Goodman, 1998). But despite this, different African leaders are advocating for computerization of various national sectors including education. In the case of Kenya, President Moi and the Minister of Education are quoted saying, “We want the schools to prepare children to use modern technology” (Makau, 1987 as cited in Hawkridge, 1991, p. 61), hence necessary steps are being undertaken to realize computerization in this sector.

Although the number of computers has increased rapidly in some places, the process of computerization has not been as successful as it should be in a majority of African countries including Kenya. While technology has penetrated many sectors including banking, transportation, communications, medical services and so on, the Kenyan educational system seems to lag behind. In addition, there is a prevailing dilemma as regards computer use – that is, whether computers should be used as a tool or taught as a subject (Kirauni, 2001). A brief description of the educational system in Kenya will be useful in shedding more light on the issue of computer use in Kenyan classrooms.

Education in Kenya

Christian missionaries laid the foundation for formal education in Kenya in the 1800s. During this period, the school’s primary purpose was to promote evangelism, hence reading was introduced to help spread Christianity (Kenya Web, 2000). As the
education system developed it became instrumental in producing skilled labor for the settler’s farms and clerical staff for the colonial administration, hence the teaching of technical subjects such as carpentry and gardening. During the colonial period, education was racially stratified – that is there were separate schools and curricula for the Europeans, the Asians and the Africans. As a result, there were great disparities in educational opportunities between races and also between different regions. However, Africans got the least advantage in the system as reported by the Kenya Web (2000).

In 1960, as independence became imminent, the discriminatory system of education was abolished and in 1963 after gaining independence from Britain, the Kenyan government was faced with a need to train Africans for middle-level and upper-level government service positions. As a result, both the commercial and industrial sectors of the economy called for the restructuring of secondary and higher education. Therefore, in 1964 a Post-Independence Education Commission commonly referred to as the Ominde Commission (named after its chairman, Professor Simon Ominde), was set up to survey the education system in relation to the national policies. This commission mainly focused on secondary education and saw the need to reform the education system (Rharade, as cited in Kivuva, 2001, p. 2), because “secondary education was seen as a gateway to training the highly skilled staff that Kenya needed” (Kivuva, 2001, p. 2).

As noted by Lawafrika (n.d.), the government passed the Education Act of 1968 in an effort to meet the objectives for the Kenyan education system. The objectives for education included: to foster national unity; to serve the needs of national development; to foster and develop the rich and varied cultures of Kenya and to prepare and equip the youth with knowledge, skills and expertise necessary to enable them play an effective
role in the life of the nation, among others. As a result of the influence of the Ominde Commission, secondary education enrollments grew tremendously but despite the growth, the problem of unemployment persisted and the government was faced with the task of curbing it (Kivuva, 2001).

Subsequent reports followed including the Gachathi Report (1976), which aimed at addressing the problem of unemployment and hence advocated for the introduction of technical subjects in secondary schools (Kivuva, 2001). This would help students who failed to join the university to find jobs in the non-formal sectors or be self-employed. The Mackay Report (1981), also known as the Report of the Presidential Working Party on the Second University, on the other hand, not only emphasized the need to form a second university since there was only one university at the time, but also the need to restructure the educational system (Kenya Web, 2000; News Africa, 2000).

As a way of reforming the educational system, a new 8-4-4 system of education was introduced in 1985 to replace the 7-4-3 system. This system basically consists of eight years of primary school, four years of secondary school and four years of college. This new system was intended to meet the increasing demands of the economy for technically and professionally qualified personnel. As a result, the curriculum was re-organized and improved with a greater orientation towards sciences and practical subjects such as carpentry, arts and crafts, home science and agriculture. The new educational structure aimed at moving away from the traditional examination-centered form of education to one that prepares a learner to be self-reliant –that is, to be able to find jobs or participate in income-generating projects if they did not qualify to join colleges or university (Tostensen & Scott, 1987).
Management Structure of Formal Education in Kenya

According to Kivuva (2001, p. 21), “Educational planning and management in Kenya is highly centralized.” She further notes that although several players are involved in the running of the education system, the topmost officials mainly from the Ministry of Education are in charge of making decisions. This is underscored by the Ministry of Education’s national report presented to the 45th session of the International Conference on Education in Geneva in 1996, which indicated that,

The educational system in Kenya is managed through the network that extends from the headquarters through the provinces, districts, divisions and zones. The Minister of Education carries the political portfolio for education while the Permanent Secretary, assisted by the Director of Education, the Chief Inspector of schools and a team of other senior officers, is the executive head and accounting officer. There is a provincial director of education for each of the eight administrative provinces.

District education officers on the other hand take charge of educational administration in their respective districts, supervising the divisional and zonal officers. At the administrative level head teachers are appointed to be in charge of the day-to-day administration of their schools, assisted by school committees and boards of governors. Since the 1970s, Parent and Teachers Associations have evolved to play a role in the management of educational institutions, assisting particularly with raising funds to construct physical facilities and to purchase needed equipment and materials. (p. 5)
From this description, it is clear that the Kenyan educational system is managed through a traditional top-down management model. That is, most of the information, policy development and decision making power is placed with a few leaders at the top (Knapp & Glenn, 1996). With this centralized system of management, teachers are rarely consulted even though it is mainly their job to implement and make innovations work in the classrooms (Tyack & Cuban, 1995).

Currently there is no specific place for computers in the curriculum but the situation is beginning to change as radical reforms are being made in the educational sector. At the moment, one of the Ministry of Education’s priorities is to encourage as many schools as possible to integrate computers into their teaching and learning processes (Sanya, 2001). The Kenya Institute of Education and the Ministry of Education, are responsible for curriculum design and development, and are working towards helping schools to accomplish this goal.

*Computer Use in Kenyan Classrooms*

The ‘computer revolution’ in Kenyan classrooms dates as far back as the early 1980s. In 1982 the Ministry of Education, Science and Technology decided to allow for small experimentation in computer education through a pilot project. This was mostly to help teachers gain experience and be able to produce computer literate students as observed by Wray, 1989 (as cited in Hawkridge, 1991, p. 61). However, during this time computers were most commonly used in private schools as opposed to now, when computers are slowly finding their way into the public schools. The Aga Khan Foundation, a non-profit organization, was responsible for the introduction of computers in Kenyan secondary schools through Computers in Education Project in Kenya.
commonly known as CEPAK (Hawkridge, 1991). Through this foundation, a proposal was made to introduce microcomputers into one of its own schools (Aga Khan Academy) as a pilot project. The success of this project would in turn lead to more schools being involved (Makau & Wray, 1987).

Therefore, in 1983 the Aga Khan Academy, a private co-education secondary school in Nairobi, was the first school to embrace the new technology when it received five computers and the necessary hardware and software from the Aga Khan Foundation (Makau & Wray, 1987). Research indicates that this computer project was successful and as a result, the Aga Khan Foundation with funding from the International Development Research Center (IDRC) set up a second phase to introduce computers to four other schools in Kenya namely, Moi High School, State House Girls, Ofafa Jericho and Coast Girls Secondary schools (Odhiambo, 1991). Of these schools, two are public (fully government maintained), one is government assisted (that is, partly private and partly assisted by the government) and one is private (Hawkridge, 1991), which clearly shows the CEPAK project was not only aimed at private schools but also public and government assisted schools.

The success of the CEPAK project in the pilot school and subsequent schools laid the foundation for other schools such as Starehe and Braeburn to begin using computers and other forms of technology in their classrooms. Since then, most other primary and secondary schools in Kenya have embraced the new technology. As noted by Odhiambo (1991), computer use in Kenyan schools is not only improving the learning process but also increasing the efficiency of teachers, in addition to stimulating the interest of students.
Along the same note, Helen Abwavo, the head of the computer department at Ofafa Jericho Secondary school in Nairobi, underscored this by saying, “Before the introduction of computers in Kenyan schools the chalkboard was the main teaching aid, but we now have a teaching aid that can interact with the students” (Odhiambo, 1991, p. 26). With the use of computers in Kenyan classrooms, students are actively involved in the learning process as opposed to being passive learners. This can be depicted through various studies such as Odhiambo (1991), in which the head of the computer department says, “My students enjoy the computer classes because of the marvel of using this innovation for the first time” (p. 26). Unlike before when teachers were in control of all activities in the classrooms, the students now have the opportunity to actively participate by using the computers.

However, with computers and other technologies slowly making their way into the Kenyan classrooms, most teachers and school administrators feel quite uncomfortable around computers. As a result, “not every teacher wants to hop onto the computer bandwagon” (Calkins, as cited in Lumsden & Norris, 1999). As indicated in the IDRC reports by Odhiambo (1991), a majority of these educators (teachers and administrators) merely see computers as “those things we see in magazines and on the television screens” (p. 26). It is therefore, not a surprise that only a small proportion of teachers and other educators in Kenya are using computers in their classrooms.

With this thought in mind, one is left to wonder how educators are expected to use technology, such as computers in their classrooms, when some teachers and administrators, especially those in rural areas, may never have seen a computer before.
Such observations indicate the need to do more research on computer use in Kenyan classrooms, hence the significance of this study. Knowing and understanding teachers’ perceptions and experiences with computers will be very useful in trying to “win over” especially, the reluctant teachers and administrators. This is because the success of any educational innovation on computer technology depends upon the support, attitudes and perceptions of the teachers and administrators involved (Woodrow, 1991). In agreement with this, Rice and Wilson (1996) note that training teachers in the uses and integration of technology not only positively changes their attitudes towards technology, but also raises their skill levels and can lead to new opportunities and resources for students.

Statement of the Problem

The Kenyan education system is strongly oriented towards preparing students for public examinations (Hawkridge, 1991). According to Kangoro, the educational system is plagued by too much emphasis on passing examinations at the expense of the development of other non-cognitive skills. With much emphasis placed on mastering textbook material and passing examinations, teachers are obliged to focus on teaching the syllabus set for each subject by the examining body instead of inculcating in students skills such as problem solving and critical thinking that are needed to survive and be successful in today’s information age, technology driven and dependent society (2001). A notable Ministry of Education official, Dr. Wamae observed that the syllabus followed in the Kenyan classrooms not only fails to put technology into context but it also does not embrace recent developments in the information technology world (The Daily Nation, 2001).
Several studies including Ghai (1974) and Republic of Kenya (1976) (as cited in Makau & Wray, 1987) assert that the majority of teachers in Kenya are constrained by the system to a very formal teaching style and hence there is little or no awareness of the new technologies. Because technology has the potential to change the teacher’s instructional practices (Rice, Wilson & Bagley, 2001; Kiboss, 2000), there is dire need for teachers and administrators in a country such as Kenya to embrace it and integrate it into the school curriculum. Having recognized the importance of technology in schools in the developed countries, most schools in Kenya are now under pressure to familiarize themselves with computers as this will help to improve the quality of classroom instruction and prepare youth for the 21st century (Makau & Wray, 1987).

Although progress seems to be made, having made computer science an examinable subject in the Kenya Certificate of Secondary Education in 1998, a lot more still needs to be done as regards technology use and integration in the curriculum. According to Aduda (2000), teachers have hardly been trained to teach the subject. The Daily Nation newspaper reported that a majority of Kenya’s 234,000 teachers are computer illiterate and there is no program to train them on the skills. In addition, there are no data on the projected demand for and capacities by teacher training colleges and universities to provide teachers for computer sciences (The Daily Nation, 2001). Due to lack of qualified teachers to teach computer science, most schools depend on computer experts and/or in some cases schools have taken teachers for training in computer packages in commercial colleges and then assigned them to teach the subject (Aduda, 2000).
According to the Minister of Education, Henry Kosgey, the Kenyan government is ready to make changes in many aspects of the education sector as part of new telecommunications sector policies. In his view, these policies would not only seek to integrate the use of technologies including computers in the education system, but also train teachers on how to blend the new approaches into their teaching practice. In addition to this, the policy would also seek to introduce a national information and communications curriculum for primary and secondary schools targeting both students and teachers (Standard Correspondent, 2001). Consistent with these, Knapp and Glenn (1996) note that although the pressures of new technologies will not change schools, technology if integrated into effective teaching and learning practices can help teachers restructure their classrooms. This calls for teachers in Kenya to move away from the traditional teacher-centered lecture approach with the teacher being the transmitter of knowledge and the students as the recipients, to a more learner-centered inquiry approach (Peck & Dorricott, 1994; Grabinder & Duffield, 1996; Norum, Grabinder & Duffield, 1999; McCombs, 2000; Rice et al., 2001).

According to Rice et al. (2001), teaching and learning can be enhanced if teachers changed their instructional practices and adopted the learner-centered paradigm because through this approach, students are actively involved in critical thinking, problem solving, decision making and exploration. Thus, it encourages creativity and the participation of students in the learning process. However, for technology to be successfully integrated into the curriculum, there is need for good leadership and professional development for both teachers and administrators. Several studies indicate
that lack of training is one of the reasons attributed to inadequate use and integration of technology into the curriculum (OTA, 1995; Batane, 2002).

Therefore, the purpose of this study was to examine the perceptions and experiences of teachers towards computer use in the Kenya classrooms and their role in technology integration. Teachers’ perceptions and experiences are important contributing factors to the successful integration of technology into the curriculum. The study aimed at understanding teachers’ views about computer use in the classroom and hence questioned teachers on several topics including how technology is used and integrated in the classroom, how this process has impacted teacher practice in the classroom and the significance of teacher education in their effective implementation of technology. Understanding such concepts will be helpful in the design and implementation of teacher preparation and staff development programs in Kenya.

The study was guided by literature on integrating technology into the curriculum. Literature, as depicted by various educational technologists including the International Society of Technology in Education (ISTE, 1999), advocate the use of technology/computers to enhance the teaching and learning process by integrating them into the curriculum. Watts (1984) for instance, observes that the idea that a computer can be a tool seems to have eluded most educators especially those who view computers as something to teach about rather than something to teach with. Although no provision has been made to enable teachers in Kenyan classrooms to use the computer as a teaching tool or integrate it into the curriculum, this is beginning to change. As noted by a Ministry of Education official, Dr. Wamae, with the new technological policies in the
educational sector, “every teacher should be able to use computers to suit his or her subjects whether it is mathematics, history or geography” (The Daily Nation, 2001, p. 3).

Brooks and Brooks (1993) explicitly describe the learning and teaching situation in most American schools and they observe that,

First, the American classroom is dominated by teacher talk ... Second, most teachers rely heavily on text books … Third, although there exists a growing interest in cooperative learning, most classrooms structurally discourage cooperation and require students to work in relative isolation on tasks that require low-level skills, rather than higher-order reasoning … Fourth, student thinking is devalued in most classrooms … Fifth, schooling is premised on the notion that there exists a fixed world that the learner must come to know. (p. 6-7)

This situation is no different with the current situation in most Kenyan classrooms. As Kenyan schools move towards restructuring, educators must place less emphasis on teaching facts, skills and concepts and instead help students to learn to think for themselves and be able to create knowledge (Knapp & Glenn, 1996). Thus, there is need to examine the curriculum and the way the schools are organized in order to provide learning environments that enable students to think abstractly, collaborate with others and develop strategies to solve problems they will encounter as they enter the 21st century.

According to Dooley et al. (1999), although public schools are installing computer technology at an alarming rate, the training for this infusion of technology does not always transfer to integration of technology into the curriculum. Likewise, Shubert (as cited in Collis, 1988, p. 302) notes that computers have not yet found a place in the
curriculum for the majority of teachers and students despite their proliferation in schools and society at large, hence the underutilization of computers in schools. Similarly, the curriculum in Kenya does not have a place for computers and as a result, only those schools (especially private schools and a few public schools) that have and use computers in classrooms have embraced this technology. There is a need to help teachers and school administrators to use technology effectively as this may be the most important step in realizing the current and future investment in technology (Dooley et al., 1999).

Research Questions

This study addressed the following research questions:

1. How do teachers and administrators in Kenya view the use of computers in classrooms? What are the obstacles and benefits?
2. How does the pre-service training among teachers in Kenya impact their use of computers in the classrooms?
3. How do teachers in Kenya maintain their effectiveness in using computers in the classroom?

Significance of the Study

Limited research has been carried out on the topic of teachers’ and administrators’ perceptions towards technology use in Sub-Saharan Africa. The purpose of this research study was to analyze and understand the teachers’ perceptions towards computer use in the classrooms, specifically in Kenya. The study aimed at understanding their perspectives of computer use for various tasks (including instructional and administrative) and their role in the technology integration process. This study is
significant, as the findings will impact the design of not only teacher preparation
programs but also the staff development programs in Kenya. This is more so for the pre-
service teachers who are prepared at teacher education institutions for the task of teaching
with technology integration as a major component and for the in-service teachers who
also require professional/staff development programs in order to improve on their
teaching with technology as a tool to enhance teaching and learning.

Through this study, various strategies such as the adoption of the computer
integration model emerged that may be useful in helping teachers and administrators in
Kenya to acknowledge and embrace technology. The findings of this study will also
contribute to the field of technology and education since there is limited research on
technology use in African schools. A paper will be published out of the study and it is
hoped that the findings will motivate more teachers and administrators (especially those
in Kenya and other developing countries) to integrate technology into the curriculum.

Limitations of the Study

The research focused exclusively on in-service teachers’ and administrators’
perceptions and experiences towards computer use in Kenyan secondary schools and
their role in technology integration. Therefore, the study does not focus on teachers at
other levels such as elementary and primary schools. Besides this, the participants were
from two high schools, the Ministry of Education and the pre-service teacher training
college, all of which are located in an urban region of Nairobi, in which case rural
schools were not included. In addition, the study did not focus on perceptions and
experiences of students towards computer use in Kenyan classrooms which would have
helped understand the phenomena from a different perspective.
Definition of Terms

In order to understand the teachers’ and administrators’ perceptions and experiences towards computer use in Kenyan classrooms, the reader is supplied with the terms and definitions in this research study as used in this study.

Technologies: All forms of computers and their peripherals including hard disk drives, CD-ROM, projection devices and networks offering telecommunication linkages (OTA, 1995).

Technology integration: The use of computers to support and enhance the curriculum goals and objectives in all content areas.

Learner/student-centered: Approach to learning with more of the learning under the control of the learner.

K-12 classrooms: Kindergarten to 12th grade in the U.S; equivalent of Kindergarten/Preschool to Form four in Kenya.

Computer literacy: Basic computer knowledge and skills.

In-service teachers: Practicing teachers.

Pre-service teachers: Students in a teacher education preparation program.

Computer studies teacher: Teacher who taught computer science and/or computer literacy program.

School administrators: Heads of schools. Also commonly referred to as headmasters/headmistresses/principals.

Professional/Staff development: Continuing education of currently practicing teachers and school administrators.

Organization of the Study

This study is organized into five chapters: introduction, review of literature, methodology, findings and discussion and recommendations. Chapter One basically gives the introduction and describes the background of the study. The purpose of the study is stated, as well as the statement of the problem and the significance of the research. Chapter Two provides a review of literature regarding the research questions pertaining to the problem of study, whereas Chapter Three focuses on the methodology, research design and data collection and analysis. Chapter Four presents the findings of the study and Chapter Five is a discussion of the findings, recommendations and implications for future research.
CHAPTER TWO

Literature Review

Introduction

Existing literature indicates that computers have not only caused a restructuring of some classrooms and changed the way teachers teach and organize their classrooms (Knapp & Glenn, 1996) but they have also changed what and how students learn (Sheingold, 1990). Much of the literature on use of computers in schools does not focus on schools in Africa. However, studies indicate that similar changes are being experienced in schools in Africa. Kiboss’ study (2000) of teacher/pupil perspectives on computer-augmented physics lessons on measurement in Kenyan secondary schools confirms this. His study found that computer-based instruction (CBI) had a positive influence on the pupil’s classroom interaction patterns. In addition, use of CBI also positively impacted the way the teacher perceived the teaching and learning process. These results clearly show that schools in Kenya are benefiting from using computers in the classroom although the application and use of computers in Kenyan public schools is relatively uncommon (Kiboss, 2000).

As far as schools in other African countries such as Botswana, Zimbabwe, and South Africa are concerned, the use of computers in education in these countries is likewise increasing, and results indicate that their use has impacted student learning positively. For instance, Batane's study (2002) on technology use in secondary schools in Botswana shows that public schools in both the rural and urban areas are using computers, and this has changed the way teachers teach and even the way students learn.
Students are now actively participating in the learning process as opposed to being passive learners. Likewise, the role of the teacher has changed from one who disseminates information to one who facilitates students’ learning activities. As for schools in South Africa, research indicates that most of them are beginning to slowly integrate technology and to help facilitate this, the “government has mandated that schools create computer/media centers in their schools so that teachers can learn to use technology and teach these skills to their students” (Van der Wal & Pienaar, 1996-97, p. 12).

Similarly, Zimbabwe, like Kenya and South Africa, has embraced the use of computers in their schools, and computers seem to be changing not only the way of life for the students but also of the teachers and administrators. This is depicted in a speech by the Minister of primary and secondary education, Comrade Fay Chung, who was quoted saying, “Computer technology is going to change ways of teaching and possibly challenge the manner in which we think about our schools” (Hawkridge, 1991, p. 67). From these studies and many others not mentioned, the literature points to the use and impact of computers in schools in Africa, including Kenya.

An analysis of the literature regarding computer use and integration in the classrooms results in the identification of four broad topics. The first topic is why use computer technology in K-12 classrooms? The second topic is in-service teachers and the use of technology, the third topic is pre-service training programs, and last but not least, professional development for teachers and administrators.
**Why Use Computer Technology in K-12 Classrooms?**

A variety of emerging information technologies including computers seem to be penetrating each and every sector of our economy including the educational sector. As Kook (1997) notes, computers have become the most sought after electronic devices both in the homes and schools. Furthermore, they are the most powerful teaching and learning machines to enter the classroom as students and teachers can interact with them in ways impossible with film, radio and television (Tyack & Cuban, 1995). In order to understand computer uses in K-12 classrooms, researchers have identified four basic rationales why schools are using computers today. These include: the social rationale, the vocational rationale, the pedagogic rationale and the catalytic rationale (Hawkridge, 1991; Hawkridge, 1990). *The social rationale* deals with student’s place in society and hence policy makers want to be sure that learners are prepared to be unafraid of how computers work and to understand their role in society. *The vocational rationale* on the other hand, proposes that learning to operate computers is important because it enhances employment opportunities. *The pedagogic rationale* that calls for improved teaching and learning presupposes that computers can enhance traditional instruction methods. Finally, *the catalytic rationale* supposes computers as catalysts to enable desired change to take place in schools (Hawkridge, 1991).

While the social and the vocational rationales seem to dominate in the United States (Ely, 1993), most African countries place much more emphasis on the vocational rationale and less on the social, pedagogic and catalytic. This is because governments of these countries believe that “teaching children how to operate computers and use
application programs gives them skills that may be useful to them as students and when they move into job markets” (Hawkridge, 1991, p. 60). As much as this is the case in some countries, it is no surprise that the Kenyan educational system like other educational systems in developing countries is meritocratic and strongly oriented towards passing public examinations (Hawkridge, 1991). As a result, it cannot adequately prepare students to live, learn and even work in a global, digital age (Lemke & Coughlin, 1998). While Ministries of Education in various African countries need to have policies on computers in schools, it is also important that these policies are backed by a rationale or rationales (Hawkridge, 1991).

Nonetheless, this is beginning to change as most schools are beginning to realize the need to incorporate technology in the curriculum. It goes without saying that technology is a powerful tool, which if effectively used has the potential to prepare students to learn the skills that are necessary for today’s constantly changing workplace (Recesso & Carll, 1999). These views are shared by Bialo and Solomon (1997), who caution that,

If you keep technology out of the schools today, don’t be shocked several years from now when students are unprepared to take their place in the competitive job market of the 21st century – a market in which the vast majority of jobs will require the use of technology. (p. 70)

Similarly, Driscoll (2001) believes in the power of technology to facilitate and even transform teaching and learning. She argues that it is by “using technology in a transformative way that students are able to realize the potential of technology and hence begin to develop more powerful uses and applications” (p. 335). Besides this, technology
can also help teachers restructure their classrooms, according to Knapp and Glenn (1996). Kook (1997) and OTA (1995) add that because the computer is a highly versatile tool, the teacher may use it for his/her own personal productivity and as a way to expand classroom instructional activities. Despite the power of computers to transform the teaching and learning process, research on the effective uses of technologies for enhancing teaching and learning is still in its infancy (Driscoll, 2001). However, the most important issue concerns the decisions teachers make about how and why they incorporate computers in their instruction (Driscoll, 2001; OTA, 1995).

In spite of the teacher’s decision not to use or to use and integrate computers or other technologies into the teaching and learning process, and regardless of the rationale offered for computer use in schools, most countries both developed and developing are deciding to put computers in their schools. As Recesso and Carll (1999) pointed out, this may be largely due to the fact that as children grow up they are bound to encounter computers everywhere, be it at home in the form of stand-alone units or Play Stations, at the library as they search for and borrow books, at supermarket checkout counters, at the banks, just to name a few. They further observed that as these children grow, they become consciously aware that computer technology underpins the world we live in and affects our lives in various ways (Recesso & Carll, 1999). Because technology is used extensively outside of school in various areas, using computer technology in schools only makes the conditions of school more authentic and better prepares the students to comfortably use them elsewhere.

According to Bialo and Solomon (1997), many critics cite less promising studies to show that “technology is not working” because they ask the wrong
question which is, does technology work? and in so doing ignoring the benefits of technology. They advocated for people to open their eyes, acknowledge the existing evidence and hence propose asking the right question: under what conditions does technology work and how does it work? Lemke and Coughlin (1998) responded to this question, by noting that given the right conditions – prepared teachers, contemporary technologies, supportive schools and new approaches to teaching and learning, technology can be a powerful, effective learning tool toward improved student academic performance.

Other studies, such as A Nation at Risk (1993), revealed the capabilities that computer technology can provide to both students and teachers in K-12 classrooms. For teachers and administrators, technology supports functions that are fundamental if they are to provide authentic, active learning experiences that include but are not limited to developing instructional materials, conducting ongoing assessments of student learning and expanding teachers’ content and knowledge. This is further supported by Driscoll (2001), who analyzed literature dealing with integrating technology in education. She indicates that in a study which aimed at putting new information technologies into Quebec schools, one school board administrator revealed the articulated goals for why technology is important by saying, “Technology can allow us to adopt a more child-centered and individualized approach and given resources such as the internet, teachers would be able to work around topics and themes that both peak [sic] student interest and motivation” (p. 340).

From this administrator’s viewpoint, technology not only helps transform teachers’ teaching styles but also enables them to focus on the interests and needs of
individual students. To students, on the other hand, technology offers a powerful support for learning skills through inquiry and problem solving (A Nation at Risk, 1993).

Furthermore, it equips learners with the necessary skills including higher-level thinking, collaborative problem solving and an ability to create new knowledge in order to succeed in today’s technological society (Knapp & Glenn, 1996). This is supported by Driscoll (2001), who observed that in addition to acquiring the necessary skills, helping students to use computers and various kinds of technology as tools helps them to construct meaning and to facilitate, document and enrich their learning. Consistent with these views, Bialo and Solomon (1997) observed that in addition to improving “traditional” learning, technology can also expose students to experiences that were not possible before. Thus with technology, students are encouraged to discover, to integrate and interpret data into information and finally to apply that information in action (Maurer & Davidson, 1998).

A review of the literature related to implementation and use of technology further reveals technology’s potential to improve student learning and necessitating the need to use technology in K-12 classrooms. Recesso and Carll (1999) cited different studies that demonstrate this. For instance, Vacc (1991) found that children using computers in math are more independent learners, MacArther et al. (1990) who studied computer interaction with learning disabled students discovered that students are more engaged and as a result achieve higher spelling scores, while Crandler (1997) reported on a number of outcomes for students related to their use of technology within the curriculum. He noted that technology:

(i). Increases performance when interactivity is prominent.
(ii). Increases opportunities for interactivity with instructional programs.

(iii). Helps prepare students for work when emphasized as a problem-solving tool.

(iv). Increases mastery of vocational and workforce skills.

(v). Increases student collaboration on projects.

(vi). Provides instructional opportunities otherwise unavailable.

All these diverse views on the use of computers in schools show evidence of what technology can do, and the fact that its benefits are enjoyed by all—students, teachers, school administrators and the general public. Although technology can invite change, it cannot ensure that this change will be successful unless there is good and effective leadership. Hence Recesso and Carll (1999) outlined a number of factors for technology leaders to consider when designing the technology implementation process. Questions to be asked include:

1. Does technology fit in here as a tool?

2. Will it provide support for core curriculum?

3. Will it be a tool to enhance and extend student learning?

Thus, technology as an innovation is affected by administrative procedures and for this reason, there is need for proper planning for technology to be well integrated into the K-12 classrooms.

*Technology Integration in the Curriculum*

In much of the literature, researchers frequently use the words, “technology integration” or “integrating technology” and it is important to understand what they mean. Vojtek and Vojtek (1999) offer an appealing definition of what it means to “integrate.” To them, integrated “means blended, or evenly distributed in the curriculum,
so students learn the knowledge and skills of the curriculum and simply use technology as a tool to help them learn efficiently” (p. 67). Thus like other researchers, they advocate for the integration of technology and feel that “the only way we truly integrate technology into instruction, is by using it as a tool to help students improve their learning” (p. 69).

According to Byrom (n.d.), having access to technology is one thing and using it is another thing. This is true especially for schools in Africa, which may acquire computers and other technologies through donations (Hawkridge, 1991). Because the donated computers arrive in an uncoordinated fashion into the schools, and because these schools have no plan or purpose for them, they do not utilize them to help improve the teaching and learning process. This is emphasized by Hardy (1998) who observes,

The mere presence of technology in a school or classroom is no guarantee that it will be used effectively. The teacher is the central figure who essentially decides whether to utilize computer technology in the classrooms and therefore needs to be aware of or have a basic understanding of how the technology can be integrated and effectively used in the classroom. (p. 119)

Most schools are far from effectively integrating technology into classroom activities despite the fact that computers and other emerging technologies are steadily finding their way into the K-12 classrooms. As the CEO Forum on Educational Technology (1997) indicated, less than 3% of America’s schools are at the forefront of integrating technology. This was further supported by the U.S Department of Education report, Teacher quality: A report on the preparation and qualification of public school
teachers, which indicated that only 20% of full-time public school teachers reported feeling very well prepared to integrate technology into their curriculum (1999). As this may be the case, according to OTA (1995) the use of technology in schools is most effective when it comes in the form of curriculum integration. Kook (1997) also indicated that “one way to provide activities that give teachers and students a sense of the world in which they live is to include computers and communication technologies in the curriculum” (p. 59).

Although much of the literature emphasizes the importance of integrating technology into the curriculum, Hardy (1998) pointed out that “classroom teachers are significant contributors to the successful integration of computer technology in K-12 schools” (p.128). Along the same line, Kent and McNerney (1999) argued that the use of technology/computers in the classroom depends on the ability of teachers to integrate it. Sparks (1999), the executive director of the National Staff Development Council, similarly felt that teachers must be at the core of leadership communities if schools are to be places in which students and educators are successful, especially at effectively using computers and other technologies in the classroom. This was further made clear by Hope (1998), who informed us that one of the reasons many teachers are not integrating technology is their lack of prior experience using it as a productivity tool.

Lack of confidence may also be the reason for their failure to integrate technology. Delton (1989) as cited in Kalkowski (2000, p. 2) found that teachers are likely to ignore an innovation when they lack confidence to integrate it. Other researchers such as Rosen and Weil (1995) similarly found that nearly one third to two thirds of the teachers they surveyed were not using computers personally, or with their students
because they lacked confidence, felt uncomfortable and were to some extent frightened by technology. Another influential factor in the teacher’s decision to integrate technology is teachers’ attitudes. This was depicted by Hardy’s study (1998), which sought to determine teachers’ attitudes toward and knowledge of computer technology. Her study revealed that the teacher’s own confidence had a much stronger effect on the teacher’s decision to use technology compared to the variables of access to equipment, administrative support and time.

Likewise, Ropp (1999) in her study of preservice teachers demonstrated that even if teachers demonstrate proficiency integrating technology into their teaching but do not believe that technology has a use in the classroom, they will not teach with technology despite their proficiency. These studies clearly indicate that if teachers have knowledge of the technology and hence feel confident and comfortable using it, and see value for their students, then, they are likely to integrate it in their classrooms. However, for technology to be truly integrated, educational reforms must take place in schools. As Recesso and Carll (1999) noted, putting computers into a room where all learning is teacher-directed, didactic, and compartmentalized (as in the case of Kenya) will result in neither educational reforms nor effective integration of computer technology within that classroom.

They further pointed out that for reform to take place, “the classroom must be a place where students can explore, where they have interactive modes of instruction, and where they have sufficient time to pursue authentic and multidisciplinary work within collaborative groups” (p. 4). With this in mind, administrators need to review the staff development provided in order to plan for successful staff development related to
technology. An assessment of training already provided to teachers needs to be conducted in order to devise a cohesive plan that takes the best from the past to build upon the future. According to Kook (1997), it is important that teachers are part of any systematic plan for integrating computing and communication technologies into the classroom.

Since technology has been recognized as an indispensable tool and identified as an important factor in preparing students to enter the workforce (Recesso & Carll, 1999), there is need for schools and other educational institutions to adapt technology/computers and successfully implement them into the curriculum, including schools in Kenya. However, the current and previous research related to the adaptation and implementation of computers in schools has focused more on schools in the developed countries as opposed to the developing countries. This dissertation therefore reviewed literature on computer use not only in the United States but also in other countries in Africa and in particular Kenya.

**Technology Integration in Kenya**

Having earlier indicated that the Kenyan educational system, like other educational systems in developing countries, strongly emphasizes passing exams, the literature indicates that this scenario is beginning to change. As of now, most schools, especially private schools, are beginning to realize the need to incorporate technology in the curriculum. One such school that demonstrates these changes is the International School of Kenya (ISK). For several years this school only had one phone line, but now it not only has 150 networked computers but also a 64K modem that maintains the students’ websites. Additionally, the school takes advantage of technology through e-pals projects with public schools in the United States and Venezuela (Foster, 2001).
Another school that seems to be emulating ISK in computer integration is Braeburn High School. Though a high-cost private school, the use of technology at this school is no different from other private schools in Britain and in the United States (Sanya, 2001). According to the computer science teacher, Mrs. Sanya, Braeburn High School has realized the need to expose her students to information technology as early as possible in order to prepare them for the Information and Communication Technology (ICT) society of the 21st century. ICT is also integrated in the teaching of other subjects and it is now compulsory at lower levels in years 8 and 9” (p. 5).

In addition to this, the school also ensures that staff members are adequately equipped through regular training in order to incorporate information technology into their areas of specialization (Sanya, 2001). As much as private schools are attempting to integrate computers into their teaching, public schools such as Starehe and Ofafa Jericho High Schools among others are also doing the same. According to the head of computer department at Ofafa Jericho, Helen Abwavo, “What we are teaching our students is not computer science as such, but how to use the machine as a learning tool” (p. 26).

From the way computers are being used in some of the schools in Kenya and other parts of the world, it goes without saying that technology is a powerful tool, which if effectively used has the potential to prepare students to learn the skills that are necessary for today’s constantly changing workplace (Recesso & Carll, 1999). Besides this, technology if integrated into effective teaching and learning practices can help teachers restructure their classrooms and move from the traditional teacher-centered
lecture approach to a more learner-centered inquiry approach (Peck & Dorricott, 1994; Grabinder & Duffield, 1996; Norum, et al., 1999; McCombs, 2000; Rice et al., 2001).

Because teachers and other educational administrators in Kenya are inclined towards the more traditional teacher-centered approach, use of technology would provide an opportunity for teachers to move away from this approach as technology fosters the use of more student-centered learning strategies (Norum et al., 1999). As Knapp and Glenn (1996) and Norum et al. (1999) pointed out, technology is an integral component of restructuring not only schools and classrooms but also the way teachers teach and organize their classrooms. Therefore, this study aimed at understanding the perceptions of teachers towards computer use in Kenyan classrooms. There is need to understand the way these teachers and administrators use and integrate computers into public school classrooms. Various studies have documented the need for integrating technology into the teaching and learning process. These studies will be useful in providing a basis for Kenyan teachers to use and integrate computers into the curriculum. Although there is a genuine desire to adopt computer use in many schools, the conditions for implementation are not always present (Ely, 1993).

Foster (2001) mentioned that integrating technology in a developing nation poses special concerns that range from long and frequent power outage, wrong hardware such as a keyboard with French accented letters and directions in French, among others. In addition to this, Picciano (1998) observed that inadequate or non-existent planning has been frequently cited as one of the factors for poor technology implementation in schools. Also, OTA (1995) cited lack of training in computer use as one of the barriers to technology integration in schools. Despite the lack of planning for technology and the
occasional inconveniences experienced in Kenyan schools, a Nairobi school superintendent pointed out that living, learning and working in Kenya is a rewarding experience. This is because with technology being integrated into the curriculum, the students’, teachers’, administrators’ and even community members’ way of life is being transformed (Foster, 2001).

Role of Teachers and Administrators in Technology Implementation

According to Norum et al. (1999), technology not only changes the way students learn but also the way teachers teach and administrators operate. Because technology fosters the use of more student-centered strategies, it is likely that the roles of those involved in education, that is teachers and administrators, will fundamentally change (Kook, 1997). In his discussion of how computers and communication networks in educational settings prepare teachers for new roles, Kook remarked that as technologies such as computers change the teaching and learning process, the teacher’s roles will likewise be transformed. Like other researchers, he indicated that teachers will take on the roles of information consultants, team collaborators, facilitators, course developers and academic advisors.

In agreement with this, Cuban (1986, p. 37) observed that, “teachers are the gatekeepers of instructional technology,” yet this observation is often overlooked. This is true because school administrators may plan for and buy technology but unless teachers open their classroom doors then the technology will go unused, and hence the objectives of improving teaching and learning will not have been achieved. These views are reiterated by Valdez (1998), who added that teachers not only hold the key to
implementing and sustaining change within the classroom but also provide the bridge between a school/district’s plans and the benefits learners gain from those plans.

Research also indicates that while community partners such as parents, business representatives, religious leaders and so forth play an important role in developing philosophical and practical support for technology planning as well as helping structure and implement new policies (McNabb et al., 1999), administrators and teachers have an equally important role in the implementation of technology in K-12 classrooms. Administrators are especially crucial for facilitating systemic planning since they are involved in decision making regarding teaching and learning processes, curriculum, strategic planning for technology (including infrastructure), evaluation and assessment and external relations and ethical issues (Knapp & Glenn, 1996; Anderson & Dexter, 2000).

Besides playing a role in the planning, integration and implementation of technology in educational institutions, educational leaders are also responsible for identifying funding resources (McNabb et al., 1999). This is a crucial step in the planning process because the regular budget is generally inadequate to support the infusion of technology. As a result, other sources of funding need to be explored including grant opportunities, business partnerships, local foundations and other sources and this requires the know-how of the leaders. Therefore, educational leadership must consider “incorporating as an annual budgetary expenditure funds to maintain existing technology, to provide technology related professional development, to update or replace obsolete equipment on a regular basis and to provide necessary technology support staffing” (Apple Computer, 2002). The role of school leaders in technology infusion and
implementation cannot be at all underestimated if technology is to be effectively used to improve the teaching and learning process.

Teachers on the other hand are essential in the design and implementation of the plan. According to Picciano (1998), the teaching staff is the fulcrum for curriculum integration because teachers are critical for identifying applications and evaluating software and hardware and also the staff development needs. Consistent with Picciano, Mehlinger (as cited in Anderson et al., 2000, p. 2) claims that unlike other educational innovations, successful technology is driven by teachers rather than outside experts. This is because teachers know their students’ needs and understand them better, hence they know when and where to integrate technology to help meet the needs of their students. Therefore administrators need to work together with teachers to provide the leadership needed and also to ensure that the resources for hardware and software, for training, facilities and staffing are available (Picciano, 1998). This will in turn facilitate the implementation process.

Research has indicated that both teachers (Moursand, 1999; Dexter, Anderson & Becker, 1999) and school administrators (Conte & Weber, 1999) are important change agents for technology adoption in schools. Because of this, Wetzel (1999) added that there is need for school districts to have visionary leaders who are enthusiastic about incorporating technology but also helping their teachers to do so. For effective changes to take place in schools, effective leaders are needed. Vojtek and Vojtek (1999) classify leaders into three groups, namely executives, who comprise the superintendent or school administrator, internal network leaders, who include peers such as department chairs and finally local line leaders who include the teachers. According to Kalkowski (2000), “For
technology to be truly integrated throughout a system, and to become a tool that increases the ability of students to achieve, leaders must come from all the three types” (p. 4).

**In-service Teachers and the Use of Technology in the Classroom**

Studies indicate that schools are busy filling classrooms with computers. The National Center for Educational Statistics (NCES) reported that the ratio of students to computers in primary and secondary schools in the U.S is five students to one computer (2001). Despite this, a large percentage of teachers remain reluctant and skeptical about using computers in their classrooms (McKenzie, 1999). In fact, teachers among other professionals have been perceived to be more hesitant and less likely to embrace computer technology (Paprzycki & Vidakovia, 1994). Hardy (1998) pointed out that many inservice teachers received their training before computer technology was available and hence were not taught with technology while in the teacher education programs. As a result they are not comfortable enough to integrate it in their classrooms.

Therefore, it is no surprise that many practicing teachers feel that they have not been adequately prepared to effectively use technology in their classrooms (Faison, 1996). More evidence shows that as many as 70% of the teachers in American classrooms fall into the “reluctant” or “late adopter” categories when it comes to computers and other new technologies (Becker, 1999). Similarly, Chin and Hortin (1993) in their study of elementary teachers’ perceptions towards technology found that more than 50% of the teachers in a Kansas urban school district used technology with their students less than 30 minutes in a school day. A study by Bychowski, Deborah, Van and Ralp (as cited in Mukti, 2000, p. 1) on current classroom computer usage and computer knowledge revealed that most of the teachers surveyed did not feel that they
possessed adequate knowledge on the aspects of computer technology to effectively use computers in the classroom.

Similarly, the CEO Forum’s School Technology and Readiness Report indicates that “only 20% of teachers report feeling very well prepared to integrate educational technology into classroom instruction” (1997, p. 3). In his study of computing styles, Evans-Andris (1995) evaluated how teachers responded to the presence of computers in their schools and found that 60% of the teachers surveyed did not overtly embrace computer implementation. The OTA (1995) report also estimated that less than a quarter of our teachers had integrated computers into their regular classrooms programs (p. 2). From the various studies, little is being done to prepare teachers, especially reluctant teachers, to integrate computers, yet OTA (1995) reported that helping teachers to become comfortable with the technology may be the best way to ensure the effective use of computers in the classroom.

Although most of these findings are from schools in the United States, the situation is no different in Kenyan schools. According to Aduda (2000), few teachers in Kenya have the necessary computer skills to teach computer science let alone integrate computers into other content areas. As a result, most schools depend on hired personnel to teach the subject, yet most of them are not professionals in classroom teaching. This indicates the need to train teachers in computer education in order for them to make meaningful decisions to use them in their classrooms. The need for computer literacy has been underscored by the Director of Kenya Education Staff Institute (KESI), John Odanga, while speaking at the African Virtual University based at Kenyatta University, where some 200 teachers completed information technology courses (Aduda, 2000).
Nevertheless, Wanzare and Ward draw attention to the efforts being made by the Kenyan government with regard to in-service training for teachers,

The Kenyan government in an attempt to ensure quality teaching in schools, has invested substantial amounts of financial and human resources directed towards inservice training programs for teachers. However, little consideration has been given to developing services which would increase teacher commitment, interest, motivation and self-fulfillment, make teachers feel secure and confident about themselves as professionals and promote pupil learning through improved teacher performance. (2000, p. 265)

Although efforts are underway as indicated above, more needs to be done to motivate teachers and also help them feel confident enough to integrate computers in their classrooms. Picciano (1998) indicates that when planning for staff development programs for teachers, it is important that incentives are provided. Because teachers in most schools are burdened with heavy workloads, use of incentives such as reduction in workloads to create time to attend professional development, reimbursement of travel expenses, earning credit hours are some of the ways to encourage teachers and other staff members to pursue staff development programs.

Besides planning for staff development programs that include provision of incentives, Van der Wal et al. (1996-97) proposed the use of computer centers (such as Boitjhorisong Inservice Training Center in South Africa) as one way of training both teachers and administrative staff in the use of computers in the classroom. Because such centers have been instrumental in contributing to the computer literacy of teachers,
administrators and students in South Africa, Van der Wal et al. suggest it would be ideal for schools in Kenya to consider similar approaches for teachers and administrators especially in cases where there are many teachers who need to be trained and fewer trainers.

As Deal (1999) observed in her study of teacher training programs in Kenya, many teachers lack formal university training or adequate education to pursue their jobs. From her interview with Mr. Muindi, a faculty member at Kenyatta University’s Educational Communication and Technology Department, it is apparent that there is a lack of adequate preparation of many teachers. Coupled with this, student teachers in Kenya may also be faced with their own reluctance to pursue formal academic learning and in addition, “the community around does not give much support to the school” (p. 6). This shows that lack of training is not the only factor but other cultural factors also contribute to teacher practices in Kenya. Despite this, Bialo and Solomon (1997) noted that,

A closer look at the research shows that technology is most effective when teachers receive more training in its instructional applications; when it is used to supplement a carefully thought-out program of classroom instruction; and when software being used includes an appropriate amount of learner control, helpful feedback and sound pedagogical design. (p. 70)

Thus it is important that schools keep such thoughts in mind when planning for staff development programs for in-service teachers.

Teacher attitudes and experiences have also been found to significantly impact the degree to which teachers use computers in the classroom (Hardy, 1998). As Woodrow
(1991) pointed out, the success of any educational computer technology largely depends upon the support and attitudes of the teachers involved. This is also supported by Reeves, Harmon and Jones (1993), who observed that teacher status, skills, knowledge and attitude are important factors in educational innovations. For instance, if teachers perceive computer programs as not fulfilling their own or their student’s needs, then they are likely to resist or reluctantly adopt such programs (Mukti, 2000). As far as experience is concerned, Dickey and Kherlopian (1987) reported that most teachers believe that their level of computer experience positively impacted their attitude towards computers. On the whole, teacher attitudes and experiences have been associated with successful implementation of computer usage. However, other factors such as teacher’s background and prior knowledge and concerns are equally important as depicted in Mukti’s study (2000). Her study found that:

(a) Teachers who were less knowledgeable perceived that they needed more skills and adequate knowledge in order to implement computers in their classrooms.

(b) Teachers who were knowledgeable in the use of computers showed a more positive attitude towards the use of computers in the classroom.

(c) Teachers also expressed many concerns (such as hardware and software) related to the use of computers in their classrooms.

Reeves et al. (1993) further outlined important questions that need to be addressed when considering and planning for in-service teachers to use and integrate computer use in their classrooms. These questions are: Will a massive retraining of teachers be necessary to enable them to implement computers in classrooms? What are the attitudes of the teachers? Will they promote technology or will they feel threatened by it and act to
prevent its implementation? Addressing these questions will be useful in helping teachers to embrace technology and use it appropriately rather than imposing it on them.

Pre-service Training Programs

In order to clearly understand the impact of preservice training programs on new teachers, Frattianni, Decker and Korver-Baum (1990) asked the question, Are new teachers ready to teach in today’s technologically changing world? A look at various studies will be useful in providing an answer to this question. A growing body of research indicates that as much as technology needs to be integrated into the classroom activities, it is not a focus in preservice educational experience (OTA, 1995; Bruder, 1991). While preservice teachers need to be prepared through adequate training in the use of technology and its integration into the curriculum in order for them to be able to meet the needs of students in the information age (O’Bannon, Mathew & Thomas, 1998), most preservice teachers feel they are inadequately prepared to integrate technology into the curriculum (Byrum & Cashman, 1993; Topp, 1996). Various studies have demonstrated this lack of preparation of preservice teachers yet a preservice teacher’s decision to use computers hinges on attaining a level of comfort and expertise (Gabriel & MacDonald, 1996). For instance, Faison (1996, p. 57), observed that many practicing and preservice teachers “report that they have had no systematic exposure to or integration of technology in their teacher education programs.”

A study by Fratianni et al. (1990) to determine whether student teachers were prepared technologically to meet the needs of administrators indicated that about 18% had adequate preparation in the use of technology while 81% felt that undergraduate preparation in the use of technology was inadequate. Similarly, Wilson’s (1990) study on
the preparedness of Australian and British teacher trainees to use computers in teaching, consistent with Fratianni et al’s and OTA’s, indicated that while a majority of the teachers studied expressed positive feelings about computers, 68% of them still felt that their knowledge of computer usage was inadequate. Although Fratianni and Wilson’s studies were done 12 years ago, these numbers are alarming and thus leave a lot to be desired about teacher preparation programs.

However, more recent studies such as Jerald and Orlofsky (1999) also indicate that as few as 20% of teachers reported that they felt prepared to integrate technology into the curriculum. Another study by Mowrer-Popiel, Polland & Pollard (1994) on the perceptions of preservice teachers towards technology and its use in the classroom revealed that as much as most respondents were positive towards their experiences with computer technology, preservice education students indicated that they wanted instruction in ways to integrate computer technology within the classroom and also in how to use the computer as a teaching tool. While Faison (1996) made it clear that many pre-service teachers have a “fear of the unknown” when it comes to technology integration (p. 57), Gabriel et al. (1996) agreed that a significant number of teachers entering teacher training institutions are fearful when exposed to computers and hence feel uncomfortable utilizing computers in the classroom. Despite various studies pointing to fear of using technology as a barrier to technology use for preservice teachers, Hardy (1998) indicated that many new teachers express lack of systematic exposure to or integration of technology in their teacher education programs. And as a result, their knowledge of using technology in the classroom is limited.
In order to help counteract this problem, O’Bannon et al. (1998) advised that for new teachers to be comfortable with technology, faculty at teacher preparation colleges must model technology in the classroom and integrate these tools throughout the preservice preparation period. On the other hand, Byrum and Cashman (1993) proposed that it is important for preservice teachers to have experiences that not only show how computers are used for instruction but also as learning tools in order for them to become competent technology-using teachers. But for this to occur, faculty in teacher preparation programs have to create learning environments enriched and supported by technology according to O’Bannon et al. (1998).

From these studies of preservice teachers it is apparent that teachers lack effective technology training at the preservice level and this in turn impacts the use of technology when these teachers enter the public school setting (Mowrer-Popiel et al., 1994). O’Bannon et al. (1998) observed that “preparing these teachers to meet the needs of students in the information age requires that they receive adequate training in the use of technology and its integration into the curriculum” (1998, p. 7). In support of this, various researchers have also indicated the need for more and better teacher training if teachers are to become knowledgeable and comfortable about using computers in their classrooms (Bialo & Solomon, 1997; Zehr, 1997; Boyd, 1997; CEO, 1997). Moreover, others such as Brooks and Kopp (1989) and Moursand and Bielefeldt (1999) have documented the need for incorporating existing and emerging technologies in teacher education and adequate integration of information technologies into classroom teaching practices.
A recent study by the Milken Exchange on Educational Technology and the International Society for Technology in Education (1999) pointed out several deficiencies prevalent in teacher education programs that need to be addressed for teachers to use technology. Included are:

- Approximately one-third of teacher education programs are limited by their information technology facilities.
- Most teacher training faculty do not model the use of technology in teaching.
- Most teacher training programs do not have a written, funded, regularly updated technology plan.
- Most student teachers do not routinely use technology in their field experience and do not work with teachers who can advise them on its use, although information technology is available in the K-12 classrooms where student teachers get their field experience.

Deal (1999), while focusing on issues regularly confronted by Kenyan supervisors during teacher preparation, agreed with the Milken Exchange study. However, she goes beyond to also look at the physical surroundings and the conditions of the faculty while candidly describing the situation at Kenyatta University (KU). This is one of the institutions responsible for providing training programs to pre-service teachers in Kenya. She noted that,

Lecture halls often have too few seats for the number of students which forces most of them to attend lectures on the lawns outside classrooms. Windows and furniture in classroom buildings are frequently broken;
faculty are assigned a single piece of chalk for the semester. Few departments are provided with overhead projectors let alone computer equipment. Textbooks are selected based on availability, not faculty choice. Rarely are enough copies of texts available to meet student need, forcing hundreds to share a dozen copies. Most often, students simply rely on lectures to become familiar with textbook material. As a result of the limited resources, the lecture is the primary means to convey information; heuristic learning, independent student research projects, practica, and labs are nearly impossible to implement. (p. 3)

It is clear that faculty and students in these institutions do not enjoy the facilities enjoyed by their counterparts in the United States. As pathetic as the situation may seem, it is the truth having personally experienced it both as a student (at this institution) and as a teacher. This study also indicated that pre-service teacher trainees at KU not only cope with deficient facilities (textbooks, computers) and occasional cultural opposition to education, but also face various challenges such as frequent riots and strikes when attempting to achieve effective classroom management, all of which impact their preparation to become effective teachers (Deal, 1999). Since Deal’s study was carried out about five years ago, the hope is that the situation has improved for the better.

According to Kook (1997), the teacher preparation program is one of the crucial issues that need to be addressed in order for the successful introduction of computers and communication technologies in schools to take place. He further indicated that acquiring the skills or knowledge is one thing and applying it is another. Thus the successful application of computer technologies in education largely depends on the teacher’s
competence to use existing methods and being able to adapt to future and new
developments. Because there are no definite modes of instruction to prepare prospective
educators to successfully use computers and other technologies, prospective educators
themselves need to take the initiative to learn.

According to Norum et al. (1999) individual teachers must be willing to take
risks, be models and mentors to peers and be willing to face their own fears and struggles
with technology by educating others on issues related to the integration of technology in
the classroom. In agreement, Moursand (1999) explained that when it comes to
technological innovations, teachers must take personal responsibility for their own
professional development. His approach to educational change is by working with
teachers as he believes that “if I can change a teacher, that teacher can change the
education of hundreds of students; once teachers gain insight into the capabilities of
computers they can completely reorganize the courses they teach” (1984, p. 181).

He noted that teachers are willing to learn, and eventually become learners when
they start to use computers in their classroom (Moursand, 1999), and are also provided
with the necessary staff development programs. Kumari (1997) added that these staff
development programs should be comprehensive, immersive and effective in order for
them to stimulate the social and knowledge changes that are needed to produce creative
adoption of information technologies in the schools of tomorrow. In conclusion, Kook
(1997) recommended that,

Teacher education programs should also have the ability to reach future
educators and to provide them with the amount of instruction required to
successfully apply such technologies, not only to their personal and daily
lives, but especially, and more importantly, to the essential teaching opportunity and the learning experience of those who depend upon them for the technological tools to face and deal with life in the Information Age. (p. 60)

*Barriers to the Infusion of Technology into Schools and Teacher Preparation Programs*

A national survey conducted by the Milken Exchange on Education Technology indicated that currently the biggest barrier to schools in effectively using technology are the teacher’s lack of understanding and skill in using technology and the lack of quality informed technology planning by educators (Fulton, 1998). As most notable studies including OTA (1995) and Cuban (1986) have indicated, lack of appropriate training for teachers is one of the barriers hindering the implementation of technology in schools. And as Hardy (1998) explained, despite many schools providing technology training for their inservice teachers, most such efforts have not only been few in number but are also poor in quality and uncoordinated.

This underutilization of computers and other technological resources in schools may largely be attributed to some teachers being resistant to change due to their familiarity with certain teaching styles and also the overwhelmingly busy curriculum with huge workloads (Moursand, 1984; Collis, 1988). The starting point for such teachers would be to find “the place where the learner is at” and begin from there since learning begins with the learner (Bruner, 1960) and provide them with the necessary professional development.

Despite the desire of many African countries to adopt computers in classrooms, many barriers remain, the greatest barrier being shortage of trained personnel. As
research in African countries by Hawkridge (1990) indicated, the installation of hardware is not a problem since it may be done with the help of foreign aid, but because of lack of trained staff, computers are underused. Other barriers such as lack of hardware and software, poor infrastructure are also prominent. In addition to these, one other barrier that seems to go unnoticed is the heavy duties imposed on imported hardware and software by the government. This is a stumbling block to the success of using computers as indicated by one secondary school teacher, Mrs. Abwavo, who noted that high import duties are charged on the computers because they are listed by the Kenyan government as luxury items (Odhiambo, 1999). While this may have been the case years ago, computers are not a luxury anymore, hence the need for the government to address this problem.

In their study of issues that impact the implementation of a technological innovation in small business centers in Kenya, Githeko and Johnson (1997) examined the barriers and problems encountered during implementation of e-mail technologies. From this study, the most prominent barriers that are likely to influence computer implementation in Kenyan classrooms included financial constraints, technical difficulties, and lack of trained staff. Many developing countries have formidable natural and structural barriers to instructional innovation, such as impassable roads and undependable power resources. Dooley (1995), who studied problems and issues encountered while demonstrating a project for distance learning using interactive video in the U.S and selected African countries including Kenya and Zimbabwe, identified financial, educational, cultural, technological and political issues impacting technology implementation.
Similarly, Mather (2001), who looked at technology use in international schools, more specifically schools in Nigeria, Botswana and Ethiopia, noted that

Regardless of the number of computers connected to the internet, the fact remains that because of infrastructure issues on the continent, lines can slow to a crawl or be completely unavailable at times. Even electricity can be unreliable and for this reason many schools have their own generators.

(p. 24)

According to McKenzie (1999), there is need to pay attention to these barriers and more importantly to the needs and interests of reluctant technology users. Hence he offers strategies to help reach such teachers. These include providing rewards and incentives, finding out what turns them on, offering continual support, being able to deliver a complete package, just to mention a few. Since teachers play a key role in the success or failure of computer use in schools, it is also important to explore their feelings or concerns about innovations (Kalkowski, 2000).

*Educational Technological Needs of School Administrators*

Although effective leadership is an important component for technology to be successfully integrated into the curriculum, professional development has focused less on the needs of school administrators (Schmeltzer, 2001). This is supported by Schorny, Heaton, and Washington (1999) who noted that “while the need for improved technology training for teachers has been increased in recent years, the training needs of pre-service and in-service school administrators has received minimal attention” (p. 1). Although issues that are related to instructional technology development for school administrators
have been ignored for the most part, Schorny et al. (1999) reported that administrators are still faced with the responsibilities of ensuring that technology is infused into their schools. In addition, they play a critical role in technology integration and resulting changes in classroom practices according to Norum (as cited in Rice et al., 1999, p. 227).

Therefore, “if we expect our administrators to provide the vision and understanding needed to guide the development of instructional computing programs, we must encourage them to increase their computer competence” (Beaver, 1991, p. 4). But first and foremost they must have,

- A vision and know-how to harness technology and make it part of the fabric that supports teaching and learning in schools; they must be able to understand how technology can improve instructional practices, and develop strategies for helping teachers use technology effectively in their classrooms. (Schmeltzer, 2001, p. 16)

Thus, it is important that administrators’ needs, just like those of teachers, are considered when planning for technology.

Brooks (1997) in her discussions with fellow administrators found that the majority of them were concerned with the acquisition of technology rather than what would take place after the acquisition. Educators ought to realize that bringing technology into the classroom will not cause profound educational change, neither will providing opportunities for children to work on computers prepare them for the twenty-first century (OTA, 1995) without their good leadership and professional development. This is further supported by McNabb et al. (1998) and Lemke and Coughlin (1998), who maintained that educators are the key to the effective use of technology in schools.
Apparently it is after they embrace the use of technology that they are able to initiate changes in both the classroom and school practices.

There is also need for teachers and administrators to receive sufficient training and professional development in order for them to effectively integrate technology into schools. Lack of sufficient training has been found to be one of the obstacles to effective technology planning and implementation (OTA, 1995). In order to counteract this, teachers and administrators must develop new competencies for applying technologies in support of educational reform as reflected in national, state and local curriculum guidelines. This can be accomplished through continual provision of professional development. Thus, professional development is an important aspect in any organization as it creates an environment that enables stakeholders including teachers and administrators to acquire new knowledge, grow individually and hence enhancing their job related skills and expertise according to Butler (1997).

*Professional Development for Teachers and Administrators*

Professional development may be defined as growth promoting the learning process that empowers stakeholders including teachers, administrators, staff and other school personnel to improve the educational organization (Hawley, 1996). According to Boyd (1997), staff development or professional development in technology has long been an area of neglect yet, for educational improvement to take place the focus must be on enhancing both teacher and administrator skills (Cooley, 2001). Policy makers and administrators do not always support staff development for teachers as observed by Bradshaw (2002). Despite this, various studies have cited the need for more training in this area. For instance, Gallo and Horton’s study (1994) showed that the success of a
program depended upon the amount and quality of training provided by the teachers. The study also showed that when training was successful, teachers reported feeling more excited and confident about using technology such as the internet to enhance instruction.

Since lack of training in computer use has been found to be one of the barriers to technology integration in schools (OTA, 1995; Hardy, 1998), there is need for schools/districts to carefully plan for the effective implementation of technologies in education with staff development being at the heart of the implementation. OTA (1995) observed that for teachers to use technologies well, they not only need access to these technologies but also an opportunity to discover what the technologies can do, to learn how to operate them and also to experiment with ways to best apply them in the classroom. And this calls for professional development programs.

A survey (Boyd, 1997) of various programs in the country indicated that 72% of the participants mentioned training and staff development as one of the most important components of an effective technology program. Hardy (1998) concluded that although teachers are positive about integrating computers into the curriculum, they still have concerns that need to be addressed such as lack of hardware and software, lack of time for computer activities in the classroom, ways of effectively integrating computers into the curriculum and lack of adequate training to build their confidence and computer skills. All these concerns need to be addressed by providing the necessary staff development programs.

Importance of Professional Development

Professional development is important in an educational institution in order to help improve student learning as new strategies and methods of teaching and
administration will be employed leading to enhanced student performance (Hawley, 1996). In addition, professional development creates an environment that enables stakeholders to acquire new knowledge, grow individually and hence enhance their job related skills and expertise (Butler, 1997).

Professional development is essential to school improvement and hence must be seen as an investment in lifelong learning for all educators (Hawley, 1996). Changes in school organizations and increased student performance expectations call for new forms of professional development which assist educators in developing skills and strategies to effect change in practice. Studies indicate that staff members in educational institutions, like others in the workforce, are becoming more involved in seeking and taking advantage of opportunities to improve their professional skills and increase their effectiveness (Butler, 1997). Because student achievement is contingent on the improvement of teachers’ and administrators’ skills (Cooley, 2001), it is important that adequate training and support is provided.

Thus, there is need to convince the stakeholders to adopt and implement staff development programs. Everybody should be involved in decision-making because change and input will depend upon these people’s enthusiasm and dedication and their willingness to modify familiar patterns of operation and try something new and different. For this reason, the community of leaders in K-16 ought to take the responsibility of assuring the continued professional development of its staff. Research agrees that continued training with follow up can be effective as opposed to “one shot” training sessions (Kortecamp & Croninger, 1994; Strudler, 1991; Thomson, Schmidt, & Hadjiyianni, 1995, as cited in O’Bannon, 1998, p. 8).
In order to improve the quality of education in Kenya, there is need to increase
teacher effectiveness through provision of appropriate professional development. Just as
much as educators are advocating for staff development programs for teachers and
administrators in order for technology to be effectively used in American schools,
educators in Kenya are also calling for in-service training for teachers and administrators.
For instance, George Eshiwani, a prominent writer and the longest serving vice
chancellor of a public university, has advocated for staff development for both teachers
and administrators, for he believes that the quality of education is “heavily dependent on
the quality of staff” (1993, p. 214). He argues that because the improvement of education
depends mainly on the improvement of teacher competence, it is important that there are
systematic upgrading and training programs for primary, secondary and tertiary level
教学 staff through long-term and short-term courses. In addition, there is also need
for upgrading the management skills of head teachers through in-service training
(Eshiwani, 1993).

In response to this call, some of the efforts aimed at helping teachers in Kenya
improve their technology skills have involved offering various courses at the African
Virtual University (AVU) that is based at Kenyatta University (Aduda, 2000). Although
efforts are being made in this area, more needs to be done. In their article on rethinking
staff development in Kenya, Wanzare and Ward argued that,

Teachers and head teachers need staff development opportunities in order
to grow professionally, that current in-service training programs for
teachers in Kenya are skewed to meet the needs of only a few experienced head teachers, and that these programs do not fully address the needs of the majority of Kenyan teachers. (2000, p. 265)

In order to improve the quality of education, with technology as an important aspect, rather than staff development programs in Kenya focusing only on the needs of administrators, there is need to include teachers since they are the ones involved in the implementation of technology in the classroom (Tyack & Cuban, 1995). As much as in-service training is vital to professional growth for teachers and administrators, in-service training has mostly been delivered under a variety of titles including refresher courses, upgrading courses, crash programs and induction courses (Ministry of Education, 1994; Olembo et al., 1988 as cited in Wanzare et al. 2000, p. 267). Yet as research has indicated, staff development offered in form of refresher courses or “one shot programs” is not as effective as a program that is continuous and ongoing (Speck, 1996).

In order for this kind of staff development to be ensured, Wanzare et al. (2000) recommended that various organizations that are involved in in-service training of teachers, namely the Kenya Education Staff Institute (KESI), the Kenya Institute of Education (KIE), the Teachers Advisory centers (TAC) and the Kenya National Union of Teachers (KNUT), need to review the current in-service training programs and make them more relevant to the needs of the teachers and administrators. As this may be the case, their concerns about computer literacy also need to be taken into consideration. While it is important that teachers must learn to integrate technology in their teaching, for this to take place, school principals ought to find out from teachers the kind of training and support they need, and such training should be geared to the teachers’ needs and
levels of familiarity, to school goals and to the demands of technology (Metzer & Sherman, 1997).

Summary

A review of the literature reveals the potential of using computers in schools both in the developed and the developing countries including Kenya. Technology has been identified as a powerful tool in preparing the students for the competitive job market of the 21st century. In addition, it is also an integral component of restructuring schools and classrooms. Research shows that computers have changed the way teachers teach and organize their classrooms and also what and how students learn, hence the need for teachers in K-12 classrooms to consider integrating computers in the curriculum.

However, for technology to be integrated into the curriculum and for its benefits to be realized, both inservice and preservice teachers need to be prepared to confidently use and teach with technology as a tool. Hence, this calls for effective leadership in order to plan and provide for the needed staff development programs for teachers.

In one study that demonstrated this, Cradler (Milken Exchange, 1998), who studied 12 California schools that used technology well, found that these schools had some common features that resulted in the effective use of technology. They included the following:

1. A principal or district administrator committed to the project.
2. A belief on the part of educators that technology is a way to extend the curriculum and to support education reforms.
3. The involvement of teachers in schoolwide instructional decisions.
4. Adequate allocation of time and money for staff development.
5. A history of openness to educational innovations.

6. A link between technology and district or state curricular standards.

Similarly, Sheingold and Hadley’s (1990) study of 608 computer-using teachers who have integrated computers into classroom practices demonstrated that despite the barriers likely to be encountered in using computers, if teachers are positive, are supported by the administration and are provided with sufficient training in the use of technologies, they are more likely to integrate technology. Their study found that teachers,

Devote considerable time and effort to teaching with computers in their classrooms, and are supported in their efforts; the key incentive for them in teaching with computers is their students’ using these tools effectively for their own learning; these teachers work in schools that have technology as well as experience in using technology for instruction; these teachers use the computer as a multipurpose tool; using the computer has changed their teaching; although barriers to the integration of computers have lessened for most of these teachers, over the years, significant barriers still remain. (p. vii, viii)

As depicted in the various studies, despite the barriers likely to be encountered when using technology, teachers need to be supported and provided with the necessary training. In addition, they need to be actively involved in the planning process. This is because teachers are mainly involved in the implementation of technology in the classroom yet they are rarely consulted when planning for technology. Therefore, this study aimed at investigating and understanding the perceptions and experiences of
teachers towards computer use in Kenyan classrooms. Although African leaders are advocating for computerization of the educational sector, and various African countries including Kenya are reforming their educational systems to provide room for computer use in the classrooms, an understanding of the teachers’ perceptions and experiences will be helpful in delineating strategies to better prepare teachers to use computers in the Kenyan classrooms.

Despite the efforts being made to familiarize schools with technology, little is being done as regards preparing teachers to teach with technology. Thus, it is important to understand how teachers in Kenyan classrooms are using computers in the classrooms, how they are being prepared to use computers and other forms of technology and also the kind of professional development they are getting to help them better use computers in the classrooms. By addressing these areas, this dissertation is aimed at helping to fill in the gaps in the literature regarding the use of computers in African classrooms, but more so in the Kenyan classrooms.
CHAPTER THREE
Research Methodology

This chapter describes the overall methodology that was employed in the study. It comprises a description of the rationale for the methodology, site selection, selection of participants, the researcher’s role and the data collection procedures. The chapter has been organized in six headings: 1) research design, 2) selection of site, 3) selection of subjects, 4) sources of data, 5) procedures in data collection, and 6) data analysis. The primary data collection methods that were used include in-depth individual interviews and focus group discussions. In order to triangulate this research, participant observation and document analysis were used secondarily. This is consistent with Stern’s view that the use of more than one method allows for a more holistic view of the phenomena (1994).

Research Design

This study employed qualitative inquiry as an ideal research design because it uses a naturalistic approach that seeks to illuminate, extrapolate and to better understand an occurrence or phenomenon (Hoepfl, 1997). Furthermore, it allowed the researcher to highlight the perspectives held by the teachers and administrators regarding the effectiveness of computer use for instruction and administrative tasks (Newman, 1989). Through this research design, I was able to gain insight into the experiences of teachers from their own perspectives. In addition, this research design was flexible (Bogdan & Biklan, 1982), and provided an opportunity to obtain information that was rich with details to better understand the phenomenon of computer use in Kenyan classrooms. Johnson (1995) echoed similar sentiments as he proposed that as technology educators,
there is need to engage in research that probes for deeper understanding rather than surface features, and qualitative inquiry has this characteristic.

*Conceptual Framework*

This research study was guided by phenomenological inquiry approach. Since this study aimed at understanding the perceptions and experiences of teachers from their own point of view, phenomenology was an ideal guiding framework as it is committed to understanding phenomenon from the actors’ perspective (Taylor & Bogdan, 1998; Bogdan & Biklen, 1982). In addition, phenomenological inquiry focuses on the question, “what is the structure and essence of experience of this phenomenon for these people?” (Patton, 1990) and the study sought to understand the structure and experiences of the participants.

By interviewing the participants and also participating in their everyday events, I not only had an opportunity to understand what reality is for teachers but also attempted to understand the meanings and interactions of the participants from their perspectives. Thus, I did not go into the field assuming that I knew what things meant to the people being studied (Douglas as cited in Bogdan and Biklen, 1982, p. 23). Instead, I went to the field with an open mind that was ready and willing to understand how and what meaning the participants constructed around events in their daily lives (Bogdan & Biklen, 1982).

However, after collecting data, grounded theory became the framework for the analysis. According to Bogdan and Biklen (1982, p. 22), “good researchers are aware of their theoretical base and use it to help and analyze data.” Denzin and Lincoln (1994) added that grounded theory is a way of thinking about and conceptualizing data and that the essential idea is that the theory will be developed inductively from the data. Thus, the
goal of grounded theory research is to construct theories to understand phenomena (Haig, 1995). Therefore, as I thought about and analyzed my data using Glasser and Strauss’ (1967) open coding procedures, I was able to develop categories and properties from the data and a comparison of the categories led to the emergence of various themes. It is from these themes that grounded theory, which is a theory that is grounded in the data, is reflected in the proposed ICT model. Thus, the model is a visual representation of the grounded theory.

_Selection of Research Sites_

The study was conducted in two schools, which have been given pseudonyms; Rehasi Boys and Satet Girls High schools. These schools were located in Nairobi, a metropolitan city of about three million people which is also the capital city of Kenya. Although none of the schools was situated within the city center they were both within three miles. Rehasi Boys School was located in a poor neighborhood, mostly referred to as a slum area because of the muddy surroundings and not very pleasant atmosphere. Most people living in this area are known to be low income earners. Despite the economic status of the neighborhood, Rehasi Boys School academically outperforms all other schools in the nation. This is attributed to a number of factors. The school admits top students from around the country mostly from poor families who cannot afford school fees. They also have a well established academic tradition, well trained teachers, and a highly motivated school administrator.

Satet Girls School on the other hand, was located in a rich neighborhood. The people living around this school are the upper class and hold high ranking positions such as managing directors, permanent secretaries, lawyers etc. As I walked into the school for
my interviews and participant observations I noticed parents driving very expensive cars in and out of the school. Also, for the entire period I was at the school collecting data, I hardly saw parents walking in and out on foot. It was clear that Satet Girls School was one of the highly esteemed and respectable schools in the country not only because of its status but also its academic excellence.

The two schools were not similar in size. Rehasi Boys School was bigger than Satet Girls School, and it enrolled more students and had more teachers. Both schools had students ranging from Forms 1 through 4, an equivalent of Grades 8-11 in the United States. For the past several years these two schools have developed a reputation in the country for academic excellence in the national examinations. For instance, Rehasi Boys School has been ranked in the top ten schools in the country since 1975. Records indicate that for the past ten years, it has ranked consistently as Kenya’s Best National School (Rehasi Boys School Profile, 2002). National schools in Kenya are considered to be the most highly equipped and thus the best schools. This is because they admit a particular number of the top students from each of the eight provinces in the country as set forth by the admissions board.

Statistics indicate that Rehasi Boys School takes more pupils to local universities than any other school in the country. This is depicted in the 2001 Kenyan National Certificate of Education examination results whereby all students who attained a B and above joined university: A: 31, A-: 66, B+: 49, B-: 12 and C+: 5. Unlike Rehasi Boys School, which is a national school, Satet Girls School is a provincial school. Provincial schools admit 85% of the students from within the province and 15% from outside the province. Despite this, it is also ranked among the top best schools because of its
excellent academic performance as depicted in the 2001 examination results: A-: 10, B+: 10, C+ and above: 91.

I chose to get participants from these two schools because they are public schools that have been using computers for quite some time compared to other schools. For example, Rehasi Boys School had been using computer since 1983 although it is not until 1998 that they started offering computer science as an examinable subject. Similarly, Satet Girls School had been using computers for a period of over 5 years. In addition, the schools are also located near the Ministry of Education (an agency responsible for education in Kenya) and as a result, are accessible to the best resources from the Ministry of Education.

Both schools that participated in the study have been construed as having the “best” resources in relation to other schools. Because of their consistent good performances in the national examinations they tend to be given priority by the MOE in terms of receiving the “best” resources compared to other schools. They are also in a position to get the “best” (highly qualified) teachers from the nearby teacher training colleges such as Nairobi and Kenyatta universities. “Best” in this case refers to adequate and well functioning equipment, well-trained and sufficient teachers and so forth.

Besides their good performance in national examinations these public schools had also been using computers for over 5 years and hence were considered ideal for the study. On the basis of these qualities these two schools were chosen for the study and offered interesting sites for investigation as they are representative of many other public schools in urban areas of Nairobi province in terms of how teachers and administrators use and
perceive computers in the classrooms, as well as where they are in their knowledge of computers.

Social and Cultural Context of the Schools

Rehasi Boys School

Rehasi Boys School is located in Nairobi on a 48-acre piece of land that was donated by the Government of Kenya. It was founded in 1959 as an act of charity to care for and educate poor and needy boys. This school remains a charitable institution and since its inception, 11,400 boys have gone through the school. Presently there are 1011 boys, of whom 851 are in high school, 68 are in the primary school (although it is being phased out) and 92 are in the technical institute. 70% of the students come from all around the country and they are orphaned or otherwise disadvantaged. Hence, these boys receive free care and education. The other 30% pay school fees according to their parents’ income. There are 108 teachers that are mainly provided by the Kenyan government although there are a few foreign volunteers and privately paid teachers.

Rehasi Boys School has been one of the top ranked schools in the country since 1975. The school not only believes in discipline which is firm and stresses self control but also believes in granting a great measure of trust, responsibility and freedom to the boys. As indicated by the school administrator, who has been in the school since its foundation, the success of the school is attributed to both the discipline of the students and hard work by both the teachers and the students.

Satet Girls School

Satet Girls School is also located in Nairobi, Kenya. It is situated along State House road and it was founded in 1956. Initially the school was admitting both boys and
girls, but in 1958 the boys moved to a new site. This school is one of the oldest provincial girls’ schools in the country. Like Rehasi Boys, Satet Girls School is ranked among the top schools in the country. According to the principal of the school, over the years, the school was supported by the former President of Kenya (Daniel Arap Moi). The school has a population of 543 students and a teaching staff of 38 teachers. The school has facilities such as four laboratories (two laboratories for biology, one for chemistry and one for physics), a home science block, and a computer lab. All these facilities are fully equipped according to the principal.

The philosophy of Satet Girls School is “all are winners and hence what is needed is for all to strive to excel through thick and thin” (The New Wave, 2002). The vision of the school is to equip the girl-child for responsible leadership. Its mission statements include: 1) providing quality education with emphasis on the cognitive, social physical and spiritual development of the individual girl, 2) creating and maintaining a conducive and enabling environment to help each girl realize her potential and realize the potential and enjoy the wholesome experience of a growing girl. According to the principal, it is through hard work and self-discipline that the girls will be able to “quench their thirst for “new” knowledge and hence leave the school as greater winners.” (The New Wave, 2002).
Participants

The participants in this study were high school teachers, school administrators (mainly principals) and Ministry of Education administrators. There were a total of 27 subjects. Nine of these participants were computer-using teachers, ten were non-computer-using teachers, two were school administrators, four were administrators from the Ministry of Education and two were administrators from a pre-service teacher training college. The participants included teachers who were not using computers in the classrooms because these teachers had a different perspective from those who were using computers.

Gaining Entry

First and foremost, I sought permission from the Ministry of Education Research and Training in Kenya in order to conduct research in Kenyan classrooms. An application for a license was filled out and submitted with the necessary documents. After the documents were reviewed and approved, I was given a license to take to the principals of the selected schools. The schools in turn granted me permission to conduct the research. In order to gain access to the participants, I used key informants. According to Lofland and Lofland (1984), researchers are more likely to gain access to situations if they make use of contacts that can help remove barriers to entrance, hence my choice to use key informants. I identified two key informants who played a key role in identifying and helping to recruit the participants from the schools.
My two key informants were teachers from each of the two high schools. These informants were selected with the assistance of the head teachers/principals. Having talked to the principals and explained to them the nature and research goals of my study, they felt that the heads of the computer departments (teachers in charge of computer use) in the schools would be the ideal key informants. After identifying these key informants, I then scheduled appointments at their own convenience to talk with them and inform them of my study. Through their assistance, I was able to identify and recruit some teachers who were using computers in the classrooms to participate in the individual interviews and those who were not using computers that participated in the focus group discussions.

Selection of Participants

The participants in this research study were purposefully selected. Merriam (1998) explained that purposeful sampling is “based on the assumption that the investigator wants to discover, understand, and gain insight and therefore must select a sample from which the most can be learned.” (p. 61) This method of selection was ideal because through it I was able to get a variety of opinions. According to Patton (1990), the power of purposeful sampling lies in the selection of information-rich cases for study in-depth and such cases are those from which one is able to learn a great deal about issues of central importance. He further points out that the purpose of purposeful sampling is to select information-rich cases whose study will illuminate the questions under study, hence, my choice to focus on teachers who are either using computers or not. The purposeful sampling technique was helpful in answering my research questions as it sought information-rich cases that were in turn studied in-depth. It is by studying these
cases that I was able to identify shared patterns that cut across the cases as observed by Hoefl (1999).

Additional participants were selected through snowball sampling. Through my key informants from the two schools, I was able to use snowball sampling to get participants from the schools and from the Ministry of Education. Snowball sampling is a type of purposeful sampling that identifies cases of interest from people who know people who would be willing to participate in the study and these people know other people who could be referred and the chain continues. The snowball gets bigger and bigger as one accumulates new information-rich cases (Patton, 1990). Through this method of selecting participants from the schools and the Ministry of Education I was able to get good interview subjects referred to me by my key informants and their friends. These participants also provided me with information that was rich and in-depth.

In addition to using participants from the two schools that were selected through snowball sampling, I also had a focus group discussion. The participants in this group were likewise selected through snowball sampling. I had two focus group discussions consisting of a total of ten participants. One group consisted of five non-computer-using teachers from one school and a similar group of five was from the second school. These teachers were ideal because they had certain characteristics in common (non-computer users) that related to the topic of the focus group as advocated by Krueger and Casey (2000). With the assistance of my key informants I ensured that at least some of the participants had not used computers before. This was important, as it provided a variety of additional information from a different perspective.
Data Collection

According to Bogdan & Biklan (1982), qualitative interviews may be used either as the primary strategy for data collection or in conjunction with other techniques such as observation, and document analysis. The main method of data collection was in-depth interviewing. This method of data collection was ideal because it not only provides one with information that is rich and in-depth, but is also “directed toward understanding informants’ perspectives on their lives, experiences or situations as expressed in their own words” (Bogdan & Biklen, 1998, p. 88). However, participant observation and document analysis were used as secondary methods of data collection.

Interviewing

This qualitative technique involves face-to-face interaction between the researcher (interviewer) and the participants (interviewee). Because in-depth interviews are aimed at “understanding the experience of other people and the meaning they make of that experience” (Seidman, 1998, p. 3), this was an ideal methodology to adopt. After identifying my participants, I arranged for a convenient time to meet and carry out the interviews. The interviews took two forms, individual interviews and focus group interviews. Both interviews were in-depth and were conducted in English. For the individual interviews, I employed the use of open-ended questions as they allowed participants to explore their thoughts and feelings freely without being restricted to only answering closed questions. Thus, they allowed for individual opinions by providing a wide range of responses from the participants (Patton, 1990).
The individual interviews were also semi-structured in nature. This is because semi-structured interviews offer a "middle ground" of questions between structured and unstructured ones according to Parker (2002). Because in a semi-structured interview, the questions are "more flexibly worded" or include "a mix of more and less structured questions" (Merriam, 1998, p. 74), this format allowed me to guide the interview by "a list of questions or issues to be explored" (Merriam, 1998, p. 74). This type of interview format also gave me the opportunity to react and "respond to the situation at hand, to the emerging worldview" of the participants and "to new ideas on the topic" (Merriam, 1998, p. 74). In addition, the use of semi-structured interviews allowed for more flexibility in the inquiry since the interviewer was free to probe and explore within the predetermined inquiry areas (Hoepfl, 1997).

Despite the interviews being semi-structured in nature and using open-ended questions, an interview guide or “schedule” was useful. This is a list of questions or general topics that the interviewer wanted to explore (Hoepfl, 1997). For samples of questions that were used as interview guides for teachers, school administrators and Ministry of Education administrators, refer to Appendix B. The purpose of the interview guides/protocol was to ensure a high degree of consistency on the researcher’s part. That is, it ensured that basically the same information was obtained from each person. However, the interview guide was subject to change as the situation dictated in the field or depending on the person being interviewed. The individual interviews took approximately one hour each and they were scheduled according to the participants’ convenience.
Similarly, specific questions were used for the focus group interviews. The use of these questions allowed respondents to give specific responses that helped identify some commonly acclaimed ideas about computer use in Kenyan classrooms and their ability to improve the teaching and learning process from the perspective of non-computer-users. The purpose of the focus group interviews was to enable the researcher to get a wide array of ideas from the participants. Krueger and Casey (2000) justify this by noting that use of focus group discussion is “a way to better understand how people feel about an issue, product and service” (p. 4). In addition, some people were better able to express themselves in a group than they would as individuals. The focus group interviews on the other hand were done after the individual interviews. By so doing I was able to design my questions for the focus group interviews in such a way that they focused more on those areas that were not well covered during the individual interviews. I also scheduled these interviews according to the participants’ convenient time.

In order to develop my interview protocol questions, I looked at the existing literature about computer use in Africa and other parts of the world. After reviewing the literature, I then used findings from similar research studies (such as Kiboss, 2001; Hardy, 1995; & Christensen, 1998) in addition to literature on phenomenological inquiry approach to guide me in the construction of interview questions that were used in the study.

Permission was sought from the participants to tape record both the individual and focus group interviews. Tape recording was important as it helped me to capture the words of the people being interviewed. Besides this, use of a tape recorder permitted the
researcher to be more attentive to the interviewee and hence responded to the interviewees’ needs and cues as opposed to relying on note taking. As Patton (1990) notes, “The raw data of interviews are the actual quotations spoken by interviewees” (p. 284) and since there is no substitute for such data, there was need to tape-record all the interviews. I therefore ensured that each interview was recorded as fully and fairly as possible. Although Patton advocates for the use of a tape recorder during interviews, he does not rule out taking notes. I therefore took notes where possible and this note taking primarily consisted of key phrases, lists of main points and key terms or words made by the respondent.

*Participant Observation*

Participant observation took place in classes where teachers used computers. The use of participant observations was important as it enabled the researcher to observe “in the natural field setting” and “a firsthand encounter with the phenomenon of interest” (Merriam, 1998, p. 94). I was not only able to participate in and to observe what happened in the classrooms but was also able understand the role of the teachers and the students as they interacted with one another and with the computers. According to Spradly (1980), this is a method of data collection whereby the researcher immerses him/herself in the activities taking place in a social situation. Patton (1990) further adds that the use of participant observation is important as it can lead to deeper understandings than interviews alone since it provides knowledge of the context in which events occur and may also enable the researcher to see things that participants themselves are not aware of, or that they are unwilling to discuss (Patton, 1990).
Basically, the researcher observed the activities that took place in the classroom including answering questions and offering help where needed. The purpose of participating was to make the researcher a part of the activities that took place and also closely observe and listen to how the teacher used computers and interacted with the students. During the observation, the researcher kept detailed field notes and observer’s comments as suggested by Spradley (1980) and Bogdan and Biklen (1998). Real time field notes were taken where possible and where it was not possible, reflective field notes were taken immediately after the observation. The researcher went into the field with an eye to taking detailed field notes, being able to keenly observe the activities without ignoring the details and included in this, are the cues of the participants. All of these notes were useful during the data analysis.

**Document Analysis**

In addition to using interviewing and participant observation as my main methods of data collection, document analysis was also used as a secondary method of data collection. In accordance with this, Punch (1999) notes that “in conjunction with other data, documents can be important in triangulation, where an interesting set of different methods and data types is used in a single project” (p. 190), hence my choice to include document analysis. Bogdan and Biklan (1982) categorize documents as personal documents, official documents and popular culture documents. For the purpose of this study, I analyzed official documents that included schemes of work, lesson plans and past computer science examination papers that were obtained from the teachers.
First and foremost, I developed rapport and a deep understanding with my participants and then requested for volunteers to share these documents. Although some participants did not feel free to share such information, I made my intentions known to them and also assured them that everything would be kept confidential by providing them with an oral consent form. The use of such documents from the individual schools was important, as they are rich with information that is detailed in nature and hence was very useful in the data interpretation and analysis. Although I had hoped to obtain other official documents such as guidelines and government policies regarding computer use in the classrooms, in addition to what various schools, both public and private are doing, to ensure that computers are effectively integrated into the curriculum from the Ministry of Education, this was not possible because such documents could not be released.

About the Researcher

As a researcher, one concern that I needed to address was, what do I bring to this study that will help in making it successful? Addressing this concern was important because according to Morse (1994), qualitative research is only as good as the investigator. I believe that my background as a Kenyan greatly influenced the success of my research study. Having been born and raised in Kenya not only give me an advantage in carrying out the research compared to a complete outsider, but it also enabled me to bring to the research the experience I had acquired both as a student and teacher in Kenya and in the United States. My interactions with people from other parts of the world opened up my eyes and widened my spectrum of thinking and coupled with all this, is the knowledge I had acquired in my research courses, which I believe was very useful as I conducted the
study. However, as a researcher I also had my own underlying assumptions about computers in classrooms.

My main underlying assumption was that computers are a valuable and powerful tool hence the need to use them in the classrooms. The second assumption was that although teachers and administrators in schools in Kenya are at various levels in their use of computers it is by integrating computers into the curriculum that the benefits of computers will be better realized. Having studied and stayed in the United States for a period of 6 years, I was exposed to the computers and used them extensively in my studies. This in turn helped me to acknowledge the importance and hence usefulness of using computers in the classrooms. I was not only able to learn about computers but also used them as a tool to help improve the teaching and learning processes.

Having said so, I went into the field assuming that since the two schools that participated in the study had been using computers for a period of time and were offering computer science as an examinable subject, that they too would equally be integrating computers into the curriculum but this was not the case. My third assumption was that teachers’ and administrators’ professional development was a crucial component if computers were to be used effectively to improve the teaching and learning processes.

Despite these assumptions, as a researcher employing a naturalistic qualitative inquiry and because of my familiarity with the Kenyan education system both as a student and as a teacher, I was considered a part of the community, that is, an “insider” and not an “outsider.” I therefore made my intentions known to my participants and readily shared their experiences and frustrations with them. I strongly believe that such experiences played a major role the success of the study. Lincoln and Guba (1985)
summed up the characteristics that make humans ‘instruments of choice’ in a qualitative inquiry by saying, humans are responsive to environmental cues, and are able to interact with the situation; they have the ability to collect information at multiple levels simultaneously; they are able to perceive situations holistically; they are able to process data as soon as they become available; they can provide immediate feedback and request verification of data; and they can explore atypical or unexpected responses.

Brucherhoff (1996) further supports this by pointing out that, because qualitative research is about human relationships, the researcher ought to develop a good relationship with the persons being studied. He indicates that researchers must:

- Have a genuine interest in the people studied.
- Listen well.
- Ask questions revealing insight and interest in the situation at hand.
- Show respect for others’ ideas and actions.
- Remember details about people, places and events in the field study.
- Present an attractive personality and appearance.
- Give something of lasting value to the persons or groups studied.
- Keep accurate records of everything according to acknowledged criteria.
- Be honest about intentions and perceptions relevant to the field study.
- Exercise caution.
- Do no harm.
- Admit personal and professional weaknesses as well as the limitations of the study. (p. 7)
In summary, “the qualitative researcher must become a student whose best known, personal attributes are a child-like innocence, uncommon good manners, and a facile mind determined to know and understand other people and cultures” (p. 7). These are powerful words that I carried with me to the field as I conducted my study and as a qualitative researcher.

Data Analysis

Bogdan and Biklen (1982) defined data analysis as “working with data, organizing it, breaking it into manageable units, synthesizing it, searching for patterns, discovering what is important and what is to be learned and deciding what to tell others” (p. 145). Along the same line, Marshall and Rossman (1990) indicated that data analysis may be divided into categories that include organizing the data, generating categories, themes and patterns, testing the emergent theory against the data and finally writing the report. Before adopting this method of data analysis, all the taped interviews were transcribed verbatim and the analysis included what the researcher heard, recorded and saw. The data were analyzed inductively whereby themes emerged out of the data (Patton, 1990). My data analysis involved reading all the interview transcripts to get a general sense of the data; reading the transcripts a second and a third time to generate the themes from the data segment; making a list of topics and subtopics generated and also making a comparison of the topics for overlapping meanings. Finally, I was able to classify the topics into major categories/themes that directly related to the purpose of the study. I also applied the same principles to the participant observation and document analysis. The results were then reported according to the identified themes.
**Validity and Reliability**

While internal validity refers to the extent to which the findings accurately describe reality, external validity refers to the ability to generalize findings across different settings (Hoefl, 1999). Therefore, to ensure internal validity, the researcher employed strategies such as method triangulation, member-checks, long-term observations at the research sites and peer examination as suggested by Merriam (1998). Triangulation resulted from the use of multiple data collection methods including interviews, observations, and document analysis. Member-checks occurred between the participants and myself to make sure the data and interpretations were accurate. Similarly, repeated observations and peer examination among colleagues and myself were conducted to allow for discussion on the findings as they appeared. External validity, on the other hand, was enhanced by the use of “rich, thick description” and this allowed for transferability to be made possible by the reader. According to Merriam (1998, p. 211), it is by providing the readers with a rich thick description that allows them “to determine how closely their situations match the research situation, and hence, whether findings can be transferred.”

Lincoln and Guba (1985), feel that “since there can be no validity without reliability, a demonstration of the former is sufficient to establish the latter” (p. 316). In order to enhance reliability, I adopted the use of an “inquiry audit,” as proposed by Lincoln and Guba. That is, I examined both the process and the product of the research for consistency (1985, p. 317).
Summary of Methodology

This chapter described the procedures that were used to collect data for the research study. A description of the research design was offered, a description of the research location and the participants, the methods to collect data, a brief description about the researcher, and finally how data were analyzed. The next chapter presents the findings of the study.
CHAPTER FOUR

Findings

Introduction

The purpose of this chapter is to present the findings collected from the field. Although there is evidence that computers are slowly finding their way into the Kenyan classrooms, little research has been done to capture the views of teachers and administrators as regards computer use in the classroom. This study therefore aimed at investigating the perceptions and experiences of teachers and administrators towards computer use in Kenyan classrooms. According to Quezada (1999), teachers’ and administrators’ perceptions and attitudes about technology are important contributing factors to the success of technology integration in the classroom. Hence, teachers and administrators were interviewed on a variety of topics including: how they used computers in the classroom, their views and attitudes about computer uses, how their pre-service training impacted their use of computers in the classrooms, and last but not least, teacher professional development. The following research questions guided the research:

1. How do teachers and administrators in Kenyan view the use of computers classrooms? What are the obstacles and benefits?

2. How does the pre-service training among teachers in Kenya impact their use of computers in the classrooms?

3. How do teachers in Kenya maintain their effectiveness in using computers in the classroom?
The participants in this study were computer-using teachers, non-computer-using teachers, and school and Ministry of Education administrators. The teachers were selected from two urban public schools for Forms 1-4 that had varying levels of computer technology. The schools participating in this study were given pseudonyms for anonymity. A total of 27 people participated in the study. Of these participants, nine were computer-using teachers, ten were non-computer-using teachers, two were school administrators, four were Ministry of Education administrators and two were administrators from a teacher training college.

According to Punch (1998), semi-structured interviews are those interviews whereby the researcher is more of a moderator or facilitator than an interviewer. Because the researcher employs the use of open ended questions, the participants are able to express themselves freely. The individual interviews that were conducted with the computer-using participants therefore took this format and the interview questions focused on how the participants viewed the uses of computers in the classrooms. Also, an emphasis was placed on the impact of teacher training on their uses of computers and the teacher professional development that they received to improve on their use of computers in the classrooms. On the other hand, specific questions were used for the focus group interviews that were conducted with the non-computer using teachers.

Both the individual and focus group interviews revealed a great deal about how teachers and administrators viewed computer use in Kenyan schools. In addition to the in-depth interviews, data were gathered through participant observation and document analysis. The primary findings of the study were: 1) both teachers and administrators
viewed the use of computers in Kenyan classrooms as a worthwhile experience and computers were basically used to teach computer science and computer literacy, 2) barriers that hindered the effective use of computers included shortage of hardware and software, limited time, shortage of power, and lack of quality training for teachers and administrators, 3) computer-using teachers and administrators were enthusiastic and spoke positively about computer use, whereas the non computer-users felt left behind technologically, 4) teachers and administrators reported feeling unprepared by the teacher training colleges to use computers in the classrooms, 5) teachers and administrators expressed the need to provide both practicing and pre-service teachers with professional development opportunities in technology.

*Instructional Uses of Computers in Kenyan Classrooms*

This study revealed that computers are used in Kenyan schools in a number of different ways in aiding instruction and learning. Computers were basically used in two ways: to teach computer science and to teach basic computer literacy. Since the two schools had been using computers for quite some time, the researcher anticipated finding computers being used as a tool to aid the teaching and learning process across the curriculum, however, this was not the case in either school that participated in the research. In both Satet Girls School and Rehasi Boys School, computers were mostly used to teach computer science and computer literacy. While computer science was offered to a group of higher-grade level students (mostly forms three and four), computer literacy was limited to only lower level students (forms one and two).
Use of Computers to Teach Computer Science

According to a Ministry of Education official who is in charge of computer studies at the secondary school level, and had worked in that role for 4 years, computer science is not offered to all students in Kenya. Only a few able schools that meet the standards set by the Ministry of Education (MOE) are allowed to prepare and present their students for the computer science examination. The standards to be met include availability of resources, ability to allocate adequate time to the subject and trained staff, just to mention a few. According to this administrator, although the MOE launched the computer science syllabus in 1996, it was not until 1998 that computer science was introduced as an examinable subject in the Kenyan educational system.

The same MOE administrator indicated, “There was too much pressure on the Ministry to provide a curriculum for schools to teach computer science,” and because of this pressure, schools including Rehasi Boys and Satet Girls which met the MOE requirements, were now allowed to offer computers as an examinable subject. Therefore, in both schools computer science is offered as a specialized area of study for students with particular interests in technology. Students who take this subject not only use computers to learn about computer technology, especially the programming aspect, but also to learn about basic computing that is needed to help ensure success in the global marketplace.

Although there are no exact figures to indicate the number of students who have sat for the computer examination, the MOE administrator in charge of computer studies at the secondary school level indicated that at the beginning, candidature was quite small.
However, it has been increasing rapidly. For instance, last year there were about 65 schools and a candidature of about 1300 or more students. As far as this year is concerned, the administrator indicated that more students are likely to have been registered although data had not yet been obtained from the examinations council.

Having offered the subject for the last five years, one would expect the MOE administrators, especially those in charge of computer studies, to know how many schools are using computers nationally since they oversee the use of computers in schools, but this was not the case. When asked how many public schools are using computers in the classrooms, the MOE administrator in charge of computer studies at the secondary school level responded by saying,

At the secondary level, well, it is not easy to tell because even though they were required initially to contact us before they launch the subject they don’t actually adhere to that. So we just come to know of the number when they are registering for the exams and that is why we are really interested in how many are enrolling for the exams.

Despite the fact that not all schools contact the MOE before offering computer studies in their schools, the MOE administrator further indicated that efforts are being made to ensure that schools meet the requirements laid down by the MOE. Therefore, in her role as the inspector in charge of computer studies of secondary schools in the country, she frequently inspects schools, especially those that are registered with the MOE, to ensure they meet the set standards. When asked to describe her role as a MOE administrator she replied by saying,
Besides being involved in curriculum development for the subject, I am also involved in its implementation. That is, ensuring that it is implemented according to the standards laid down by the Ministry, namely, that the facilities [hardware and software] that they require are available before they launch the subject, that adequate times are allocated to the subject and that these schools have trained teachers. So we do inspections quite often and advise schools according.

The Computer Syllabus

The MOE provides schools with the syllabus that is used to teach both computer science (CS) and computer literacy (CL). Although one syllabus is used for CS and CL, it is clear from the syllabus that during the first two years of high school, when the focus is on computer literacy, the students learn the basics of computing. The topics covered during this period include:

1. Introduction to computers:
   Basically what is covered in the introduction to computers is the definition and classification of computers, computer components; that is distinguishing between hardware and software, storage devices namely input devices, output devices and storage devices and distinguishing between system software and application software.

2. Safe care and use of computers:
   During this period, the focus is on behavior in the lab and handling of materials and equipment. Also included are the safety precautions and practices, and precautions to loss of data and programs.
3. Operating systems:
Not only is the term Operating System defined but also the functions and types of operating systems are discussed. In addition, a list of DOS commands and disk management commands such as formatting a floppy, labeling and copying disks are also discussed.

4. Computer fundamental concepts:
The content that is covered under this topic includes a definition of data processing and data, description of data processing cycle, explanation of data representation in computers, description and types of computer files, description of file organization methods and description of various processing methods.

5. Word processing:
Under this topic, word processing is defined, a description of the concepts of word processing and creation of a document are discussed. In addition, editing features of a word processor, demonstration of document formatting and demonstration of document printing are also covered.

6. Spreadsheets:
For the topic of spreadsheet fundamentals, the contents covered include definition of spreadsheet, distinction between traditional analysis sheet and electronic sheet, description of worksheet layout, creation of worksheet, using functions and formulae, applying charting and printing of spreadsheet worksheets and graphs, and sorting data. (For details on each topic, refer to the syllabus and schemes of work in Appendix C)
Looking at the topics above, the first four topics, namely introduction to computers, safe care and use of computers, operating systems and computer fundamental concepts mostly focus on computer awareness. That is, definition of terms and what the computer, as a form of technology can do or perform. However, in the last two topics, namely word processing and spreadsheet, the focus includes application. Thus, students are exposed to ways of using the computer to create and edit documents. Although from the topics above only the basic concepts of computing are covered during computer literacy, as the students advance to forms three and four, the focus shifts towards the more advanced aspects of computing, i.e. computer science. The topics covered during this period include:

1) Programming, and 2) Impact of technology on society

For Programming I, the content includes introduction and definition of programming, levels of programming languages, introduction and stages of program development and definition and types of program documentation. Contents for Programming II, which is based on the PASCAL or C programming language, include concepts of structured programming, data types, the need for structured programming and description of program types. Under impact of technology on society the content covered includes issues resulting from the use of computers, issues on rules and procedures, data, software and hardware in the computing field, future trends and career opportunities in the computing field.

According to the computer-using teachers interviewed, from these two topics students should be able to transfer and apply the knowledge acquired in programming, to
help solve real life problems. In their view, as much as they may learn isolated skills, they should be able to understand how those various skills fit together to solve problems. In agreement, the MOE administrator in charge of computer studies pointed out that,

The topics covered during CS and CL are important as they reflect the Ministry’s objectives of introducing computers in Kenyan classrooms. More so, the topics covered in CS help students not only learn to apply what they have learned to everyday life but to also appreciate the value and impact of technology on the society as a whole.

Although it is important that teachers adhere to the syllabus provided because the computer science examinations are based on the syllabus, the MOE administrator in charge of computer studies further acknowledged that while a syllabus for teaching computer science and computer literacy is available in Kenyan schools today, very few teachers have the ability to use it. According to this administrator, from her field inspections of the schools offering CS and CL, teachers did not follow the syllabus mainly because they lacked time due to heavy workload. Since some teachers taught as many as 28 lessons per week, yet the average workload for teachers especially in big schools is 12-15 lessons per week, these teachers did not have adequate time to prepare and follow the syllabus.

While the computer science syllabus is designed by the Kenya Institute of Education (KIE), which is a branch of the Ministry of Education (MOE), there are other related bodies such as the Kenya National Examinations Council (KNEC) that play an important role in its implementation. An administrator at the KIE who is involved in the
development of the computer and business studies curriculum explained the roles played by the different bodies. According to this administrator,

The MOE, KNEC and KIE are the three main bodies involved in the design and implementation of the syllabus. While KIE is concerned with preparing the syllabuses, the MOE is involved with implementation and finally KNEC are the evaluators. In addition, we also have the Jomo Kenyatta Foundation who are the publishers. They play an important role because once they are informed of what the curriculum entails and also the standards that need to be met, they come up with the required textbooks.

From this administrators’ viewpoint, all four bodies have to work hand in hand in order for the syllabus to be designed and successfully implemented in the schools. Because the Kenyan educational system places a lot of emphasis on passing examinations, it is important to understand the role of the curriculum designers. The researcher therefore asked a group of administrators at KIE what their main role was and one curriculum developer in charge of teacher education had this to say:

We are mainly curriculum developers. Although our main role is curriculum development, when it comes to setting and doing of the examinations, we have to be there first to see to it that whatever was set is within the syllabus. Because KNEC will examine what is in the syllabus, it is therefore important that teachers teach whatever was in the syllabus.

Thus, it is the hope and expectation of the curriculum designers that if teachers follow the syllabus provided students should know what is in the examinations and hence are expected to pass. Although the 8.4.4 system of education aimed at moving away from
the traditional examination-centered form of education to one that prepares the learners to be self-reliant (Tostensen & Scott, 1987), the findings of this study indicate that this is not the case. The focus is still placed on passing examinations and hence the computer examinations (Refer to Appendix D) basically reflect the topics covered in the syllabus.

Although these curriculum developers are involved in developing the syllabus required to teach computer studies, in most cases the teachers who implement it in the classroom are not involved in the decision-making process. When asked if curriculum designers work with teachers to design the syllabus, the curriculum developer in charge of teacher education was quick to say, “No, we don’t work with them, instead we work with panels.” That is, a curriculum designer in charge of a particular subject calls a panel of about 30 people from all over the country who provide them with the needed information. While panel members need to be a diverse group of people, including representatives from religious organizations and from the universities, it is surprising that teachers who implement the curriculum in the classroom are left out in some subject areas.

Though the curriculum developer in charge of computer studies agreed that they work as panels to develop the syllabus, she also indicated that in their area they do work with teachers. She explained that as a curriculum designer in charge of computer and business studies, she calls panel members who not only include representatives from each and every province but also teachers from the field and a representative from KNEC. According to this administrator, it is important to include teachers because they provide curriculum designers with useful information from the classroom level, such as, “if the course content is too difficult or if they are unable to cover it within the specified period
of time and so forth.” Such information in turn impacts the way the curriculum or syllabus is designed. Due to the existing centralized system of administration in Kenya, once the curriculum developers design the syllabus, it is reviewed and approved by an academic board before it is passed down to the teachers who then implement it in the classroom. The computer-using teachers who were interviewed individually were those teachers who taught computer science and computer literacy programs and hence used the syllabus provided by the MOE. Before understanding the views of these teachers it is important to understand the Ministry’s need to introduce computer science into Kenyan classrooms.

*The need for Computer Studies in Kenyan Classrooms*

A review of literature indicated that computers are slowly finding their way into Kenyan classrooms, and in order to understand why this is happening the researcher asked the administrators what motivated the MOE to introduce computer science into the schools. Different administrators had different views. For instance, the MOE administrator in charge of computer studies at the secondary school level had this to say:

Well, we can’t escape from computers because we are part of the society and we have to go with the trends in the society and computer is become noble. Kenya cannot be isolated even though we are just trying to struggle, you know, with our limited resources to give the students an opportunity. You know when they come out of schools, the market demands that they be computer literate, and when there is an opportunity for a job they give priority to those who are computer literate. So we want them to have an opportunity, especially those children who may not have an opportunity to
go for further studies after secondary school. But if they are computer literate they can easily get something to do with what they learned at secondary school. Therefore, what we are giving them is not detailed, it is just basic, and to some extent it allows room for post-secondary.

From these comments it is clear that the need for computers is based on the social and vocational rationales discussed in Chapter Two. That is, since students are a part of the society they should be prepared to use computers and also, the job market demands that they be computer literate. Therefore, there is need to provide computer education as it lays a foundation for their careers in computer related fields (Hawkridge, 1991).

The curriculum developers shared similar sentiments regarding the Ministry’s decision to introduce computers into Kenyan schools and hence supported the social rationale by advocating that no one should be left behind technologically. The administrator in charge of curriculum development of teacher education explained that,

The Ministry looked at the many technological changes in the world and hence felt the need not to be left behind. In addition, there were so many commercial schools in towns that were offering computer courses and the kids were going there. Although within six months they had completed the courses and obtained a diploma in a certain aspect of the computer, it was found that their job performance was below the required standards and this posed a major problem.

While this administrator felt that computers were needed for the people of Kenya to keep abreast with what was happening in other countries in the field of technology, and also to prepare students for the job market, the curriculum developer in charge of computer
studies added that the curriculum that they prepare is supposed to reflect the needs of the society. Therefore, the research and evaluation division of the MOE conducted research on what the society required and found that there was a demand for computers as a discipline. It is thus important that the Ministry meets the needs of people from the society in order to avoid commercial colleges from exploiting parents. The curriculum developer in charge of computer and business studies explained that,

Since there was no syllabus, various computer packages that were taught at the commercial colleges were taught with no standards. These packages were taught anyhow provided you “cough” some money, and so definitely we come to bridge that gap to meet the needs of the society.

The great demand for computers by the society therefore spearheaded the introduction of computers in schools. Since the commercial computer training colleges were out to make money from parents and hence charged exorbitant fees without quality training, the MOE felt the need to address this problem by introducing computers in schools as reflected in the comments above.

As regards the objectives of introducing computers to Kenyan schools, the inspector in charge of computers at the MOE explained that there are six objectives, which she read directly from a manual. She said computers were introduced with an aim of helping the learner to:

1. Appreciate computers and their components,

2. Develop basic skills in the use and care of computers and their peripheral devices,
3. Become acquainted with fundamental concepts of computing, appreciate the use of computers in different areas of application packages, appreciate programming and so forth,

4. Identify different educational opportunities available in the computing field,

5. Acquire a firm base for further education and training in the world of work, appreciate the aim of the secondary education computer science,

6. Acquire a firm foundation in computer literacy.

These objectives coincide with the objectives stated in the syllabus and the teacher’s schemes of work. An analysis of the above documents indicates that teachers have to closely adhere to what is set forth by the MOE. The main topics that are covered at the different forms (grades) are more or less similar to those provided in the syllabus (Refer to Appendix C). It is clear that the work of the teachers is not only to implement what is passed down to them from the Ministry but also adhere to what is in the syllabus provided. This is because the examinations are set based on what was covered in the syllabus, as explained by one of the curriculum developers.

Although the objectives for the introduction of computers in Kenya are in place and teachers are provided with the syllabus, adhering to them is another thing. Due to the centralized system of administration in Kenya, for these objectives to be achieved the government has a major role to play. To address this issue the researcher asked the MOE administrator in charge of computer studies at the secondary school level what the Ministry or government is doing to help schools achieve these objectives. She replied:
Mainly we have to provide the curriculum. I can say that the government has problems in going further than that. Although the Ministry is expected to provide facilities, the equipment and the teachers, we have not done that so far. Computer as a subject is still not really popular in our institutions of higher learning and even so, most of the teachers who are teaching out there have not done these courses at the university or college level. This is because it was not available at the time and even when they did, it was just for their own good because they were not very competent, and now when they go out they cannot be useful to a school where they have been employed.

Since the Ministry cannot go beyond providing the syllabus, what normally happens is that when a school decides to offer computer studies they train their own teachers. For example, they will take a mathematics or science teacher or a business oriented teacher for further training and then when they come back they teach both the subject that they were sent there to teach and computer studies. Despite this, the government is trying to introduce computers as a discipline to the teacher training colleges, although so far, KTTC is the only college that is training teachers in computer studies according to the MOE official.

It seems the government only provides the syllabus and the individual schools handle everything else. This implies that only those schools that are financially able go beyond providing hardware to ensure their teachers are trained, whereas those schools that cannot afford to do so either assign any teacher to teach the subject or resort to
employing non-teachers from commercial colleges to teach the subject as stated earlier in the literature.

Computer Resources

For the case of Rehasi Boys School, there were two computer labs. One computer lab consisted of 10 old model (486) computers while the second computer lab consisted of 20 PCs (Pentium IV, 64MB). In both labs, computers were arranged in a U-shape. Whenever students were stationed at the computers, the teacher did not have his/her own workstation. As a result, he/she was forced to use any nearby student computer for demonstration purposes. Besides the computers in the computer lab, the school also had four other computers, which were used for administrative purposes and not instructional purposes. Two computers were in the administration block building, one in the deputy principal’s office and one in the principal’s office.

None of the computers at Rehasi was connected to the Internet. Therefore, if students need to use the Internet they had to go to the nearby Technology Institute to do so. While the institute is a walking distance from the school, it was an inconvenience to both the teachers and the students due to scheduling conflicts. All the CS and CL classes were held in the computer lab. The other resources in the computer lab besides the computers were an inkjet printer and a chalkboard, which was used mostly during the theory lessons. The total number of students taking CS at this school was 140 while those taking CL has 400. These are huge numbers bearing in mind that only 20 computers were functional at this school since the computer lab with old model computers is rarely used.

Similarly, in Satet Girls School, the resources available for teaching computers included one computer lab with 12 PC computers. Of these computers, 8 were Pentium 1
(Compaq) and only four were Pentium IV (Gateway). The computers were arranged along the walls parallel to each other. On either side of the walls, there were notes on various topics or also diagrams such as one showing parts of a computer. The notes included how to open a file, how to save your work, and how to switch off a computer, among others. While such notes guided the students as they worked at the computers, others gave rules to be followed including the following:

1. Students should only come to the computer lab during their lessons.
2. All students must be time-tabled [scheduled] to browse the Internet.
3. If you are found browsing dirty sites such as pornographic sites you will be sent home.

From my classroom participant observation and interview with one computer teacher, it is very important that students adhere to the above rules. Students are thus encouraged to read them before each class begins and refer to them if they needed help such as in saving files. This was clearly demonstrated in the field notes taken on 09/19/2002 during a typical computer lesson:

This was a form one class of about 30-35 students. Because of the limited number of computers (12) in the computer lab, two students and sometimes three shared a computer. The lesson started at 9.20 a.m and it was a two period lesson that lasted for 80 minutes. The topic for the day was how to use the copy and paste commands. The teacher started off the lesson by explaining the uses of the two commands. The teacher did most of the talking while the students listened keenly and took notes. However, occasionally they asked and answered questions. The first half of the
lesson was theory and the second half was practical: the students practiced using the two commands and towards the end of the lesson they were given a group assignment. The teacher then asked them to save their work on the diskettes he had provided.

Some students were able to save their work without any difficulties. However, a group of four students who were seated close to the door did not know how to save. As I walked around the classroom, I could hear them murmuring and asking each other what needed to be done. While one student called out, “Teacher, teacher we need your help,” another student said they could refer to the notes on the wall. Before the teacher could attend to them, they quickly perused through the notes on the wall to find those on “saving files” and were able to save their work.

From this excerpt, the notes on saving files not only came in handy in guiding the students but also allowed the teacher to attend to other students with major difficulties. In my conversation with the computer teacher, after the participant observation, I inquired what motivated them to come up with notes on various topics and this teacher who had taught computer studies to Forms 1-4 for 3.5 years responded by saying,

It was because one teacher handled a large group of 40 or even more students and hence was not able to attend to all their needs. Therefore, computer teachers thought of ways to help students solve the basic problems without having to wait or call on the teacher.
In this teacher’s opinion, the easiest way out was to write notes and since the notes are hung on either side of the walls, students are able to see them and hence, they can quickly refer and make use of them.

In addition to the computers, there is an inkjet printer, a laser printer and a chalkboard at the front of the classroom. The school also has one other computer in the principal’s office that is used mostly for secretarial work. All the 12 computers in the computer lab are connected to the Internet and students are permitted to use email. Just like in Rehasi Boys School, all the CS and CL classes meet in the computer lab. However, in this school, 70 students take CS, 200 take CL and the rest (230) choose not to do the computer courses.

Use of Computers to Teach Computer Literacy

Although emphasis is placed on the teaching of computer science in Kenyan schools, to a small extent other students not taking computer science are also being exposed to computers through the computer literacy programs, as indicated by one computer studies teacher who had been teaching the subject for 8 years. He said:

Our school (Rehasi Boys School) has one philosophy and the philosophy is that all students going through the school should be computer literate. This is because we have come to realize that without being computer literate you are as good as illiterate in the information age. So we have two programs: what we call the mainstream academic program and then we have a side program that we call a co-curricular program. This co-curricular program we simply call it computer literacy in which all the
students who go through this school are taken through some basic computing, and that includes the computer history and awareness, and then we do the application packages such as Office 2000.

Although at this school they cover some useful application packages namely word processing and spreadsheet in the CL classes, they are done in such as short time (due to scheduling problems) in addition to the high student to computer ratio that the students do not grasp them very well. Therefore the focus is more on the basics of computing than on the application packages.

From my individual interviews with both the MOE administrator in charge of computer studies at the secondary school level and the curriculum developer in charge of computer and business studies, the MOE stipulates that those schools offering computer literacy make it compulsory for all students in lower level classes. They explained that it is compulsory at forms one and two, and then at form three to four computer science is voluntary. That is, at the end of each year, an examination is administered by the individual schools and then based on their performances teachers select from these students those to continue with the subject. One computer studies teacher at Rehasi Boys School agreed with these administrators but also added,

Before we select computer science students, we offer a minimum of four continuous assessment tests per term in addition to the end of year examinations. These tests cover particular topics like Spreadsheet, Word Processing projects, and PowerPoint among others.
The computer awareness program is aimed at introducing the students to computers and helping them to understand the basics of computing as seen in the topics covered in the syllabus and scheme of work (Refer to Appendix C).

Since KTTC is the only institution at the moment that is entirely devoted to preparing teachers to teach with technology according to the MOE administrator in charge of computer studies at the secondary school level, it was important to inquire if computer literacy was being offered to all teachers. Therefore, when an administrator at the KTTC who is also the head of the computer department was asked if computers are offered to all teachers he replied,

What we do, just like we actually say, every teacher going out should know something in computers. So everybody entering the gate of this college must do some level of computers. We call it introduction to computers and it is supposed to sensitize them to what it is and what it does. Although some computer courses are now taken as electives by students in other departments such as accounting and engineering to mention a few, the bottom line is that everybody entering here must do introduction to computers.

Just like at Satet Girls School and Rehasi Boys School, efforts are also being made at the KTTC to help all teachers become computer literate as indicated above.

The syllabus and schemes of work being used in schools clearly reflect that students who take the literacy classes mostly cover the basics of computing including introduction to computers, safe care and use of computers and the fundamental concepts
of computing among others. However, in some schools such as Rehasi Boys, application packages such as word processing and spreadsheet are also covered but not in detail to enable students to apply it to real life situations. In addition, these students meet less frequently than computer science students. For instance, at Rehasi Boys School, computer literacy students meet for two lessons a week, each lesson running for 40 minutes, while the computer science students meet for five lessons of 40 minutes each in a week.

Similarly, at Satet Girls school, those students taking computer science meet for five lessons a week, each lesson running for 40 minutes. However, those taking the literacy classes only meet for about an hour or less per week as expressed by one computer teacher who said, “You know, those students who are being taught the general packages imagine they have one hour a week! Is it even one hour or 40 minutes a week?” Indeed it is hard to imagine how much knowledge these students (about 40 of them in a computer lab with 20 computers) are able to acquire within one hour or less, yet teachers are blamed if the syllabus is not well covered.

Due to the inadequate time allocated and the limited number of computers available, not all the students taking computer literacy have an equal opportunity to work on the computers. As a result, much of what is covered in class is theoretical. Thus, they cover the theory part and later during their free time (mostly after school) go to the lab to practice on the computers. Because the computer literacy students do not meet as regularly as those who take computer science as a subject, they are not as enlightened, according to one computer studies teacher who said,
In our school computer science students are the only ones who are enlightened when it comes to using computers as a tool but the rest of the school is not because their lab hours of using the computer system are limited.

In light of these comments, it is important to understand the obstacles that are hindering teachers from effectively teaching using computers in the classrooms.

*Barriers to Effective Computer Use in Kenyan Classrooms*

Both teachers and administrators attributed their lack of effectively using computers to a number of obstacles. The most common included shortage of hardware and software, limited time, shortage of power and lack of quality training.

*Shortage of Hardware*

The principle barrier noted by computer-using teachers to classroom computer usage was a lack of sufficient hardware in classrooms. One computer studies teacher felt that,

> Although most teachers at this school know about computing, they know a few packages here and there but incorporating computer technology into the classroom has not been possible because of one: the number of computers we have in the schools. They are very few and the computer room …you know, we have a computer room of 15 computers and it is serving a school of 500 girls plus (laughter).

The teacher’s laughter indicated that this was not an ideal situation. Hardware was a major hindrance to computer usage in this school. Therefore, in order to address
the hardware issue some schools rely on donations to be able to use computers in their classrooms. Nevertheless, the computer-using teachers were not happy with the performance of the donated computers since most of them were slow and outdated. One computer studies teacher noted that,

Before we were relying on donations but some people tended to mainly donate what we didn’t want. We also realized that the donations we were receiving were not that adequate enough for us to prepare the students for the outside world. The people who were donating these computers were donating them because they were of no usage to them and the school realized that.

For those schools that do not rely on donations but instead use the few computers that are available, students end up sharing two or three per computer. Hence, the needs of these students are not well met. As indicated one computer teacher who had taught computer studies for only 2 months, “The computer to student ratio is a limiting factor because not all students get access to the computers. As a result, they have to do it in turn.” Another computer studies teacher at the same school further emphasized this by noting:

Sometimes they share even three or four which is not good. In fact, I have been agitating to get more hardware but with no success. Because of the scarcity of the computers themselves, what I observe is that there is a rush when students come to the computer lab. Obviously you expect that because of the number of systems we have.
Time Tabling/Scheduling

Because of the huge number of students in the schools and the limited computers, the computer-using teachers expressed time to be another obstacle. For instance, Satet Girls School has a total of 543 students and 38 teachers and all share one computer lab with only 12 computers. Likewise, Rehasi Boys School has a total of 851 students, 108 teachers with two computer labs consisting of 20 computers each. However, in this school only one computer lab is frequently used since the other one contains the old model of computers and is basically used for introductory courses such as typing/keyboarding to those students who have never seen or used computers before.

With these huge numbers of students, priority is given to the computer science students and hence they are allocated more time in order to prepare them adequately for the examinations. This means that the students taking computer literacy programs have only limited time to use the computers. It was clear that time scheduling (also called timetabling) was a major problem as indicated by one computer science teacher who said,

You realize that the timetabling for teaching computer science itself fills the normal school timetable. So the computer room is so held up with computer science lessons such that the other teachers cannot get time to come there with their classes during their lessons to teach. As a result, the other students who are not doing computer science are normally given time after school to use the computer lab. But even so, timetabling them is so difficult, like my form four class I have only 7 students therefore what about the other 193 students? Because in our school, form fours alone are
around 200 so it becomes very difficult to know who will come and at what time…

Therefore, with respect to scheduling, the MOE official said that the students taking computer science as an examinable subject were scheduled for more computer time while all others were scheduled for less time. According to the administrator in charge of computer studies, “Adequate time needs to be allocated to computer studies in forms three and four. These classes need more time because they have to be prepared for the examinations.” The fact that priority to use the computer labs was given to those students taking computer science and the computer literacy program impacted the way non-computer-using teachers felt. One teacher who taught geography expressed that,

I never find time to use the computer lab. Even if I wanted to take my students there I just cannot because the schedule does not allow. These labs are always in use by the computer science students and teachers…this makes me hate computers sometimes.

As much as this teacher would like to use computers with her students, she cannot do so because the schedule does not allow. In addition to scheduling, and related to hardware as being an obstacle to the effective use of computers in Kenyan schools, is the fact that the majority of those computers were older model computers. These computers not only lack the capacity to run current CD-ROM programs but also are slow to connect to the Internet. In fact, the teacher in charge of computer use at Satet Girls School indicated that 8 out of 12 computers in their computer lab were Pentium I. In addition, he said,

These computers are very old and very very slow especially if you have to use the Internet…like you have seen our computers, most of them are very
slow and if you try to access multimedia files they can be extremely slow
and this is very discouraging.

*Shortage of Power*

Supply of power was another common obstacle to the effective use of computers
in the classrooms. Power was a major problem as it limited the extent to which teachers
used computers. In fact, one computer studies teacher who had initially majored in
mathematics but later changed to computer science expressed concern about rural
electrification by pointing out that some schools could not use computers due to lack of
power supply in their areas. According to this teacher, “Rural schools can have
computers that they may have received as donations, but without electricity, it becomes
difficult for teachers to use them. As a result, they just sit on the shelves and accumulate
dust.”

In addition to lack of power supply, there is the issue of rationing especially in the
urban areas. This is whereby power supply is rationed during the day as opposed to the
later hours of the night. Hence, those schools or institutions requiring power during the
day end up being limited on the supply. This was clearly emphasized by a MOE
administrator in charge of computer studies at the secondary school level, who noted,

Teachers have expressed various obstacles, one of which is the supply of
power. Power is a problem right now. Although it’s been taken care of,
sometime back when there was rationing it was a real problem and there
were cases whereby students in some schools were staying in the lab well
past midnight doing their projects for their exams. So power is a problem
and many of those who would like to teach computers are also limited by
this problem. So we are advising schools to have solar energy or alternative power. It is expensive to them but they need to ensure that they have alternative sources of power.

As much as shortage of power remains a major problem to some schools, it is evident from the views of this administrator that having alternative sources of power such as generators might be the most ideal solution. This is because it would not only serve as backup in cases of shortage, but also enable schools that are not accessible to electricity to use computers in their classrooms instead of allowing them to accumulate dust.

*Lack of Training for Teachers*

Lack of quality training for the teachers was another commonly expressed obstacle. The teachers reported that their lack of expertise with using computers strongly impacted their use of computers in the classrooms. While most computer-using teachers reported some competency in using computers in different ways, having taught themselves, the non-computer-using teachers felt disadvantaged that they were not exposed to computers in any way and hence, lacked the knowledge to teach using computers in their classrooms. In a focus group discussion with the non-computer-using teachers, one music teacher expressed his disappointment at not being able to use computers by saying:

*In music, there is so much you can do with computers. For example, one can use the music notation software especially where composition is concerned, and also demonstration of examples can be done using the playback facility. You only need to have a computer and be computer literate, which most teachers are not…I feel that generally the computer-
users are more advantaged than us who do not use computers. If only we had the necessary training, we would be transforming students in very many exciting ways.

Another non-computer-using teacher who taught geography to forms 1-4 for 7 years and shared similar views added, “Most teachers including myself are ill equipped to handle computers in classrooms. I would say that we are computer illiterate and because of this, we are lagging behind in modern technology and information technology.” These views were echoed by one English literature teacher, who was not embarrassed to say,

I have never used computers before. In fact, the first time I came close to a computer was when I came to teach here…even so, I have not had an opportunity to use it, and so I guess I feel left behind technologically.

Although most non-computer-using teachers, expressed disappointment and resentment at their lack of training in the use of computers, the head of the computer studies department at Satet Girls School maintained and summed up that, “The problem we have, I think, is a problem of exposure. Most teachers are computer illiterate.” From the views of all these teachers and administrators, lack of training in using computers greatly limited their use of computers in the classrooms. In an effort to help these teachers, the head of computer studies further explained that they have been actually trying to launch a computer literacy program for the teachers. However, “every time we try to organize a class for the teachers, they rarely come in. It is always like an extra burden to them.” Thus, since teachers already have a huge workload, they cannot find time to attend such literacy classes. All in all, teachers indicated they did not regularly
incorporate computers into their classroom instruction as a result of the obstacles mentioned above.

**Benefits of Using Computers**

Despite these obstacles, overall teachers felt that computers had benefits that could not be overlooked. Some felt that computers helped to make their work easier because one is able to manage his/her work much better. This was clearly depicted when one computer studies teacher who had taught for 3 years explained, “The main advantage in teaching using computers is that managing your work becomes easier since there is not a lot of duplication.” That is, once a teacher prepares class notes, a lesson plan or scheme of work and saves it on the computer, it is easier to modify it depending on the class instead of having to prepare new ones, and by so doing they are able to save time. Along the same line, another computer studies teacher said, “Computers have helped me to save time because I am able to maintain and manage students’ records easily and also I use it for preparing lessons and setting examinations.” Another computer-using teacher who had also taught computer studies for 3 years summed up the benefits of using computers with regards to preparation on the teacher’s part, by explaining that if he wanted to model something, it is much easier to do it on the computer using a program such as desktop publishing than to do it manually.

Besides helping teachers to ease their workload, others thought that computers helped their students to become independent learners. One computer studies teacher indicated that,

*Use of computers has increased my students’ interest in the subject and helped them to learn some things on their own without my assistance.* You
realize that with the Internet, students are able to communicate through email, and even to search for information from anywhere, be it about a particular project or product, They are now able to see and experience how powerful the computer is and hence have developed a desire to learn more about computing.

Another computer studies teacher added, “Using computers has improved the students’ learning capability because they [computers and computer software] contain in-built help facilities which even guide students on their own.” Thus, students are able to learn independently without relying on the teacher at all times.

In addition to management of work and helping students to become independent learners, teachers also indicated that use of computers helped prepare students for the industrialized job market. According to one computer-using teacher who taught computer studies, biology and chemistry, “Use of computers is a step in the preparation of students for the industrialized world.” In this teacher’s view, because the current job market requires employees who are computer literate, exposing students to computers enables them to acquire basic knowledge that they require to fit in the work place. In support of these views another computer studies teacher added, “Use of computers, especially the Internet, keeps students informed of the latest technology to enable them to function well in the society.”

In spite of the scarcity of computers in Kenyan schools, computer-using teachers also reported that using computers had helped to increase students’ participation. To justify this, one computer teacher at Satet Girls School said, “By allowing my students to have hands-on experience, for example using the Internet to send and receive email or
chatting with friends on-line, has made my students to be active learners as opposed to being passive learners.” Thus, using computers gives students an opportunity to learn by doing.

Classroom Experiences with Computers

Teachers and administrators who participated in the interviews had many things to say regarding their experiences with computer use in the classrooms. While the computer-users had many positive things to say, the non computer-users on the other hand had mixed feelings.

First time Experiences of Computer-users

Teachers who used computers to teach computer science felt that their first experience of using computers was embarrassing yet challenging at the same time. In response to the question, “What was your first experience of using computers in the classroom?” one computer studies teacher reported:

In the classroom…my very first experience, I remember I came across a program that I did not know…this was from the Lotus Suite. You know, I had used Windows 95…the very first Office Suite but I had never come across Lotus Smart Suite. So I remember it was a bit of an embarrassment because some of my students knew how to use it but I did not. It had to take me time to learn but all in all, my very first lesson was very difficult for me because I was not very familiar with the package.

Another computer studies teacher who shared similar sentiments said that,

It was very challenging because most of the areas I had not even learned them at all. So it was quite challenging but what helped is that the learner
was quite ignorant and there were no computers elsewhere so they were just relying on me. That helped me because it made me actually, when I am preparing, to be a step ahead. But if it were like today, it would have been more difficult because the learners today get access to these materials and could be even ahead of you, and when the learners are ahead, you really get challenged.

As challenging as the experiences of these teachers were, some also indicated it was exciting. For example, one computer studies teacher reflected on her early experiences as a computer teacher, “It was quite exciting because of the total curiosity expressed by the students to get attached to the information technology world.” Another computer studies said, “It was very exciting because I could see that what I was able to do for many hours could be done in a few minutes. So I enjoyed the tool as it helped to ease my work.”

Although it was challenging and fascinating for some teachers, others experienced difficulty, especially at the beginning of their teaching careers. One teacher indicated that, “It was a little difficult but with time, it became part and parcel of my teaching.” In agreement, another added, “I experienced difficulty introducing students to managing their own learning.” From these remarks it is clear that some teachers were not only enthusiastic about using computers in their classrooms, but it had become an essential part of their teaching strategy.

Experiences of Non-computer-users

While the computer-using teachers felt enthusiastic and hence expressed positive feelings about their experiences in using computers, the non-computer-using teachers did
not feel the same. In a focus group interview with the non-computer-using teachers, results indicated the following:

   Researcher: How do you feel about not using computers in your classrooms?

   Teacher 1: It is a big disadvantage because most material for music is now in CD form and I feel my students don’t get access to so much.
   
   Teacher 2: I feel terrible.
   
   Teacher 3: I feel disadvantaged.
   
   Teacher 4: I feel left behind technologically.
   
   Teacher 5: I am not happy about it but there is nothing that I can do.
   
   Teacher 6: I am not aware of their likely contribution to my teaching hence, I have no feelings.
   
   Teacher 7: Computer is a powerful tool and a great idea but since I don’t use them in my classroom, I guess I feel nothing.
   
   Teacher 8: It does not affect my teaching but could be useful as a teaching aid.

   As much as the non-computer-using teachers felt disadvantaged and left behind, they also felt that lack of using computers negatively impacted their students’ learning. As one geography teacher who had taught for 15 years explained, “It denies learners access to modern innovations associated with information technology.” In addition to this, another teacher who taught mathematics and physics indicated, “Students feel disadvantaged in that the new innovations and ideas are not readily available.” It is evident from these remarks
that non-computer-using teachers see value in using computers and hence their lack of using them not only impacted their teaching, but also had a similar negative impact on their students.

Besides feeling that they lagged behind technologically, the teachers also indicated that lack of using computers prevented students from becoming independent learners as they relied more on the teachers. One teacher who taught music and Kiswahili noted that: “The fact that we don’t use computers has made the students wholly dependent on the teacher for the materials (such as notes etc.). They cannot supplement the notes given by the teacher and this in itself is a limiting factor.” In this teachers’ view, the fact that students solely rely on the information provided by the teacher and the textbook material limits their scope of research and hence their ability to be independent learners.

Changes in Teaching Strategies

Despite the above limitation, several computer-using teachers reported that they enjoyed using computers in their teaching. As mentioned earlier, computers not only help to make teacher’s work easier but also leave room for them to work with students as individuals. This is depicted when one computer studies teacher says,

I can easily deal with the slow and fast students comfortably because each student goes at almost his own pace. The slow students now have extra time later on after school to come and catch up. So what we normally do is prepare some lab sheets for the students to use and in addition, we also use tutorials for teaching some areas. This gives us one advantage in that the slow students will not delay those students who are fast. So what I have to
do is counter check through assessment to find out if they (fast students) are really getting what they are supposed to be getting and then the slower ones I can pay more attention to them.

This shows that to some extent, using computers has changed the teacher’s teaching strategies. Thus, it enables teachers to provide individualized instruction to students, which would not possible without the use of computers. Another computer-using teacher who agreed with these remarks felt that,

Although teaching is a difficult task, what you have to do is actually understand the student first and then get to know how to go along with the student. First thing you have to do is understand the student. Then you need to have the knowledge about what you are going to teach and which method you are going to use. For me, after knowing that this student is slow and this one is fast, I then ask myself which method am I going to use to best meet their needs and the answer for me is using computers.

For this teacher, the use of computers helped to fulfill the need to deal with and help students individually and by so doing, he enjoyed his teaching.

Results also indicated that some teachers enjoyed using computers because the experience gave them satisfaction and fulfillment. Asked if he enjoyed teaching with computers, one computer studies teacher replied by saying, “It is lovely, lovely, lovely, because it is a tool that is always with us and it is satisfying and there is always something to learn.” Another computer studies teacher expressed that,

Teaching with computers is one of the most enjoyable experiences I have ever had. If there is anything that makes me feel like being a teacher
(laughter) it is because of computers. They talk of giving me another subject to teach, in fact I have been shying away…I just want to concentrate on that area computer science because I really enjoy it.

In general, most computer-using teachers enjoyed the experience of teaching using computers in their classrooms. This is because computers not only gave them the hands-on experience that they needed, but also made teaching effective because of their ability to be used as a teaching aid. Thus, teachers felt that using computers helped them to be better teachers as it gave them satisfaction, fulfillment and confidence.

**Attitudes/Perceptions about Computers**

Teachers and administrators viewed the use of computers differently. As for the computer-using teachers, they felt that computer use was a worthwhile experience as it prepared students for the industrialized job market. According to one computer studies teacher who also taught biology and chemistry, use of computers is not only “a step forward in preparing students for the industrialized world,” but also “exposes them to the latest technology to enable them to blend well in the society.” Thus, there is need for students to be technologically literate for them to function properly in the information technology age, and for them to acquire this experience, there is need to expose them to various forms of technology.

On the other hand, the non-computer-users thought that this opportunity was only extended to a small group of computer science students while a majority of students were left out technologically. As one geography teacher maintained,

Although computers may be useful in some aspects, they are not being used as a teaching tool. Take the case of my class; computers are not
available for use in teaching geography. I feel that my learners have been
denied access to technology and also that computer is taught as a subject
as opposed to a new technology for all.

Several other non-computer-using teachers mostly shared similar feelings of
concern. In a focus group discussion, one teacher who taught Kiswahili and
history indicated that there is a prevailing “belief that computers are for science
teachers and therefore, fewer and fewer people remain interested in computers.”
The fact that priority is given to the teaching of computer science, and no efforts
are being made to include teachers in other subject areas has made some non-
computer-using teachers resentful towards learning and using computers.

In addition, another teacher who taught geography and had been teaching for 19
years pointed out the disparity that exists between schools with regards to use of
computers in classrooms. According to this teacher, “Computers are only available in
well-to-do schools, mostly private schools.” As a result, most public schools, especially
those in the rural areas, are disadvantaged because they don’t get to enjoy the benefits of
using computers. In order to help alleviate this problem, the same teacher felt that “the
government should address this disparity immediately because all children have a right to
information technology and all teachers must be computer literate at no cost.”

In agreement, another teacher who taught mathematics and physics added,
“Computer use in Kenya is sketchy, narrowed to a few urban schools. It should be spread
out to all urban schools and the countrywide. This is a dream rather farfetched bearing in
mind the problems of power and phone availability.” From the non-computer-using
teachers’ remarks, although they realized the usefulness of computers in classrooms, it is
by providing them with an opportunity to use them individually and with their students that they can better appreciate their benefits. In fact, one teacher who taught English summed it up by saying, “The Kenyan government should make the staff computer literate in order to enable faster diffusion of knowledge to students through the use of computers.”

School administrators just like the teachers felt that in addition to preparing students for the work place, computers were also useful for administrative purposes. For instance, the principal at Rehasi Boys School pointed out that use of computers has helped the school a lot especially on administration and teaching. Computers are mostly used to keep the school statistics, to write letters to parents, to provide all kinds of back-ups, keep files on individual students among others. In fact, “In every office in this building (administration block) you will finding one of them sitting there…I use it all day for school work.”

As far as their perceptions are concerned with regard to how they learnt to use computers, a majority of the computer-using teachers indicated in the individual interviews that it was through their own initiative that they learned to be computer literate. That is, much of what they knew was self-taught, as reflected in the following:

I learned most of the packages on my own. It was mostly self-taught. In college, we used to do very old packages, which by the time I graduated and came to the market, I found that they were no longer even being used.

Another computer studies teacher added, “The whole of my experience is about training. I basically self taught myself. I just took a course and then improved on my skill on my own.” While these teachers made efforts to learn computing on their own, others felt that
their training started as a club and advanced into a career interest. This was explained by one teacher/administrator at the teacher training college,

I started computing as a club of interest in 1987. In this college, computer was used as a service to other departments, so out of curiosity I took the interest to learn. It was less like a club where we could come for two hours a week and get the feel of it and went on like that, but it was that interest that led me to further my studies in computing.

Despite learning on their own to advance their computing skills, these teachers and administrators enjoyed teaching using computers because it gave them satisfaction and fulfillment. Thus, most computer-trained teachers and administrators attributed their success to their own initiatives and the training they got while on the job as opposed to the formal training from the teacher training colleges.

*Impact of Pre-service Training*

As noted earlier in the literature, pre-service training largely impacts the way in which teachers use computers in the classroom. A review of the literature on information technology and teacher education revealed that,

Most pre-service teachers know very little about effective use of technology in education and leaders believe there is a pressing need to increase substantially the amount and quality of instruction that teachers receive about technology. The idea may be expressed aggressively, assertively, or in more subtle forms, but virtually the universal conclusion is that teacher education, particularly pre-service, is not preparing
educators to work in a technology-enriched classroom (Willis & Mehlinger, 1996, p. 978)

As much as teacher-training colleges need to play a crucial role in preparing teachers to better use technology in the classroom, this was not the case in this study. As both teachers and administrators indicated, the teacher training colleges inadequately prepared them to teach using computers in the classrooms let alone integrating them across the curriculum. This is because most of the colleges that the computer-using teachers attended did not offer computer science as a major discipline of study. Instead, it was offered as a unit to other disciplines such as mathematics, electrical engineering and so forth.

When one computer studies teacher was asked if he got any training from the university or college he attended, he replied by saying, “We had modules or units in computer science. It was integrated in mathematics programs at the time. We are talking about early eighties… It is now that we are getting what we call information technology.” Although this was the perspective of the teacher who attended college in the eighties, it was not any different from the perspective of another computer studies teacher who attended college in the late nineties, as reflected in the remarks below:

Okay, my major was not in computer science. You know at that time, even in the university education they had not incorporated computer science so we did computer science as a unit…Although I did bachelor of education with a major in electronics and electricity, one of the units we did, I think pre-units, was computer science.
It is thus obvious from these remarks that in the eighties and early nineties teacher training colleges in Kenya did not recognize the importance of technology and hence did not offer it as a discipline on its own. A MOE administrator in charge of computer studies at the secondary school level justified this by noting,

So far, computer as a subject is still not really popular in our institutions of higher learning. Most of the teachers who are teaching out there have not done these courses at the university or college level because it was not available. And even when they did, it was just for their own good because they were not very competent and now when they go out they cannot be useful to a school where they have been employed.

However, this is beginning to change as indicated by an administrator who had been at the KTTC for 10 years. He pointed out that their teacher training institution is “the only college that is very articulate in training technical teachers in various disciplines including computer studies because they believe that technology is an indispensable tool that must be learned by all.” Unlike before when teachers at the teacher training colleges only took computer science as a unit, they can now take it as a major discipline and eventually obtain a diploma.

Because of a shortage of computer teachers in schools, some teachers who had majored in other disciplines saw the need to train in computers in order to meet the demand for computer teachers. This can be clearly seen when one computer science teacher explained that although his background was in electronic engineering, he developed an interest in computing and hence changed his career to become a computer
teacher. In agreement, another studies teacher said, “I was trained initially as an agriculture/biology major so when computing came, there was shortage of staff and I had trained myself with all interests in computing.” For this teacher, obtaining a postgraduate diploma in computer studies was the only qualification he needed to teach computer science.

Therefore, in order to enhance their skills in computing, some individual teachers opted to get their training at commercial colleges. As one computer studies teacher explained, he basically did computers at a commercial college not to become a computer teacher, but as a way to enhance his career. Since the training in computers that this teacher had obtained in college did little to impact how he taught using computers in the classroom, he decided to acquire more training through the commercial college. Similarly, those school administrators who had a shortage of computer teachers also opted to send some teachers to commercial colleges to acquire the basic skills to enable them to teach computer science. When the director of one major commercial computer training college was asked what kind of programs these teachers specialize in, he explained,

We have seen that a lot of what goes on at the school level is more like introduction, or just introducing people who are illiterate to computers. So we have a program here like certificate of computer applications, which has been excellent in terms of just the basic transfer of basic skills to those teachers, and in turn they do it for the students.

Although a majority of computer-using teachers mentioned that much of what they knew was through self-study, some teachers felt the need to reflect on their experiences in the
computer pre-unit courses that they took while in college. One computer studies teacher felt that what he learned was not only limited, but also more theoretical than practical. He revealed that,

What we were taught in university was very scanty. In fact the lecturer who was teaching us was also not well acquainted with the field. I don’t know if you also had the same experience when you were in Kenya in the university, where a lecturer comes and teaches you a lot of theory. You never see that computer. In fact, I never touched a computer when I was in college. I remember just standing behind some people who happened to know how to boot the system because those systems you had to boot with a floppy you know.

According to this teacher, he only got exposed to computers after he left college and through his own initiative. Since his experience at the university was theory-oriented as opposed to being practical, he did not feel confident enough to teach a practical subject such as computer science. Another computer studies teacher added that besides not getting the practical exposure that they needed, most of the packages covered in college were very old and less useful after they got into the market. Consequently, they had to update their skills in various ways such as taking courses in commercial colleges in order to be absorbed into the job market.

Teacher Professional Development

Various studies have pointed to the need to provide professional development to teachers and administrators in order for them to effectively use computers in the
classrooms. Teacher professional development was a theme that figured prominently in the comments made by the teachers and administrators interviewed. While most administrators and teachers, including the non-computer-using teachers, recognized the importance of in-service training in general, the computer-using teachers focused on the need for professional development to enable them to better incorporate computers in their teaching. One computer studies teacher summed up the need for training by saying, “We require in-service training very badly because we do not have it right now.”

In-service Training

Despite the need for training, in-service teachers pointed out in individual interviews that the government was not doing much to provide the required training for teachers and administrators. Most computer-using teachers therefore made their own initiatives to improve their computer skills. One computer science teacher explained that for his own professional development, he pursued courses in Microsoft Office from the Kenya College of Communication Technology (KCCT). Furthermore, because of lack of training opportunities in education, he has opted to take a Masters degree in computer science at Nairobi University.

Besides such initiatives, one computer studies teacher believed in the power of the Internet to help teachers improve on their use of computers. This computer science teacher noted, “It is through the Internet that most teachers are being encouraged to get information.” This is because one is able to find more refined information on a given topic through the Internet rather than just walking into the library to borrow a book and then spend hours reading it. This teacher thought that use of the Internet is not only a
great encouragement to computer-using teachers but also a break through to those teachers who don’t teach using computers.

Though teachers felt that not much effort was being made to prepare them to teach with computers, the administrators felt differently. While some administrators recognized the importance of teacher professional development and also understood that effective training could only take place with the availability of sufficient time and financial resources, others thought it was not as important. One school administrator felt that for one to be teaching computer science, he or she must be an expert on the use of computers and because his teachers were highly qualified in this area, no efforts were being made as regards professional development. In fact, he noted, “We don’t perceive it as a necessity and besides that, it is expensive.”

Contrary to this school administrator’s view as regards professional development, an administrator at the KTTC emphasized the efforts being made by their institution to provide teachers with professional development. He explained that,

At this institution, we have internal organized workshops and training facilities for those teachers who want. In fact, we have in-serviced all teachers here to be computer literate so that they can know how to plan and blend computers in their teaching because everybody needs them. We train 20 teachers every three months and we have done 80% so far and that has given an impact.

According to this administrator, “instead of a teacher using old notes that he made in 1986, he can now tap the latest in that area from the computer and relate it to their own course outline or modify it accordingly.” Echoing these preceding comments, another
administrator at the same institution indicated the need for the MOE to not only provide opportunities for teachers to get in-service training but also allow teachers who want to train in computers to do so. According to this administrator,

If someone (be it a teacher or school administrator) wants to participate in a refresher course for two months, they should be allowed to do so. I think that teachers and administrators should undertake training so that they keep abreast with technology. The one thing they need to know is that this [technology] is a different thing from all others and the rate at which it is changing is enormous and unless we get transformed we will be doomed.

As much as efforts are being made through the provision of internal workshops for teachers at the teacher training colleges, one computer studies teacher who had attended such a workshop had different views on the issue. He felt that,

What they do in Kenya is they have broken down computer training into so many units and sub-subjects. You go for programming, you go for Oracle, you go for this… you can even virtually go for Oracle at KCCT, go for Visual Basic in another college and at the end of the day you have an array of certificates from so many different places.

Research studies by Speck (1996), Kortecamp and Croninger (1994), Strudler (1991), Thomson, Schmidt and Hadji-yianni (1995), all cited in O’Bannon (1998) indicated that for professional development to be effective it should be ongoing and continuous. Therefore, providing one-time refresher courses or workshops for teachers may not be as fruitful as providing an integrated ongoing program. One computer studies teacher expressed his desire for integration by saying,
Rather than going for different workshops, I wish they had an integrated environment. That is, have a course that might run even for two days but at the end of it, you have gone through all the major current software in the contemporary computing world.

Thus, there is need for proper planning for staff development programs in order to meet the needs of the individual teachers. As far as reflecting on their immediate needs and how they can be met, most computer-using teachers and administrators expressed the need for training. They indicated the following as their needs:

“Make every person computer literate by the year 2003.”

“Make the staff computer literate.”

“Supply teachers with manuals to assist them in learning about upcoming technologies.”

“Introduce in-service training to teachers.”

From all these remarks, staff development seems to be recurring as the immediate prevailing need for the teachers interviewed. One computer studies teacher expressed the need for recognized academic institutions to come up with in-service courses for teachers and the fact that these courses should be current and tailored to meet the needs of the individual teachers. Thus, it is clear that teacher professional development should not only be tailored to address the needs of the teachers but also be current and ongoing.

Summary

This study aimed at investigating the perceptions and experiences of teachers and administrators towards computer use in the Kenyan classrooms. Primarily, teachers were using computers to teach computer science in both
schools, and to some extent they were also being used for computer literacy programs. Although there was no technology plan to guide the use of computers in the schools, a syllabus developed by the KIE, a branch of the MOE was being used instead. As indicated by the administrators at these two institutions, the Kenyan government does not go beyond providing the syllabus to the schools. As a result, individual teachers and administrators have taken the initiative themselves to obtain the required training to enable them to teach with computers in the classrooms. This was the most common source of training for the teachers and administrators.

As regards the perceptions and experiences of the teachers, most computer-using teachers expressed enthusiasm and positive attitudes towards the use of computers in their classes. On the other hand, the non-computer-using teachers expressed negativity about their lack of training in computers. They not only felt disadvantaged that they were unable to use computers in their subject areas but also at the fact that they had no opportunity to learn computers at the teacher training colleges. Despite the fact that the teacher training colleges are making efforts to prepare the pre-service teachers to be computer literate, there is not much being done for the in-service teachers. Thus, teacher professional development was expressed as an immediate need for both teachers and administrators. These findings will therefore be discussed and interpreted in the next chapter in relation to the literature.
CHAPTER FIVE

Discussion and Recommendations

The purpose of this chapter is to provide a discussion of the findings. In addition, recommendations for the Kenyan government and for further study are also provided. As indicated in Chapter Four, the researcher sought to investigate and to understand the perceptions and experiences of teachers and administrators towards computer use in the Kenyan classrooms. Although the findings of this study are limited to two urban schools in Kenya, it provides insights into teachers’ and administrators’ perspectives on computer use in the classrooms. Since the study was focused on understanding the perceptions and experiences of the participants from their own point of view, the theory of phenomenology played an important role in guiding the study.

The researcher found that with the establishment of a new Government, National Alliance Rainbow Coalition (Narc), in 2002, many changes are taking place in various sectors of the Kenyan economy including the education sector. Although the provision of free education to all primary school-going children is one of the most striking changes effected, there was also a clear indication that Kenya cannot afford to lag behind in the area of Information Communications and Technology (ICT). As indicated in Chapter Four, the MOE in conjunction with various schools is making efforts to harness ICT potential, hence the use of computers in classrooms. The results presented in this study revealed a complex picture of the attitudes and experiences of teachers and administrators towards computer use in Kenyan classrooms.

The participants in this study not only talked about the uses of computers for instructional purposes but also about their views and experiences of computer use in
classrooms. In both schools that participated in the study, computers were used mainly to teach computer science and computer literacy programs. Although it is apparent from their responses that both non-computer-using and computer-using teachers and administrators valued computers and considered their use in the classrooms a worthwhile experience, the computer-users also acknowledged various obstacles including lack of hardware and software, limited time, shortage of power, and quality training as hindering their effective use of computers in the classrooms.

The only major difference in the attitudes of non-computer-using teachers and the computer-using teachers was related to their positive and negative attitudes. The computer-using teachers and administrators expressed enthusiasm and held positive attitudes towards computers. These positive attitudes came from their own past experiences with computers, such as their own initiatives (self-study) to learn computing and the training they got from the teacher training colleges. To some extent, the training they got from college least impacted how they used computers in the classrooms. The non-computer-using teachers on the other hand, expressed negativity about their lack of training in using computers. Thus, they expressed disappointment at not being able to use computers in their subject areas.

The teachers and administrators also noted that lack of teacher professional development influenced how they used them in classrooms. While this was the most commonly cited need, not much effort is being done to help in-service teachers improve on their computer skills, and hence teach effectively using computers. These findings will therefore be discussed in relation to the literature and the discussion will be guided by the three main research questions:
RQ 1: How do teachers, school administrators and the Ministry of Education administrators view the use of computers in Kenyan classrooms?

The purpose of this research question was to determine how teachers and administrators not only viewed but also used computers in classrooms. The aim was to understand from the point of view of the participants the benefits of using computers in teaching and also the obstacles that they encountered. The teachers’ and administrators’ responses indicated that computer use in Kenyan classrooms is channeled in two directions: for computer science and for computer literacy training. The fundamental goal of introducing computer science was that it should prepare and equip students with the basic computer skills to be able to function effectively in the information technology age (Aduda, 2000).

Although computer use is aimed at fulfilling this goal, findings in this study indicated that not all the students are being given an equal opportunity to use computers. Most non-computer-using teachers believed that their students were at a disadvantage and hence lagged behind in technology. In addition, some pointed out the disparities that existed in schools with regards to computer use. These teachers felt that only students in well-to-do schools, especially those in urban areas had an opportunity to be exposed to technical and vocational education including computer science while those in poor rural schools did not. This finding is inconsistent with Batane’s study (2002), which showed that students in both junior and senior high schools in Botswana have access and use computers in the classrooms.
There is a growing debate in the world today on the use of ICT to support basic education. According to Kiraini (2001), parents in Kenyan schools have been calling for the use of computers at every level of education without any understanding of the teaching objectives, techniques or strategies to be followed. This pressure has in turn resulted in computers finding their way into Kenyan schools without proper planning. Despite this, the question at hand is, “Should computer skills be taught in isolation, in separate computer classes or they should be integrated into the curriculum?”

In order to resolve this dilemma, the MOE allows schools to offer computer science and computer literacy, but in both cases computer skills are taught as a discipline as opposed to being integrated in the curriculum. Although the focus at the moment is on the discipline, computers-in-the-classroom proponents argue that computing cannot be seen as an end in itself. However, when treated as a tool, which complements the more traditional yet active elements of instruction, the ability of the computer to expand education becomes more apparent according to Kirauni (2001).

Even though much of the prior research focuses on issues and implications of integrating computers into schools, integration is not yet an aspect of computing in Kenya. According to the MOE in charge of computer studies at the secondary school level,

Integration is even a higher level and I don’t think we are ready for it right now. For it to take place, even those teachers who are teaching other subjects will have to be trained. We hope that in future something of the sort will come up.
The results of this study, both from the teachers’ and administrators’ point of views showed that Kenyan schools are offering computer studies as a separate subject, but not yet integrating it in other subject areas. As seen in their description of benefits of using computers, there is no doubt that computer literacy is important in today’s technology age. Despite this, its effects would be felt much more, if computers were used as a teaching tool to aid in the learning process. By so doing all students including those majoring in other subject areas would also benefit.

Overall, both the computer-using teachers and the non-computer-using teachers thought and viewed computer use in classrooms as a worthwhile experience. Thus, they perceived computer use as a valuable tool, whether it was used for computer science or computer literacy. While the computer-using teachers had developed a certain comfort level with computers, hence positive perceptions of the value of computers are evident among their perceptions, the non-computer-users on the other hand, felt left behind technologically.

Several of the participants in this study, especially the computer-using teachers revealed how their past classroom experiences with computers influenced their ideas about computers and consequently how they used them in the classrooms. Although this study did not focus on how factors such as, educational level of teachers and administrators affected their perceptions of computers in teaching, it is consistent with a study on teacher perceptions and attitudes toward computers and computer-related teaching skills (Hoffman et al., 1997), which showed that teachers with positive knowledge of computers and computer applications have a positive attitude towards computer use in classrooms. Similarly, Woodrow (1991) acknowledges that positive
teacher attitudes are a necessary condition for effective use of information technology in the classroom.

According to Summers (1990), one of the most common reasons attributed to teachers’ negative attitudes towards technology is the lack of knowledge and experience in this area and the non-computer-using teachers in this study likewise expressed this concern. Since previous studies such as the ones mentioned above have revealed that experience using computers is positively correlated with attitudes, there is reason to start by giving in-service teachers in Kenya an opportunity to use computers as a personal/professional tool.

In spite of the fact that participants in this study indicated that their first experiences were embarrassing and challenging, given more time to use computers, their initial uneasiness was bound to disappear according to the participants. This is because those participants who felt challenged could have given up but due to their desire and liking for computing, they did not give up. While this was the case for some computer-users others felt that the entire experience was exciting and fascinating as reflected in their comments. In their description of their attitudes towards using computers in classrooms, most computer-users spoke positively about their experiences with computers.

In fact, one computer studies teacher expressed that using computers is the most enjoyable experience he had ever had. The enthusiasm dimension in this teacher’s comments explains his readiness and willingness to use computers for teaching and learning. Furthermore, it coincides with findings on perceptions of computer technology by Mowrer-Popiel et al. (1994), whose study showed that 75 out of 110 students were
positive or very positive toward their experiences with computers technology, while only 9 students were negative or very negative. Also, in this study just like in Mowrer-Popiel et al. (1994) study, computer-using respondents said that they enjoyed using a computer and even wanted to learn more about computers.

It is interesting to note that despite the fact that the non-computer-users in this study did not use computers in their classrooms, they still acknowledged its importance in improving learning and instruction. In fact, some teachers expressed disappointment and resentment because they could not use computers in their subject areas. For instance, one geography teacher expressed his desire to use computers in his class, but could not do so given that he lacked the know-how. Nevertheless, by the non-computer-users acknowledging the benefits of using computers in teaching, in addition to their strong desire to use computers in their subject areas are indications that these teachers are ready for change. Possibly given time and with the availability of resources and training, these teachers would be willing to adopt computers in their daily classroom instruction. Therefore, this calls for appropriate planning and policy making by the MOE with regards to integration of computers into the curriculum.

As far as the syllabus is concerned, data from the document analysis (as seen in the topics covered in the syllabus and schemes of work) and individual interviews with the teachers and administrators revealed that only the basics of computing are covered. Although the participants believed that the computer skills that the students acquired should enable them to fit and function well in the technology world, in addition to helping them solve real life problems, it is clear that the syllabus (Appendix C) lacks
certain valuable components of computing, such as software applications, and instead places much emphasis on the disk operating systems.

In agreement with this finding, Waihenya (2000, p. 2) says, “The curriculum not only lacks important components like the use of computers in information management, multi-media interaction and using computers as a learning tool, but it also lacks a clear link between the secondary school level and higher education.” In his view, this missing link between the secondary level and higher education is an indication that post-secondary teachers were not involved in its drafting and implementation. Despite this, the syllabus has some strong points, one being that students who go through it cannot be described as computer-illiterate according to the MOE administrators. Thus, the syllabus is able to facilitate imparting of important skills to the students according to the KIE director.

Just like Kangoro (2001) and Hawkridge (1991) pointed out in the literature reviewed, the Kenyan educational system places too much emphasis on passing examinations and this was evident in this study. As indicated by the MOE administrators, teachers are expected to follow the computer syllabus provided by the MOE even though it is hard to revise the syllabus often enough to keep it up-to-date. As reported in the findings, and seen in the syllabus, the emphasis is placed on operating systems such as DOS rather than on software applications. Nevertheless, as teachers make efforts to fulfill this expectation, there is no doubt that they are faced with obstacles.

The study revealed that there are various factors that inhibited or hindered the effective use of computers by teachers and administrators. From their points of view, these obstacles included shortage of hardware and software, limited time, shortage of
power and lack of teacher training. Although this study mainly focused on computer use in the classroom as opposed to integration of computers into the curriculum, the findings are consistent with those of OTA (1995) and Gilmore (1998). These studies showed lack of equipment, time and training to be constraints limiting the effective integration of computers into classrooms.

It is important to note that there are many issues involved for teachers and administrators in Kenya in using computers in classrooms. First and foremost, the schools offering computer studies should not only have the equipment (mainly computers and software) but should also allocate time to the subject and train the teachers, as stipulated by the MOE. The findings suggest that if schools meet these standards, then most likely some of the obstacles mentioned by the participants, such as lack of equipment and training, would be taken care of. Since the MOE only learns of the schools offering computer studies after they register for the examinations, according to the MOE official, there are chances that some schools might be offering the subject yet do not meet the MOE requirements. It would be interesting to monitor, for example, those schools that register for exams without notifying the Ministry to determine if this is the case.

Although efforts are being made to address barriers such as lack or shortage of equipment through the use of donations, too often schools receive outdated hardware. This hardware is not as useful and hence its use is likely to demoralize the users. This is supported by Gilmore (1998), who articulates that information technology experiences for faculty have been negative because too often they receive outdated hardware and software. The fact that such hardware is slow and old and can easily break down, yet spare parts are not easily available (Odedra et al. 1998), can be frustrating to the users,
especially teachers and administrators as they are unable to meet the needs of their students.

In fact, one computer studies teacher at Rehasi Boys School clearly pointed out that when their school relied on donations, some people tended mainly to donate computers that were of no use and hence were not adequate enough to prepare students for the outside world. This is because these computers were slow and could not be connected to the Internet. Despite this, various researchers acknowledge that the Internet is a powerful tool in helping educators to keep abreast with what is happening in the area of technology. For instance, Oyaro (2001) explained that through the Internet, students and teachers are able to access new information and share it with others. In addition, they are able to access the latest materials on subjects, which are only available in the Western countries. Therefore, while donation of computers seems an ideal solution to the hardware barrier, a consideration needs to be made by the recipient schools as to the usefulness of such hardware if they intend to use it for Internet purposes.

Time was another concern that was raised by the participants with relation to obstacles hindering the effective use of computers in classrooms. Not only did the participants in this study indicate that computer time was scarce, but also time tabling [scheduling] was a problem. This observation is consistent with prior research by Odhiambo (1991), who found overcrowding and lack of time as problems hindering teachers at Ofafa Jericho Secondary School in Kenya from effectively using computers. It is not surprising that time availability was an obstacle considering that teachers have a heavy load of work. Speaking about lack of time, one computer studies teacher said,
Sincerely speaking, I never find time to attend those [technology] workshops. I have such a heavy workload and believe it or not, I teach 28 lessons (each lesson running for 40 minutes) a week, so when do I find extra time to engage myself in such activities even if I wanted to?

This finding supports other studies, such as Chiero (1997); Becker (1994); Hadley & Sheingold (1993); Pelgrum & Plomp (1991) that have reported time as a major barrier in studies of computer use. While some computer-using teachers, such as the one above expressed a desire and enthusiasm about attending technology workshops to help increase their knowledge and skills about computers, it was not possible because of the heavy workload.

From my participant observations and individual interviews with the participants, coupled with my experiences as a high school teacher in a Kenyan classroom, it is not unusual for teachers to have such heavy workloads, yet they are expected by the school administrators and MOE to create time to improve on their computer knowledge. One therefore wonders how this can be possible and more so raises the question, “How effective are these teachers in their teaching,” hence the need for an investigation. I agree with the OTA (1995) report, which proposes significant changes to the rhythm of the school day including reduction in their workload to allow teachers and administrators more time to learn and experiment with new technologies. Since classes in Kenyan schools begin at 8 a.m and end at 4 p.m, a consideration to adjust this time, such that on some days the classes end early, might be an ideal way to create time for teachers.
With regard to scheduling, both the computer-using teachers and the non-computer-using teachers expressed it as a problem. Time scheduling was a problem because of the huge number of students with very limited hardware. This resulted in the students sharing computers. As reported in the study, some students even shared two or three per computer and priority is given to computer science students. This finding is inconsistent with other studies on computer use, especially in developed countries where the computer to student ratio is low.

In this study the computer science students were scheduled for more time than the computer literacy students. In both Satet Girls and Rehasi Boys Schools, CS students were scheduled to meet for five lessons a week, each lesson running for 40 minutes while those taking CL meet for about two lessons or less. In fact, one computer studies teacher at Satet Girls School expressed amazement at the limited time the CL students have by exclaiming, “Those students who are being taught the general packages imagine they have one hour a week! Is it even one hour or 40 minutes a week?” By this teacher asking the researcher to imagine how much knowledge one can acquire with such limited time, and also by not being exactly sure whether these students met for an hour or less leaves a lot to be desired about the depth of knowledge these students acquire.

The MOE administrator in charge of computer studies at the secondary school level justified the time difference by saying, “Adequate time needs to be allocated to computer studies in forms three and four. These classes need more time because they have to be prepared for the examinations.” Scheduling the CS students for more time in the computer labs makes it almost impossible for teachers, especially the non-computer-
using teachers to plan their lessons to include the use of computers. It is also not practical that the CL students are scheduled for such limited time, as they are limited on the breadth and depth of the content covered by the teachers.

As much as the computer-using teachers indicated that they enjoyed using computers despite the scheduling issue and heavy workload, the non-computer-using teachers on the other hand, felt that priority with regards to computer use was given to CS and CL students and not students in other subject areas. As reported in the findings in Chapter Four, some non-computer-using teachers showed interest and a desire to use computers but could not because of the busy schedules. Like one teacher pointed out, “the computer room is so held up with computer science lessons such that the other teachers cannot get time to come there with their classes during their lessons to teach.” Meanwhile others could not use computers in their subject areas because they did not have the basic training in computers to enable them to teach using computers in their classrooms.

In this study, unlike other studies published, teachers and administrators expressed supply of power as another obstacle to the effective use of computers. While students in urban schools benefited from using computers, those in the rural schools did not because of lack of power supply. As one teacher indicated, some rural schools may have computers that they received through donations but cannot be used because of lack of power. Consequently, these computers sit on the shelves and accumulate dust. As indicated by Oyaro (2001), it is impractical to talk about ICTs in a rural school because there are no basic facilities like electricity. Although none of the schools that participated
in the study were from the rural areas, it is most likely that students in these areas are lagging behind in technology hence the need for more research on such schools.

Of all the obstacles identified by the participants in the study, lack of training was found to be the most critical hindrance to the effective use of computers in Kenyan classrooms. Teachers and administrators, the key people who are supposed to equip the students with knowledge and skills in computers are themselves not trained in computers according to participants in this study. This finding is consistent with various studies that have pointed to lack of professional development for technology use as one of the most serious obstacles to fully integrating technology into the curriculum (Fatemi, 1999; Chiero, 1997; Office of Technology Assessment, 1995; Panel on Educational Technology, 1997).

For instance, Chiero’s study revealed that 78.1% of the respondents in the study rated “Not enough training” as either a significant or a moderate obstacle while 70.6% rated Equipment is too old as either significant or moderate. Similarly, participants in this study expressed lack of training, as the most immediate need although in this study, unlike Chiero’s study, the exact number of participants who expressed this concern is not given. Regardless of this, the participants in the study indicated that providing them with the needed training would help them to better teach with computers in classrooms.

The study reported that as much as the computer-using teachers experienced obstacles in their use of computers, they also felt that the benefits outweighed the obstacles. This is because teachers and administrators were able to manage their work much more easily and in addition, exposing students to the world of computers, especially programming and other applications, opened up many career opportunities in
IT for them (Waihenya, 2000). Furthermore, use of computers helped students to learn independently and also, it increased their classroom participation according to the participants in this study.

The benefits of using computers that emerged in this study are similar to those found by Akyurekoglu (n.d.), in his study on the perceptions of middle school teachers of using computers for teaching in which he found that computers were being used as “tools” for different purposes. In his study, just like in this study, teachers perceived computers as teaching tools based on their usage as tutorials for teaching and because of their ability to guide and help students to learn by themselves, independent of the teacher. Similarly, teachers in his study acknowledged that computers had the potential to be used as a management tool because one was able to manage his/her work and hence saving time, computers helped students to become independent learners, prepared students for the industrial world and helping students to be active participants in the learning process.

According to Chiero (1997), the rationales given by supporters of computer integration are that computers can:

1. Improve learning,
2. Prepare children to function successfully as citizens and workers in a technological society,
3. Enhance productivity and performance.

A comparison of these rationales with those provided by Hawkridge (1990) in Chapter One, and the ones given by the informants in this study revealed different but related things. The rationales above (Chiero’s) which call for improved teaching and learning, thus, the need for integration are based on pedagogic rationale whereas the
rationales given by the participants in this study are based on the social and vocational rationales. However, both are related in that in order for students not to be left behind technologically and for them to be prepared to be computer literate to be absorbed in the demanding job market, there is need for computers to be integrated into the curriculum.

While this study did not rank the participants in their explanations of benefits of using computers, another similar study on teacher’s perspectives on factors that affect computer use revealed that the highest percentage of subjects (94.4%) used computers for preparing instructional materials such as tests and worksheets (Chiero, 1997). Along the same line, computer-using teachers in this study indicated that computers helped to make their work easier as they could prepare their tests, lesson plans and schemes of work on the computers and save them. The fact that few teachers in this study used computers for such personal/professional uses, despite having to do so in the computer labs only but justifies the need to focus first on teacher utilities. Supporting these findings is the OTA (1995) report, which suggested that teachers’ computer uses might include: performing daily tasks, continuing professional growth and enhancing instruction.

An examination of the benefits of using computers in the classrooms in this study suggests that the use of computers is changing the structure of teaching and learning. Rather than only being used for assessment, management and the efficient delivery of instruction through preparation of classroom materials, use of computers seems to be changing the teacher’s teaching strategies as reported Chapter Four. In addition, the study demonstrates that while teachers acted as facilitators and guided student learning, use of computers helped students to become independent learners. Although further research is needed to confirm this, one computer teacher in this study indicated that “use of
computers has increased my students’ interest in the subject and helped them to learn some things on their own without my assistance.”

These findings are similar to those of Swan and Mitran (1993), who noted that in technology-based classrooms the student is made responsible for his or her own learning and there is greater individualization of learning. Other researchers who have looked at computer use in secondary schools and have reached similar conclusions include Batane (2002) and Hoffman et al. (1997). It should be noted that Batane’s study was done in a similar setting (two secondary schools in Botswana) as this study. However, her focus was more on the general use of computers in schools and to a small extent on the perceptions and attitudes of teachers towards technology.

These findings are important as they indicate to educators that computers are powerful tools for teaching which, if properly used can aid the teaching and learning processes. Odhiambo (1991, p. 27) recaps the benefits of computing by saying, “Computer use in Kenyan secondary school is improving the learning process, increasing the efficiency of teachers, and stimulating the interest of pupils. All in all, the first research question was well addressed by the findings of the study.

R.Q 2: How does the pre-service training among teachers in Kenya impact their use of computers in the classrooms?

While the focus of the first research question was on the views of both the teachers and the administrators, the second research question focused mainly on teachers. However, administrators, especially at the KTTC also expressed their views with regard to the pre-service training that teachers received while in college. This research question aimed at determining and understanding if and how the pre-service training that teachers
were exposed to at teacher preparation colleges impacted how they used computers in their classrooms.

According to the head of computer studies at the KTTC, although the majority of students entering their institution have little or no experience with using computers, it is their hope and belief that by the time they graduate from college and join teaching in schools, they are computer literate. As far-fetched as this vision may seem, this administrator/teacher was convinced that it would happen because efforts were being made through provision of workshops to help these teachers become computer literate.

Similar to the findings of Byrum and Cashman (1993) and Topp (1996), the respondents in this study indicated that pre-service training inadequately prepared them to teach using computers in the classrooms. As a result, this least impacted ways in which they used computers in the classrooms. Those teachers and administrators who had acquired computer skills and experiences attributed it to their personal interests (self-study) instead of associating those experiences with the teaching and learning that they underwent at the teacher training colleges.

The computer-using teachers and administrators in this study also revealed that computer education was mostly offered as a sub-unit of other disciplines such as mathematics and engineering instead of a stand-alone discipline. One computer studies teacher pointed out this out by saying, “During my university education they had not incorporated computer science and so we did computer science as a unit.” Despite their long stay in college (two years for diploma and four years for a Bachelors degree), it is my understanding that the first time these teachers came face to face with computers and how they work, is when they went to the schools to teach.
Although the findings of this study suggest the need for schools to integrate computers into the curriculum and use them as a tool instead of offering computer studies as an isolated discipline, the teacher training colleges should not be an exception. By these colleges’ [TTC’s] offering computers as a unit or sub-unit of other disciplines, suggests that these teachers were not fully exposed to the practical uses of computers in the classrooms. Instead, they only “touched” on the surface of computing. Yet Hasselbring, Barron and Risko (2000) point out that the content of technology training, that is, one that is aligned with the curriculum, influences the way teachers teach with computers in the classrooms.

Therefore, the unanswered question is, How can graduates from such training colleges properly handle the subject when they themselves were only exposed to it as a sub-unit of other disciplines? In order to address this question there is need for TTC’s likewise to model the integration of computers in the curriculum. That is, they should offer computer education to all teachers not as a separate discipline, and not as a sub-unit to other disciplines but as an independent well functioning department.

These finding suggest the existence of shortcomings at the teacher training institutions, especially with regard to the syllabus. This is consistent with the OTA (1995) report, which focused on the shortcomings of preservice education and found that today’s colleges of education and systems of teacher development do not adequately prepare teachers to use technology in their teaching. Similarly, in a study on the perceptions of preservice teachers toward technology and its use in the classroom, Mowrer-Popiel et al. (1994) found that respondents wanted to learn more about computers, with 95 out of 110
of them agreeing with the need to learn more about computers. Thus participants in both studies expressed the need for preservice education to prepare them to integrate computers within the classrooms in addition to helping students to use the computer as a teaching tool.

This need to review preservice education, as Aduda (2000) argued, maybe attributed to the fact that few teachers have been trained on the subject. Because of this, schools therefore depend on hired personnel to teach the subject yet most of them are not professionals in classroom pedagogy. According to the MOE administrator in charge of computer studies, schools that lack qualified teachers yet offer computer studies often rely on commercial colleges to train their teachers. This finding is supported by Aduda (2001), who goes further to articulate, “In some cases, schools have taken their teachers for training in computer packages and then assigned them to teach the subject.”

While this may seem to be the solution at hand, and bearing in mind that these teachers only get basic training in computer packages as indicated by one administrator at the commercial colleges, one wonders if these teachers acquire adequate knowledge to enable them to teach the subject effectively since the training that they receive at the commercial colleges is not tailored to pedagogy. From the existing literature on computer use in Kenyan classrooms and my analysis of the two schools that participated in the research, the findings in this study suggest the need for the MOE to investigate the situation at hand. That is, the role of commercial colleges in training teachers and also the need to take necessary measures to restructure the curriculum at the teacher training colleges to include providing teachers with training in computer education.
From my individual interviews with teachers regarding the preservice training that they received in college, most indicated that they were inadequately prepared to teach using computers in the classrooms. This is because these teachers attended colleges where technologies such as computers were available in few numbers, and hence were rarely used for instruction. In addition, many teachers in secondary schools lack basic computer skills because teacher training colleges (except KTTC) do not offer the subject according to Waihenya (2000). These findings are consistent with those found in a recent survey by the OTA (1995) whereby teachers felt inadequately prepared to use technology in their daily instruction despite the availability of more hardware and software in schools.

R.Q 3: How do teachers in Kenya maintain their effectiveness in using computers in the classroom?

This research question aimed at investigating and understanding professional development programs for teachers and administrators in Kenyan. According to Laffey and Musser (1998, p. 224), “Before technology will contribute significantly to improved teaching, teachers will need better training and support for teaching with technology.” While this may be the case, many of the computer-using teachers and administrators in this study admitted that they knew very little about computers because much of what they learned was through self-initiative. The participants’ concerns about technology were therefore varied.

While some, especially the more experienced computer-users, were enthusiastic and showed interest in learning more about computers and using them in the classrooms,
the less experienced computer-users and non-computer-users had fears of learning to use computers because their students were bound to know more about technology and that was challenging on their part. This, therefore, calls for a need to devise ways to help teachers feel comfortable about computers, hence professional development.

In a study by Becker (1994) that compared exemplary computer-using teachers with other teachers, he found that support for staff development was a significant factor contributing to exemplary use. Two types of activities that were of significance were instruction in using computer applications and formal training in using computers with specific subject matter. He also found that organized support (e.g., staff development and on-site computer coordinators) and acknowledgement of resource requirements were both associated with exemplary computer use. On the other hand, a study of experienced computer-using teachers found significant technology access to be critical (Hadley & Sheingold, 1993).

Findings from this study clearly showed that teachers and administrators did not value the training opportunities that were offered to improve on their computer skills. It seems that the existing staff development programs in Kenya have little or no relevance to the responsibilities teachers are expected perform, according to Shiundu and Mohammed, (n.d.) and also, these programs are not designed to meet the needs of the teachers. This is because computer training is not only fragmented, having broken it down into many units as indicated by one computer teacher, but also, it is not ongoing and continuous as suggested in the literature (OTA, 1995; NCREL, 2000, Speck, 1996).

As indicated by the teachers, especially the computer-users, the one-shot refresher courses or workshops that they are offered do not meet the needs of the teachers.
Providing them with an integrated program was preferred instead, as expressed by one teacher in the study. These findings support prior research by Ritchie and Wiburg (1994), which pointed out that a one-shot inservice training program was in not sufficient to enable teachers to implement technology in the classroom. In agreement, NCREL (2000) pointed out,

One-time-only workshops have not been effective in making teachers comfortable with using technology or adept at integrating it into their lesson plans. Instead, a well-planned, ongoing professional development program that is tied to the school's curriculum goals, designed with built-in evaluation, and sustained by adequate financial and staff support is essential if teachers are to use technology appropriately to promote learning for all students in the classroom. (p. 5)

Participants in this study also emphasized the need to provide release time for teachers to attend staff development programs. According to one computer studies teacher/administrator at the KTTC, “If someone (be it a teacher or school administrator) wants to participate in a refresher course for two months, they should be allowed to do so.” From my experiences as a teacher in a secondary school in Kenya, and from my interview with the teachers in this study, it is not always the case that if a teacher or administrator wanted to attend a workshop they would be excused from teaching. The need to provide teachers with release time is advocated by various researchers including Hadley and Sheingold (1993), and Milken (1998a). Both argue that providing teachers with release time will encourage technology implementation as the non-experienced
teachers will be able to observe their more experienced peers and by so doing, they can hopefully learn something new to implement it in their classrooms.

Computer-using teachers and administrators in this study explained that one method being used to improve their effectiveness in using computers is through the Internet. It is obvious that the Internet can provide access to a wealth of information for not only teachers and administrators but also students. In fact, one can retrieve information on almost any topic just with the click of a button (Steneger, 2001). As much as this form of training gives teachers and administrators the opportunity to learn new information and implement it in the classrooms, it has some weaknesses that were evidently expressed by the participants in this study.

First and foremost, teachers and administrators need to find time to use the Web, which is not possible in the Kenyan context because of their busy schedules. Like one participant mentioned, some teachers teach as many as 28 lessons per week, which is the maximum workload compared to a reasonable full load of 12-15 lessons per week. Therefore finding time is a problem for teachers with such a heavy workload. Besides this drawback, these teachers need motivation in order for them to attend the training, as revealed in a study by Gilmore (1997) on university faculty, which found motivation to be a drawback to learning via the Web.

A related study, Batane (2002), found lack of incentive as reason why teachers did not dedicate time to train to use technology. Likewise this study suggests use of incentives as an ideal way to motivate teachers as indicated by one computer-using teacher in this study who says, “Unless they give you some incentives you feel like you can use your time elsewhere.” Although the informants in this study did not indicate what
kind of incentives would be effective considering this approach is important because it has implications for how teachers and administrators might be helped to develop an interest in professional development programs.

Recommendations for the Kenyan Government

According to Sanya (2001), one of the Kenyan MOE’s priorities is to encourage as many schools as possible to integrate computers into their teaching and learning processes. However, from the findings of this study in Chapter Four, more efforts need to be made to support teachers and administrators to integrate computers into the curriculum and use it as a tool, instead of offering it as a separate subject. All teachers including non-computer-using teachers need to be encouraged to use computers in their subject areas. There is need for the concerns of these teachers to be addressed because as Recesso and Carll (1999) point out, putting computers into a room where all learning is teacher-directed will result in neither educational reforms nor effective integration of computer technology within that classroom.

Although findings in this study indicate that the integration of computers into Kenyan schools has not taken place, the MOE officials were optimistic that it would happen in the future as reflected in their visions. When asked what her vision of computer use in Kenyan classrooms was, the MOE administrator in charge of computer studies at the secondary school level replied,

I desire that we don’t just start using computers in classrooms and stagnate but grow and incorporate them in the curriculum. We hope that in future we shall integrate. There is a lot to be done, as we have said teachers must be trained but we hope that in future we shall have an integrated program
because it is even more enlightening and richer. I believe that it also opens up student’s minds and they get to know more about the computing world. So we hope that we shall come to that level soon.

Another administrator involved with curriculum development at KIE envisioned computers use in Kenyan classrooms by likening it to learning a second language. He said,

I would like to equate computer education to a language like English. Though it is taught as a separate discipline in our schools system in addition to being used teach other subjects like mathematics, it is not Kenya’s national language. I can see the same thing happening to computer education. Computers will be used to teach everything in education and in fact, use of computers in classrooms will be as popular as English language is in our school system.

With such enthusiasm and optimism from MOE officials I believe that such visions can be accomplished with time. However, this can only be accomplished if the MOE works hand in hand with the teachers, administrators, and subject specialists among others to review the computer syllabus with an aim of improving on its weaknesses.

The syllabus is a good place to start because the curriculum and examinations in Kenya are based on the syllabus as pointed out by the participants in this study. There is need to review the syllabus such that the topics not only focus on the disk operating systems but also include hands-on applications. For instance, instead of teaching spreadsheet and word processing as individual topics as reflected in the syllabus (Refer to
Appendix C), teachers in other subject areas should also be able to integrate these application software to enhance the teaching and learning processes in the various subject areas.

In addition to reviewing the content of the syllabus, there is also need to frequently revise and update the computer studies syllabus. From my individual interviews with the MOE administrators involved in curriculum development and also one computer studies teacher who had participated at one time in reviewing the syllabus, it is clear that the computer studies syllabus is hardly reviewed. According to these administrators and the computer studies teacher, sometimes it takes a period of 6-8 years before the syllabus is reviewed yet the field of technology is a very dynamic area that keeps changing. Based on these findings there is need for the MOE to frequently revise the syllabus in order to meet the changing needs of the people in the society. Furthermore, as a rationale to revise the syllabus there is also need to assess the needs of IT workers in business and other industrial sectors to ensure that their needs are being met.

While integrating computers into other subject areas and reviewing the syllabus are an important recommendation, this may not necessarily be the only approach to adopt. Specific strategies need to be undertaken to ensure that obstacles hindering the effective use of computers by teacher and administrators are also overcome. Based on the phenomenological inquiry approach that guided this study, understanding the phenomena of computer use in Kenyan classrooms, calls for the need to address these obstacles that were based on the participants’ experiences. As indicated by the participants in the study, there are disparities in the use of computers in the classrooms. That is, students in the rich
urban schools are at an advantage as they are exposed to computers due to the availability of equipment, power and trained staff, whereas, the students in the rural poor schools are not accorded the same privileges. There is need for these disparities to be dealt with if computers are to be successfully integrated into the schools. This was even supported by Amoako (1996) in his keynote address on ICT in Africa. He said,

> The burden of ensuring equitable access to the benefits of the Information Society in Africa lies both with governments and the private sectors. They must ensure that access to the information society and its benefits are equitable – across regions and gender, between cities and rural areas. It is therefore up to the governments to ensure that equitable access is an essential part of national information and communication plans.

Besides addressing the disparities that exist in the use of computers in the classrooms and addressing the obstacles hindering the effective use of computers, for technology to be integrated into the curriculum there is need to bring about changes at teacher training colleges. These institutions ought to devise ways and means of adequately preparing teachers to teach using computers. One way would be to review the curriculum such that it meets the needs of the individual teachers. However, this is not possible at the moment since TTCs such as KTTC are “not autonomous institutions but instead work under the umbrella of the MOE” according to one administrator at the KTTC. As a result, these institutions cannot make their own decisions as regards the curriculum as this is done by the KIE.
Although the researcher was not able to analyze the syllabus used at the TTC hence the need for further research in this area, Hasselbring et al. (2000) suggest that the focus of training at the teacher preparation institutions should be based on solid principles of instruction. That is, application principles/packages that lay a firm foundation in technology for teachers, rather than on obtaining technological skills, which is the case in Kenyan schools. By shifting the focus from mere acquisition of computer skills student teachers will be grounded in technology, especially the functional application of computer technology and hence can use it for problem solving in real life situations.

In my view, one of the ways would be to ensure that faculty at these institutions are well trained in computer use for them to be able to teach effectively using computers in the classrooms. This is because faculty, just like teachers and administrators in this study, may not be trained in the area of computers and hence are not competent enough to teach computer studies. One computer studies teacher in this study expressed doubt about the training of the lecturers by saying, “Those lecturers who taught computing at the university were not well acquainted with the field.” Hasselbring et al. (2000), on the other hand, advocated for the transformation of the culture of teacher education, such that technology is seen as changing relationships between students and teachers and between learners and knowledge.

It is evident in this study that for technology/computer use in classrooms to succeed there is need to invest in teachers through the provision of professional development. The study clearly shows that well designed and effectively implemented pre-service training programs that are needed during college years, and in-service training
that is necessary for practicing teachers and administrators are lacking in Kenya.
Therefore, in order to cater for the in-service teachers, there is need to focus first and
foremost on providing them with computers for instance in the staffrooms, for them to
use as teacher tools, thus for their own personal and professional uses. This is because
according to Hope (1998), one of the reasons why teachers are not integrating technology
is that they lack prior experience using it as a productivity tool.

Although one computer-using teacher indicated that he used computers for such
purposes by saying, “We use computers to prepare some lab sheets for the students to
use” this was not common with most of the other computer-using teachers in this study. It
is therefore important that these teachers are also provided with training on teacher utility
software such as software to make worksheets, quizzes, gradebooks etc, for them to be
able to use them more often. Since some teachers in this study indicated that they were
uncomfortable using computers in the classrooms because it was challenging, provision
of such opportunities and training will in turn help them to become more comfortable to
use computers in the classrooms. Furthermore, research (Kook, 1997, p. 58) indicates that
“the computer is a highly versatile tool that maybe used by the teacher for personal
productivity and as a way to expand classroom instructional activities.” Thus, chances are
that teachers, who become personal and professional users, are more likely to use it in
their teaching.

With regards to pre-service training, participants in this study indicated that the
training they received in college inadequately prepared them to effectively teach using
computers in the classroom. This is consistent with Bruder’s (1991) views that there is a
lack of training at the pre-service level and that technology is not a focus in the typical
pre-service experience. By Kirauni (2001) advocating for the integration of computers into the curriculum and hence using computers as a tool to aid the teaching and learning process suggests the importance to train the teachers so that the tool can assume its rightful place in the classroom. There is need for the government/MOE to review the training teachers are exposed to at the teacher training colleges and at the commercial colleges to ensure it meets the expected standards. Furthermore, there is need for the MOE to issue clear guidelines on IT training in schools and teacher training institutions.

There is a necessity to train teachers at the teacher training colleges in IT in order to equip them with the necessary skills to enable them handle the subject in the classrooms. But more importantly the government should be fully committed to giving priority to in-service training for all teachers across the country. In my opinion, this should be a priority because some of the in-service training programs that teachers and administrators engage in to improve their computer skills, in for instance, using the Internet are likely to fail to yield the desired effect. This is more so for teachers and administrators who lack the know-how or are not comfortable enough to use computers. Because of the limited knowledge in computers they [teachers and administrators] may not know the appropriate sites to visit, let alone, knowing how to obtain relevant information that will enable them to meet the needs of their students. Thus, there is need to evaluate the existing in-service training as this will be helpful in designing better programs that meet the needs of the teachers and administrators.

Last but not least, since teachers and administrators in this study indicated the lack of training as the most immediate need, besides offering professional development programs for such teachers there is need to consider the use of computer centers. That is,
computer centers need to be set up preferably in the community where teachers and administrators can go to learn computers especially during their free time. Since these centers have been known to successfully work in countries such as South Africa (Van der Wal et al. (1996), it would be a good idea for the Kenyan government to consider a similar approach. Below is a proposed ICT model that summarizes the major recommendations above.
The figure above indicates the proposed stages to be followed for computers to be successfully used in Kenyan classrooms. First and foremost there is need to integrate computers into the curriculum. Instead of teaching CS and CL as a discipline, computers should be integrated into other subject areas. An illustration from one of my participant
observations of how teachers were using computers in the classrooms will shed more light on the need for integration.

This was a form one class. There were 30-35 students in this class and since the computer lab only had 12 computers the students ended up sharing computers. The topic for the lesson was operating systems (MS-DOS). Because this was a two-lesson period (theory and practical), during the first lesson none of the students was allowed to work on the computers although they sat at the computers stations. The teacher started the lesson by reviewing what they had done in the previous lesson. He then drew a diagram showing the arrangement of files and directories in DOS on the board from one of the students’ books. The teacher did most of the writing and demonstrations on the chalkboard since they did not have an overhead projector. As the teacher taught, the students listened keenly and took notes. The teacher slowly read the notes to the students and occasionally he repeated to ensure they got each and every word.

The students were also allowed to ask and answer questions and those who answered questions correctly were praised with comments such as very good, well done etc. Although the teacher tried to encourage everyone to participate, I noticed that only particular students raised their hands to answer the questions. As i sat there watching and listening to the teacher, I heard a loud bang; it was a bell ringing to indicate time to change lessons or the beginning of another lesson. Once the first lesson ended at 10.00 a.m, the teacher informed the students that for the second half of the lesson they would be working on the computers. The students were given floppy disks and asked to open and work on the saved files.
The students explored the different commands, directories and sub-directories including the route directory, change directory and windows directory. As the students did so the teacher moved around the classroom to assist those who needed assistance. In order to ensure that the students were at the same pace the teacher occasionally asked questions such as, what do you do to move from the route directory to the windows directory? Although the students tried to answer in a chorus, the teacher told them that he preferred individual answers. Therefore, one student raised her hand and said, “You type CD windows then enter.” I realized that such questions and answers were helpful especially to those students who did not know the process to follow to solve the problem.

The students continued to work on the assignments which they saved on the floppy disks. At the end of the lesson the teacher took back the floppy disks for assessment and the students were dismissed at 10.45 a.m. Since the lesson was supposed to officially end at 11.00 a.m those students who wanted to check their emails were allowed to do so. While some of the students remained to check their emails, others left and a few others remained to ask the teacher some questions. From this description, the focus of the lesson was about operating systems and not how computers could be used to improve learning. Observation was continued the following week in the next lesson for the same class and it was not any different from the first. It is thus clear that there is need for teachers to consider using computers as tools and this can be accomplished through technology integration as illustrated below.
True Curriculum Integration

In my opinion, true curriculum integration occurs when teachers and administrators acknowledge the importance of integrating technology into the curriculum. That is, being able to use technology as a tool to enhance learning in the various subject areas. In technology integration, not only is the teacher able to use technology for personal/professional tasks such creating student handouts or keeping track of student grades but also students’ use of technology should be integral to the learning process. Thus, students too should be able to use the tools. According to ISTE (2000), teachers need to find ways to effectively use technology with students as it (technology) helps students to learn in ways not previously possible. The ISTE further points out, “Effective integration of technology is achieved when students are able to select technology tools to help them obtain information in a timely manner, analyze and synthesize the information and present it professionally” (2000, p. 6).

An Illustration of Curriculum Integration

Subject: Home science.

Class: Form 2 (Grade 9).

Tools and Resources: At least one computer with internet connection to every group of students, internet browser is required, presentation software, Inspiration software and word processors.

Topic: Eating healthy: The six food groups of the food guide pyramid.

Purpose: Demonstrate ways in which technology can be integrated into the home science curriculum.
Introduction:

Although technology can be used in powerful and meaningful ways in the teaching and learning of other curriculum areas, such as music, mathematics, science etc, the focus of this lesson is on Home science. Due to the limited number of computers available in Kenyan classrooms, one way in which computers could be used as a tool for instruction is by employing the use of cooperative groups. This is whereby students are divided into small groups and assigned a problem to work together and then present it to the whole class. This lesson has been planned by the teacher in such a way that technology will be infused into the learning activities. It is also assumed that the teacher is competent with computers and can comfortably use them to accomplish different tasks.

Procedure:

Students will be divided into small groups with each group consisting of an equal number of students. Each group will be assigned one food group to research for information and present to the whole class at the end of the lesson. In this “technology based-classroom”, the role of the teacher will be to facilitate learning and not to disseminate information as is the case in traditional-based classrooms. Thus, the teacher will move from group to group, looking over their shoulders, asking about the reasons for their choices, providing suggestions and support for their activities. All students will be expected to participate equally and actively. Before working on the computers students will brainstorm on the topic to get a clear picture of the kind of information to look for.
Technology Integration Procedure

1. Students will use various search engines on the Internet to locate information on the food guide pyramid. They will develop bookmarks of the useful sites and at this point, the teacher can introduce the concept of downloading and saving images from the Web and also explain the concept of copyright. The students should be able to save these resources for use in their multimedia presentations.

2. Using word-processing software, students will summarize notes on the assigned food group. Basically they should be able to explain the importance of the food group, list the food sources and the recommended daily servings.

3. Using the Inspiration software, students should be able to create a visual representation of the food sources of the assigned food group. This will later be imported and included in the PowerPoint presentations.

4. Once students have completed notes on the assigned food group they begin working on their PowerPoint presentations. They should be able to use the images saved from the Web to make their presentations interesting and interactive. Students will also be expected to have a bibliography slide to indicate the sites they obtained their information.

5. The teacher will then schedule for presentations to be done, ensuring that the appropriate technology is available. Assessment of the projects will be based on a grading rubric developed by the teacher and supplied to the students prior to completing their assignments. The teacher will share and discuss the rubric with the students to clarify expectations.
It is evident in this lesson that computers can be used in a variety of ways to help improve the teaching and learning process. The students would not only employ the use of the Internet to search for information on the food guide pyramid but would also use the word processing software, Inspiration software and PowerPoint to present their findings.

While integrating technology into the curriculum should be the emphasis for learners in the schools, at the TTCs emphasis should be placed on offering computer education as an independent discipline to all pre-service teachers instead of offering it as a sub-unit in other disciplines. This can be accomplished by offering basic computer literacy to all the teachers and in addition, the faculty at these institutions should be encouraged to model technology integration into the curriculum. Faculty at the TTCs should model the use of technology in such a way as “to communicate the usefulness and appropriateness of technology learning collaboration, acquisition of resources, analysis and synthesis and presentation and publication.” (ISTE, 2002, p. 22)

With regards to professional development, most of the participants reported lack of training as a factor hindering their use of computers. However, the proposed ICT model (Figure 1) above is grounded in the belief that for teachers to effectively prepare students for the information based society, they need to be comfortable with technology themselves first. It is therefore important that professional development is offered to the in-service teachers. From the proposed ICT model above, I would personally give priority to providing professional development to the in-service teachers and administrators since they are already using computers in the classrooms. According to ISTE (2002), because technology is constantly changing there is need for consistent access to professional
development in order for these teachers to maintain their skills. Concentration should not only be on the teachers but also faculty and administrators who participate in the preparation of teachers at the teacher training colleges need to be exposed to such opportunities.

As research indicates, professional development should be ongoing and be focused on the needs of the faculty members, teachers or administrators and sustained through coaching and periodic update (ISTE, 2002; Speck, 1996). A staff development model is proposed to help accomplish this need. The steps to be included in this model are: needs assessment, designing the program, implementing and evaluation (Refer to Figure 1 above). In-depth needs analysis of teachers and administrators is important before designing a staff development program according to Picciano (1998) as it provides an avenue to work with participants in identifying what they need to learn and the processes to be used. Providing them with an opportunity to voice their concerns not only increases their motivation to learn but also makes it more likely that what will be learned will be put into practice.

Once the needs are assessed the program is then designed with standards or technology guidelines in mind in order to meet the needs of both in-service and pre-service teachers. The program needs to provide for learning opportunities that relate to individual needs since no two people have similar needs. Furthermore, some learners may be older or are slow learners and hence the need to handle each participant as a unique individual with different interests and needs. As a result, a variety of activities including workshops, hands-on activities, one-on-one coaching, lectures, and demonstrations and so on that take place over extended periods of time ought to be included as shown in the
model. I believe that it is by providing teachers with the necessary training that they can be able to better integrate technology into the curriculum and by so doing bring about the needed change.

Besides considering the needs of the participant learners when designing a professional development program it is also important is to make the professional development continuous and ongoing as suggested by Speck (1996). If the participant learners are willing to participate in the training then there is a likelihood of improved student learning since they will adopt new strategies of teaching. Similarly, there will be individual professional growth especially for the participant learners. Therefore, making the training a continuous and ongoing process will help the teachers to keep abreast with changes in technology since this is a very dynamic area.

Another important consideration is provision of incentives for the participant learners. As in any learning situation, the learners need to be motivated. Because the teachers in most schools are very busy due to heavy workload, use of incentives in form of time, reduction in workload to create time to attend the professional development, reimbursement of travel expenses, acquiring credit hours and so on are ways in which the learners could be motivated.

After the program is designed and incentives provided it is then implemented. Implementation basically refers to the process of putting an innovation into place (Miles, 1983) and in this case it is when the participant learners apply what they learnt in their classrooms to effect change. After the implementation stage it is important to monitor and evaluate the program to assess how successful it is or whether more training is needed. Monitoring in this case may take different forms including use of teacher/staff interviews
and questionnaires, peer supervision or getting student feedback through interviews and questionnaires (Wood, Thompson, & Russell, 1981). This continuous monitoring is important to ensure that the participant learners are practicing new behaviors and also meeting their intended goals. Once this is done, then additional staff/professional development may be planned for those who need it.

Evaluation and feedback are critical for continuing planning activities, as planning participants need information on how well computer applications/technologies are achieving their objectives. Basically the purpose of evaluation is to determine how well or to what extent curricular goals have been met (Maurer et al., 1998). In addition, it also helps to ensure that your technology infrastructure is aligned with your school’s overall vision for improvement. It thus provides insight into your technology use and its impact on student learning. Through evaluation, one hopes to get timely feedback and consistent criticism on any revisions or adjustments that are necessary to a given technology plan (McNabb et al., 1999) in order to help meet the intended goals and objectives.

It is important that evaluation not only includes the program but also the personnel, that is if the administrators, teachers and other staff are consistent and have met the national technology standards. Besides evaluating the programs and the personnel, student assessment is also evaluated. All in all, evaluation is done in order to assess the impact of the program, personnel and assessment on student learning (Apple Computer, 2002). As a matter of fact evaluation should be an on-going process especially during the implementation process because it is during this stage that one can identify
what forms of training the staff members need to help them improve the programs and hence student learning.

Since evaluation is a valuable tool for pulling together perspectives from students, teachers, parents and staff about how well the technology serves their purposes, the five steps that may be useful in accomplishing this mission are: (i) Focusing the evaluation-What you want to evaluate and how you will evaluate, (ii) Designing the evaluation (iii) Collecting information, (iv) Analyzing and interpreting, and (v) Reporting information. (McNabb et al., 1999). Overall, evaluation should yield answers to the following questions:

1. What did we expect would change? What has actually changed?
2. Why did we introduce change? Has the change we’ve experienced met the needs we identified?
3. How has change affected the people involved? How do they view these changes?

Once these questions have been answered, the outcomes of the evaluation and the necessary modifications that need to be made to the original plan and why the modifications are necessary need to be communicated and shared with the various constituencies involved. Based on the findings of this study, I believe that it is by following the proposed ICT model above, that teachers and administrators in Kenyan schools will be able to better use computers in the classrooms.

*Implications for Future Research*

Although computers are finding their ways into classrooms and transforming the teaching and learning processes, capturing the views of the teachers and administrators
with regards to computer use has not always been a focus of studies. This study aimed at understanding the perceptions and experiences of teachers and administrators from their own point of view with an intent to contribute data to assist in the design of teacher preparation programs and staff development programs in Kenya. While the pre-service educators who will soon be teachers are not being exposed to computers and getting the necessary training to enable them to teach comfortably with computers, the in-service teachers and administrators who are already practicing lack the necessary professional development to help them maintain or improve on their computer skills.

These findings have implications both for the way we design teacher-training programs to prepare teachers to teach using computers and for staff development programs to help teachers maintain their effectiveness in teaching using computers. Therefore, educational institutions in Kenya must take active measures to ensure that the necessary training is provided to both in-service and pre-service teachers. Because of the small sample size in this study (two public schools in an urban area in Nairobi), the generalizability of the results is limited. Therefore, additional studies on the views and attitudes of teachers and administrators in other schools, including those in rural areas, should be done in order to determine if the findings suggested in this study are consistent.

Further research also needs to be done on the perceptions and attitudes of the students with regard to computer use in Kenyan classrooms as this would shed more light on how the students perceive and use computers in classrooms. It is also important to do more research on the pre-service teachers and faculty at the TTC in order to get their perspective of computer use in classrooms. Also, more research needs to be done on the factors that affect the perceptions and experiences of teachers and administrators towards
computer use in Kenyan classrooms. Understanding these factors and being able to deal with them will in turn impact the integration of computers into the classrooms by the teachers.

Conclusions

This study has contributed to understanding the perceptions and experiences of teachers and administrators towards computer use in Kenyan classrooms. It is apparent in the study that teachers’ and administrators’ perceptions and experiences are important contributing factors to the successful and effective use of computers in classrooms. Using phenomenological methods, several themes about computer uses were identified in the participants’ words and experiences. First, the computer-using and non-computer-using teachers and administrators acknowledged that use of computers in classrooms was a worthwhile experience and in addition, had benefits despite the obstacles encountered. The participants in this study reflected a sense of optimism and support for the role of computers to transform the teaching and learning process. Both computer-users and non-computer-users recognized how computers can be helpful tools.

Second, the computer-users spoke positively about their experiences of using computers but on the other hand, the non computer-users expressed disappointment and resentment at the lack of training to enable them use computers in their classrooms. Prior research such as the OTA (1995) report has pointed to lack of training as one of the obstacles hindering the effective use of computers in the classrooms. Data from focus group interviews in this study revealed that lack of training was the most expressed need that hindered non-computer-using teachers from using computers in their classrooms.
Another contribution of this study is that it points out the weaknesses existing in preservice education. In the case of Kenya, the computer education that teachers receive at the TTCs inadequately prepares them to teach using computers since computer education is mostly offered as a unit of other disciplines instead of a discipline on its own. Because of this, and the fact that respondents in this study learned computing through their own initiatives, impacted the ways teachers used computers in the classrooms. Last but not least, the most salient finding from the interview data was the need for professional development programs for teachers and administrators in Kenya. Although teachers and administrators are making efforts to improve on their computer skills by participating in technology workshops, in addition to using the Internet, there is need for proper planning with regard to staff development programs. Thus, these programs should not only be able to meet the needs of the individual teachers but should be ongoing and continuous as proposed in the literature (Speck, 1996).

All in all, these findings suggest that teachers’ and administrators’ perceptions and experiences play a significant role in the use of computers in Kenyan classrooms. Thus, educators can learn from these teachers and administrators the importance of providing preservice and inservice training programs to enable them successfully teach using computers in the classrooms. Importantly, the findings of this study suggest the need for the Kenyan government and MOE to review not only teacher preparation and staff development programs but also, to develop a revised national plan to implement ICT in schools nationwide over time.
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APPENDICES
Appendix A

Letter to Seek Permission from School Administrators

Dear Sir/Madam:

Re: Permission to conduct a study in your school

My name is Lusike Wabuye, a third year Ph.D. Student at Ohio University, U.S.A. My major is Curriculum and Instruction with a specialization in Instructional Technology. My main reason for writing this letter is to request permission to conduct a study in your school. I am interested in finding out the perceptions and experiences of teachers and administrators towards computer use in classrooms. (Refer to the attached abstract for more information). The benefits of this study are both individual and educational. The results of this study will provide a much-needed insight into the desires of teachers and administrators in terms of integrating computers in the classrooms. For example, there is no information concerning Kenyan teachers’ and administrators’ attitudes and perceptions about computer technology. Additionally, I would like to investigate how computers are benefiting them in their teaching. Given permission this study is scheduled to take place during the month of September and it is anticipated that it will take about one month. Upon completing the study, the researcher will return to the United States to analyze the results. After which the findings of the study will be made available to principal. If you have any questions please contact me at lw312990@oak.cats.ohiou.edu. Thanks in advance.

Sincerely,

Lusike Wabuye
Appendix B

Interview Questions

Sample of the teacher’s interview guide: Computer-users

1. How long have you been teaching?
2. What subjects/grades do you teach?
3. How long have you been using computers in your teaching?
4. What prior experience do you have with computer technology? How did you learn? E.g. was it self-taught or through pre-service training?
5. Do you enjoy teaching with computers in your classroom? Why?
6. What was your first experience of using computers in your classroom?
7. What prompted you to start using computers?
8. In what ways do you use computers? Describe in detail some technology activities that you have engaged while using computers
9. How do you use computers personally?
10. What software do you most often use? How important is to you and/or the students?
11. Do you use the Internet?
12. Do you have software to filter or control the material students in your classroom access?
13. How do students work at computers? Do they collaborate and work in teams or do they work individually?
14. How long do you have students working at computers and how often?
15. Do you know what it means to teach about technology and to teach with technology? Would you say you teach with or about computers?

16. Do you plan your lessons to involve the use of technology? What technology activities do you include for students?

17. What do you think your role should be when you teach using computers in your classroom?

18. In your opinion how has using computers in the classroom affected your teaching and your students’ learning?

19. Do you think the use of computers is a worthwhile experience? Why Or why not?

20. How do you feel or perceive the use of technology in your classroom?

21. Are there any obstacles you’ve encountered in your use of technology in the classroom? If so what are they?

22. What are your immediate technology needs and how do you think they can best be met?

23. Reflecting on your experiences of using computers, what suggestions would you offer to better improve the use of computers in schools?
Sample of the teacher’s interview guide: Non computer-users

1. How many years have you been teaching?
2. How long have you taught at this school?
3. What subjects/grades have you taught?
4. Why are you not using computers in your teaching?
5. How do you feel about not using computers in your classroom?
6. Have you seen or been to a classroom with computers?
7. How has the lack of using computers impacted/not impacted your teaching and your students’ learning?
8. Do you think it is important for students to be taught with computers? Why? Or why not?
9. Given computers to use in your classroom, how would you integrate them into your teaching and learning processes?
10. In your view what should be the role of the teachers and the role of the students in a non-computer using classroom?
11. How would you compare a classroom that uses computers and one that does not use computers?
12. What are your immediate needs and how can they best be met?
Sample of school administrator’s interview guide (head teachers/principal)

1. What is your role as a school administrator?

2. Do you also teach? If so, how long have you been teaching and what grades and subjects do you teach?

3. Do teachers in your school use computers? If so for how long have they been using computers?

4. How do teachers use computers? Do they use them to teach computer science or do they use them as a tool to enhance their teaching?

5. Is computer science offered as an examinable subject in your school?

6. What percentage of teachers use computers in their teaching?

7. What impact does technology have on the teaching and learning process?

8. Overall how do you perceive the use of computers by teachers in your school?

9. What is the role of the teacher in a technology-based classroom?

10. What efforts are being taken to encourage and involve those teachers who are not using computers?

11. What form of training do teachers using computers in your school receive to help improve their use of computers in the classroom?

12. Are there any steps being taken to help teachers in your school integrate technology in their teaching?

13. What are the major obstacles (if any) hindering effective use of computers in your schools?

14. What suggestions do you have to help advance technology or computer use in schools?
Sample of the Ministry of Education Administrator’s Interview Guide

1. What role do you play in the MOE?

2. How long have you worked in your position as a MOE administrator?

3. How many public schools are using computers? Are these schools primary, secondary or both?

4. What motivated you/the MOE to introduce computers in schools?

5. What goals/objectives do you aim to achieve?

6. What role is the government or you playing to ensure these goals are accomplished and what measures are being taken to involve teachers?

7. Who is involved in the planning and implementation of technology in schools?

8. Do you have a technology plan/guide or syllabus for schools to follow?

9. What measures are being undertaken to help teachers and school administrators better use computers in the classroom?

10. How do you monitor/assess the use of computers in various schools? How often do you do it?

11. Are there any government policies regarding computer use in Kenyan classrooms?

12. What is your vision of technology use in Kenya?

[Other questions will depend on the role of the administrator].
Appendix C

*Computer Syllabus and Schemes of Work*
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REMARKS

REFERENCES

LEARNING ACTIVITIES

RESOURCES

AIMS AND OBJECTIVES

Introduction to

Chemistry & Environment

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**Notes:**
- Activity 1: Teacher introduces a new topic.
- Activity 2: Students prepare for the activity.
- Activity 3: Group discussion on the topic.
- Activity 4: Individual practice on related skills.
- Activity 5: Reflection on the day's learning.
- Activity 6: Collaboration to solve a problem.
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- Activity 2

**ADVISORY AND OBJECTIVES**

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- Objective 2

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**HEALTH AND SAFETY**

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<td>3. Hands-on lab on computer assembly</td>
<td>4. Project: Build a mini computer</td>
</tr>
<tr>
<td>3.</td>
<td>1. Data structures</td>
<td>2. Arrays, linked lists, queues</td>
<td>3. Lab activity on data structure implementation</td>
<td>4. Project: Create a simple database system</td>
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<tr>
<td>4.</td>
<td>1. Web development</td>
<td>2. HTML, CSS, JavaScript</td>
<td>3. Lab activity on creating a basic website</td>
<td>4. Project: Develop a simple web application</td>
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Notes:
- The table above is a sample outline for a computer science course, focusing on various topics and activities.
- Exercises include hands-on labs and projects to enhance understanding and practical skills.
- Resources and references are provided for further study.

Reference:
- Comp. Department, School of Work, 2020
<table>
<thead>
<tr>
<th>Date</th>
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<tr>
<td>Mon</td>
<td>Prepare lesson plan</td>
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<td>Tues</td>
<td>Write test questions</td>
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<td>Wed</td>
<td>Grade papers</td>
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<td>Thurs</td>
<td>Prepare for next week</td>
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<td>Fri</td>
<td>Copy and distribute</td>
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<td>Sat</td>
<td>Review</td>
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**COMPLETED REVISION SCHEMES OF WORK YEAR 2011 PAGE 16 OF 2**
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**LITERATURE**

- References
- Resources
- Activities

**TOPIC**

- Tense
- Preposition
- Verb
- Adjective
- Adverb
- Noun
- Pronoun
- Modifier

**RESOURCES**

- Textbooks
- Workbooks
- Online resources
- Audio/Video clips
- Videos
- Interactive software

**ACTIVITIES**

- Read and comprehend
- Write and express
- Listen and respond
- Speak and articulate
- Practice and apply
- Test and evaluate

**REFERENCES**

- Academic journals
- Research papers
- Textbooks
- Encyclopedias
- Online resources
- Expert interviews

**TOPIC**

- Tense
- Preposition
- Verb
- Adjective
- Adverb
- Noun
- Pronoun
- Modifier
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**Sorting Data**

- Worksheet
  - in partly
  - order

- Worksheet with orders and references
  - the appearance of the worksheet
  - from the point of view
  - more and delete from gaps

- Place next and the important
  - Section page orientation
  - Sequence page
  - Destination page

- Time and sequencing
  - Planning grids
  - Planning options and features
  - Planning and decisions

- Worksheet
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**References**

**Resources**

**Learning Objectives**

**Assessment**

**Rationale**

**Weekend"
Appendix D

*Computer Science Examinations*
INSTRUCTIONS TO CANDIDATES

This paper consists of TWO sections; A and B.
Answer ALL the questions in section A.
Answer question 16 and any other THREE questions from section B.
All answers should be written in the spaces provided on the question paper.
Candidates may be penalised for not following the instructions given in this paper.

For Official Use Only

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<th>Question</th>
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This paper consists of 10 printed pages
Candidates should check the question paper to ensure that all the pages are printed as indicated and no questions are missing.
SECTION A (40 marks)

Answer all the questions in this section.

1. Describe the purpose of each of the following computer functional units: (2 marks)
   (a) control

2. Explain how each of the following would affect the suitability of a room for use as a computer room: (2 marks)
   (a) burglar proofed door

3. State three data representation codes used in computers. (3 marks)

4. State two types of documentation in program development and give the purpose of each. (4 marks)
5. Suppose a 5 element array A contains the values 9, 12, 17, 7 and 20. Find the value in A after executing the loop below.
   Repeat for k = 1 to 4
   Set A[k + 1] := A[k]
   [End of loop] (3 marks)

6. State any three activities that occur in a program compilation process. (3 marks)

7. The formula = K20 + P518 was typed in cell L21 and then copied to cell M24 of a spreadsheet. Write the formula as it appears in cell M24. (2 marks)

8. State two ways in which a computer may be used in efficient running of a hospital. (2 marks)

9. List three disadvantages of using traditional file management method. (3 marks)

10. Give one disadvantage of a single processor multi-user system. (1 mark)
11. List three differences between a micro-computer and a super-computer. (3 marks)

12. State and explain two reasons why word processing is one of the most common applications of many computer users. (2 marks)

13. Write \(-1\) in two's complement notation in byte form. (4 marks)

14. Explain the following input/output terms as used in computer systems. Give an example for each. (4 marks)
   (a) Read
   (b) Write

15. State two disadvantages of networking. (2 marks)
SECTION B (60 marks)

Answer question 16 and any other three questions from this section.

16 The following flowchart can be used to list the odd numbers between 0 and 100.

(a) Write a program segment for the flowchart using a high level language. (7 marks)
(b) What would be the output from the flowchart if the statement in the decision box is changed to:

(i) odd = 100

(ii) odd < 100

(iii) odd > 100.

(c) Modify the flowchart so that it prints only the sum of the odd numbers between 0 and 100.

(5 marks)
17 (a) List five precautions that can be taken to protect data stored in diskettes. (5 marks)

(b) State and explain two precautions that can be taken to help recover data lost through accidental erasure. (4 marks)

(c) Describe each of the following data processing methods: (6 marks)
   (i) batch processing

   (ii) distributed processing

   (iii) multiprogramming.
18 (a) (i) What is a computer keyboard? (1 mark)

(ii) List four types of keys found on a computer keyboard. Give an example of each. (4 marks)

(b) Give four differences between present days' computers and the older generation of computers. (4 marks)

(c) (i) State three advantages and one disadvantage of using a laser printer. (4 marks)

(ii) Distinguish between a line printer and a page printer. (2 marks)

19 (a) Identify three Public Universities and three National Polytechnics in Kenya where further computer training is offered. In each case, state the highest level of qualification that can be acquired in computer training. (6 marks)
(b) Distinguish between “Job replacement” and “Job displacement” in reference to computerisation. (2 marks)

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(c) Explain the following terms as used in a spreadsheet:

(i) what if analysis (2 marks)

(ii) cell (1 mark)

(iii) formula (1 mark)

(iv) pie-chart. (2 marks)