COMPUTER TECHNOLOGICAL CHANGE AND ITS IMPLICATION ON INFORMATION TECHNOLOGY TRAINING: A CASE OF SELECTED TECHNICAL TRAINING INSTITUTIONS IN NAIROBI AREA, KENYA.

BY

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DECLARATION

DECLARATION BY CANDIDATE

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This thesis is dedicated to my brother, Paul and my wife, Jane.

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ABSTRACT

Computer hardware and software technology has grown at near exponential rate in the recent years. The more frequently this technology is upgraded, the more computer obsolescence occurs causing manufactured waste and user frustration. Educational institutions must keep in pace with these rapid technological developments being experienced in the computer industry for meaningful Information Technology training. Unfortunately, financial constraints have been a major draw-back. Hence these institutions have maintained older version computers for Information Technology training but there is concern over the quality and specifications of these computers. Particularly; system memory capacity, operating systems, processing speed, compatibility and provisions for upgrading which may not be adequate enough to effectively cover the content for Information Technology courses. As computer technology improves and becomes more effective, robust, functional and user-friendly, the computer user is forced to make the decision about upgrading his or her computer system, operating system and/or application version all too often. This 'forced' obsolescence has a profound effect on the individual from the standpoint of being at the cutting edge of technology at all times or having the ability to use an application that one is perfectly happy and comfortable with for a long time even though the application, operating systems and hardware platform the application runs on are outdated and no longer supported. Elsewhere in South Africa, second hand computers from the developed countries intended to equip educational institutions have been rejected on grounds that they are inferior and Africa was being used as a dumping site for obsolete technologies. To the contrary, here in Kenya, a number of used computers are making entry into the classrooms for IT training, probably not aware of the motive by the 'west' to politely transfer the burden of disposal onto these needy institutions, since computer donation is same as computer dumping. The study adopted survey design in which triangulation approach was used. The data was collected from purposively sampled public technical training institutions offering Information Technology courses within Nairobi region. Students, teachers, ICT administrators and computers were randomly and systematically sampled to obtain research raw data through questionnaires, observations and interviews. The quantitative data was analyzed using SPSS in which Chi-square and t-test techniques were applied at level of 0.05 significance testing. The analysis was done to establish how suitable are these older version computers, acquired by or existing in technical training institutions, in covering the syllabus for Information Technology courses in technical training institutions within the total recommended time frame and particularly the practical lessons. This study was guided by the theory of Constructivism that postulates that knowledge is not a fixed object; it is constructed by an individual through his or her own experience of that object. The results show that modern computers enhance good performance in IT courses and that computer memory upgrading and adoption of high processing speed computers is required for better IT training results. Based on the findings, recommendation is made on the use of branded computers rather than cloned ones for IT training and government to adopt one internet service provider for all public educational institutions at the same kilobyte per second. Suggestions for further research include trapping the computer virus menace.

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LIST OF ABBREVIATIONS

AI	Artificial Intelligence
CD	Compact Disk.
CPU	Central Processing Unit.
CRT	Cathode Ray Tube.
CSCL	Computer-Supported Collaboration Learning.
DVD	Digital Video Disk.
GUI	Graphical User Interface.
GB	Giga Byte.
GHz	Giga Hertz.
HDD	Hard Disk Drive.
HOD	Head of Department
ICT	Information Communication Technology.
IT	Information Technology
Kb	Kilobyte.
Kbps	Kilobyte per Second.
KIE	Kenya Institute of Education.
KNEC	Kenya National Examination Council.
LCD	Liquid Crystal Display.
MHz	Mega Hertz.
MoE, S & T	Ministry of Education, Science & Technology.
NGOs	Non-Governmental Organizations.
OS	Operating Systems.
PC	Personal Computer.
PCs	Personal Computers.
RAM	Random Access Memory.
ROM	Red Only Memory.
TTI	Technical Training Institution.
UPS	Uninterruptible Power Supply.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Overview

The demand for education has ever been sky rocketing all over the world with special attention to the Kenyan society. Enrollments to higher education vary over time (Neugart and Tunistra, 2001). However, challenges and questions over the quality of education offered have worried many seeking the formal education, especially concerning to the acquisition of entrepreneurial and technical skills (Kumar, 2000). Several issues have led to compromise on quality of skills acquired in formal education system. The major one being the availability of facilities and resources. Thus, some charitable institutions have taken an initiative to mobilize and donate some of the essential facilities to the needy educational institutions. Similarly, educational institutions have resulted to purchasing cheaper instructional materials and equipment, particularly computers from dealers of second hand/refurbished units.

> The Kenyan educational system has been occasionally reviewed since independence to address the aspect of relevancy. Several commissions have, in the past, been set up to redraft the Kenyan education system in order to meet the values and standards of the day. 'Specifically the Kamunge (1988) and Koech (2000) report suggested that education in Kenya should place emphasis on the relevance and quality to enhance development' (Kitainge, 2003).

Therefore, as pertains to information technology training in technical institutions, purchasing or receiving of older version computer donations from these dealers / organizations has been a remedy to such challenges. All in all, there is concern over the quality and specifications of these computers. Since most of them are acquired from the developed world, the basis of such second hand donations or sale of refurbished computers could be away of dumping the computers into the educational institutions which may not be prepared to deal with the aftermath of such shift of responsibility of dumping (Permalink, 2006). Though not all older version computers are believed to suffer these substandard functional requirements as per the technology of the day, then it will be in order to specify the minimum specifications of such computers before they are made of use in the classrooms. Hence, the grounds/basis of this research begins at this point.

Technological change refers to the overall process of invention, innovation and diffusion of technology or process. It is characterized by technological development, technological achievement and technological progress (Juliussen, 1987). In this study, computer technological change is defined as the invention of computer technology, the continuous progress of improving the technology and its diffusion throughout the computer industry (Juliussen, 1978). The computer technological change greatly affects the effectiveness of a computer. Effectiveness means the ability of an architecture to produce the desired result within certain time and space constraints (Collins English Dictionary, 2003). The definition of effectiveness adopted in this study is adapted from the dictionary definition. Effectiveness is the capability of the computers to effectively meet the time frame

allocated for the computer courses in training institutions. Thus, an effective computer in technical training institutions will enable adequate coverage of the IT content matter within the specified total time of 155 hour for the practical lessons. These lessons comprise of Operating Systems, Word Processing, Spreadsheet, Database, Desktop Publishing, Financial Applications and Computer Aided Drawing.

In this study, effectiveness will be characterized by the ability of the computer to run the intended application software, the computer processor speed, cache and system memories, stability, reliability and the computer ability to run on latest operating systems. These specifications will ensure adequate coverage of the IT content matter and thus enabling students to competently use computers with ease to execute application programmes. The successful completion of such content matter is an important indicator of the number of computer literate students from tertiary educational institutions joining the higher levels of education or being absorbed by the business world. In order to achieve computer literacy at lower levels of education, the quality of computer hardware should be appreciatable to have a meaningful training. David and Patrick (1989) realized that computers in classroom required upgrading in order to meet the learning requirements of the day.

1.2 Statement of the Problem

In the Kenyan education system, the Ministry of Education, Science and Technology has emphasized the teaching of IT as a subject field in training institutions in line with Information Communication and Technology developments. For meaningful computer training to take place, the computers used should meet minimum functional requirements

for them to be effective with respect to the specifications of a modern computer. Hence, with the changing technology and development in the computer industry, the IT skills required for computer literacy keep on changing and even the market demand for such skills. Though the skills could be the same but how to execute them is changing due to the developments in computer hardware and software.

Commendably, some institutions like The Kenya Polytechnic University College are advancing with such changes in the computer industry; unfortunately, some have continued to maintain the older version computers and even others acquired similar obsolete computer hardware through donations or purchase of second hand / refurbished computers. With the government developmental vision of 2030 and the influence of global market, then for any person to effectively compete in today's world market, he or she must have the recent skills pertaining to that particular field. Thus, it is obvious that the difference in the quality of computer hardware used in these institutions will adversely disadvantage some students and consequently fail to compete meaningfully in the world market of computer skills.

The concern of this study was to carry out an intense critical evaluation of the suitability of older version computers for IT training. The study sought to establish whether there exists a significant difference between the performance of a modern computer and the older version computers in coverage of IT practical lessons within the allocated time in reference to new software, both application programs and operating systems, which may require more memory capacity and different computer architecture other than the existing

one. The analysis was done to establish how suitable these computers are in the coverage of the syllabus for the IT courses in technical training institutions within the recommended time of 155 hours for the practical lessons. The results were to establish the minimum specifications of older version computers required to cover the syllabus for computer courses in technical training institutions for the new software versions.

1.3 Purpose of the Study

The general purpose of this study was to assess the suitability of the older version computers in public technical training institutions, meant for IT and ICT training, in respect to the increasing obsolescence rate of technological hardware as a result of computer technological changes that has continued to occur over the time as noted by (Ping, 2008). The computers were analyzed in relation to their ability in meeting the normal learning pace of the students within the specified time of 60 minutes per lesson for the required application programs to be covered in the syllabus.

1.4 Research Objectives

The objectives of the study were to:

a) Compare the actual processing speed required for information technology practical lessons with the speeds of the older version computers in public technical training institutions.

b) Compare the actual computer memory capacity required for information technology practical lessons with the system memories of the older version computers in public technical training institutions.

c) Establish whether there were older version computers in public technical training institutions that were not able to run newer versions of software for information technology training examinable by Kenya National Examination Council.

d) Compare examination performances in information technology courses when using an older version computer and when using a modern computer.

e) Find out the extent of stability and reliability of older version computers in public technical training institutions.

f) Find out the extent of computer wastage due to 'dead' old computers in public technical training institutions.

1.5 Research Hypotheses

The following were null hypotheses of the study:

H_{01}. There is no significant difference between the processing speeds of older version computers in public technical training institutions and that of a modern computer.

H_{02}. There is no significant difference between the system memories of older version computers in public technical training institutions and that of a modern computer.

H_{03}. The older version computers in public technical training institutions are not able to run the latest versions of information technology software examined by Kenya National Examination Council.

H_{04}. There is no significant relationship between examination performances in information technology courses when using either an older version computer or a modern computer.

1.6 Research Assumptions

The following are assumptions that were adopted during the study:

i) The respondents were fully to cooperate for the research to be successful as intended.

ii) The users of the computers were aware of the computer specifications.

iii) The students had the same ability of using computers.

iv) The lessons were to be purely practical.

1.7 Significance of the study

In Kenya, the Ministry of Education, through the Kenya Institute of Education and Kenya National Examination Council has recommended teaching of computer studies as well as Information Technology in educational institutions. Since the subjects are examinable, then the specification of the computers used in these institutions should meet certain minimum standards of specifications for the coverage of the syllabus. The findings will be a regulator to the various institutions when acquiring computers for learning purposes into their educational institutions so as to ensure that such computers conform to the minimum functional requirements. Similarly, older version computers already in the institutions should be re-evaluated to establish their effectiveness in meeting the requirements for IT training on the basis of these research findings.

It was hoped that the study was to be useful for proper planning and decision making at the MoE, S & T, KNEC, KIE and the institutions resulting to adoption of uniform computer configurations and specifications with regard to changing technology for successful and relevant teaching of IT courses in tertiary training institutions in order to avoid disadvantaging of certain candidates during the end course examination due to disparity in computer qualities. The findings and recommendations of the study should also be useful to other educational institutions including secondary schools and universities as it pertains to quality of the computer hardware they use for their computer training.

Hence forth, the educational planners will rely on informed acquisition of the appropriate computer hardware for their computer training programs, from the various available computer sets in the market. Again, they will base their decisions and actions concerning computer training on concrete knowledge of issues of computer specifications with respect to the nature of computer application desired as a result of great demand in computer skills. This will enhance proper monitoring of quality of computer training in both government and private educational institutions so as to realize the goal of 'seeing' majority of the Kenyans being computer literate by the year 2030 when the country is expected to become industrialized and economically self-sustaining.

The researcher hoped that the study was to form a basis for further research on future computer specifications appropriate to classroom situation as a result of advancement in computer technologies. This should lead to the generalization of new ideas for the better

and more effective IT training in technical training institutions and other educational institutions in Nairobi Area and the rest of the country in general.

1.8 The Scope of the Study

Institutions offering Information Technology training and computer studies were chosen. Nearly, all these institutions received computer sets through donations from charitable organization /government, and still continue to use computers of older version which necessitated the need to carry out the research since the specifications of these computers differ. The sampled computers represented similar cases across the country. The subject random multiple samples were obtained from students, teachers and computers in purposively selected public training institutions; data being collected by researcher using questionnaire, observation and interview techniques. The study specifically sought to establish the disparity in quality of the computers used in training institutions in terms of processor speed, system memories, stability and reliability, and operating systems of older version computers with respect to a modern computer.

1.9 Limitations of the Study

At best, this study should have been conducted in all tertiary training institutions, both public and private. But due to financial and time constrains a sample from the public institutions was selected. The area of study defined could have been extended but these constrains could not allow. Similarly, due to different levels of educational system and the training objectives intended at each level, generalization could be limited to the tertiary training institutions.

1.10 Theoretical framework

This study is modeled on the Constructivistic approach advanced by (Dewey, 1933). The theory was used by Ausubel (1968), Piaget (1972), Bruner (1990), Perkins (1991), Cognition and Technology Group at Vanderbilt (1991) and Sherman (1995).The cognitive constructivism theory postulates that knowledge is not 'about' the world, but rather 'constitutive' of the world. This theory was preferred over social constructivism theory developed by Vygotsky (1978). It postulates that all cognitive functions originate in, and must therefore be explained as products of social interactions and that learning was not simply the assimilation and accommodation of new knowledge by learners; it was the process by which learners were integrated into a knowledge community. Such theory was used by Brown, Collins and Duguid (1989) who argued that thinking is both physically and socially situated that problem tasks can be significantly shaped and changed by the tools made available and the social interactions that take place during the problem solving.

As applied in this study, the theory holds that knowledge is not a fixed object; it is constructed by an individual through his or her own experience of that object, which would influence how the students learn the concepts. The learners build an internal illustration of knowledge; a personal interpretation of experience. Learning is an active process in which meaning is accomplished on the basis of experience (Bednar, Cunnigham, Duffy and Perry, 1995). This is true considering the fact that learning emphasizes authenticity. Therefore, if the computers in training institutions are effective, then the students' performance in IT skills will appreciatively improve accordingly.

However in adopting this theory, the researcher is not ignorant of its shortcomings that lead students to resolve to adapt the situation whereby they either fit their experiences into their existing view of the object (assimilate) or change their cognitive structure to incorporate (accommodate) the experiences. The theory also faces challenges in its change of locus of control over learning from the teacher to the student. In designing programs in such a way that students would be enticed to achieve prespecified objectives, violates both what we know now about the nature of learning (situated, interactive) and about the nature of knowledge (perspective, conventional, tentative , evolutionary) (Hanckbarth, 1996).

Based on the theory, the researcher developed a conceptual framework on recalling that a conceptual growth comes from the sharing of various perspectives and the simultaneous changing of our internal representations in response to these perspectives as well as through cumulative experiences (Duffy and Jonassen, 1992). From the theoretical stance adopted by the researcher, it emerges that technological training in the third world is a step behind in embracing/employing the state-of-the- art facilities. Therefore, such use of obsolete technologies has continued to make these countries lag behind the first world. This technological gap has been a major draw back for these countries in their quest to meet developmental goals. To the contrary, the industrializing and industrialized countries have their technological training modeled in and reflective of the day to day technological advancements that help them achieve the socio-economic objectives within a shorter time.

Narrowing down to Information Technology, the outputs (graduates) from these two training models are represented by deflated and inflated balls respectively. In such a case, the first-world IT training output symbolizes technological training in developed world in which the learners perceive a ball as a well rounded object ready to serve the purpose while third-world IT graduates have a perception of a ball in a deformed way. A deflated ball is hard to score when given the necessary force due to its poor shape which makes it not to move faster and far in air and on the ground. The opposition to such ball movement is similar to the degree of preparation (competency) the personnel would be and the challenges they face in the practical world of work which demands for perfect skill application corresponsive to technological advancements in service delivery and production processes. Fig.1 illustrates the perceived conceptual model. It shows the probable output depending on the input for IT training.

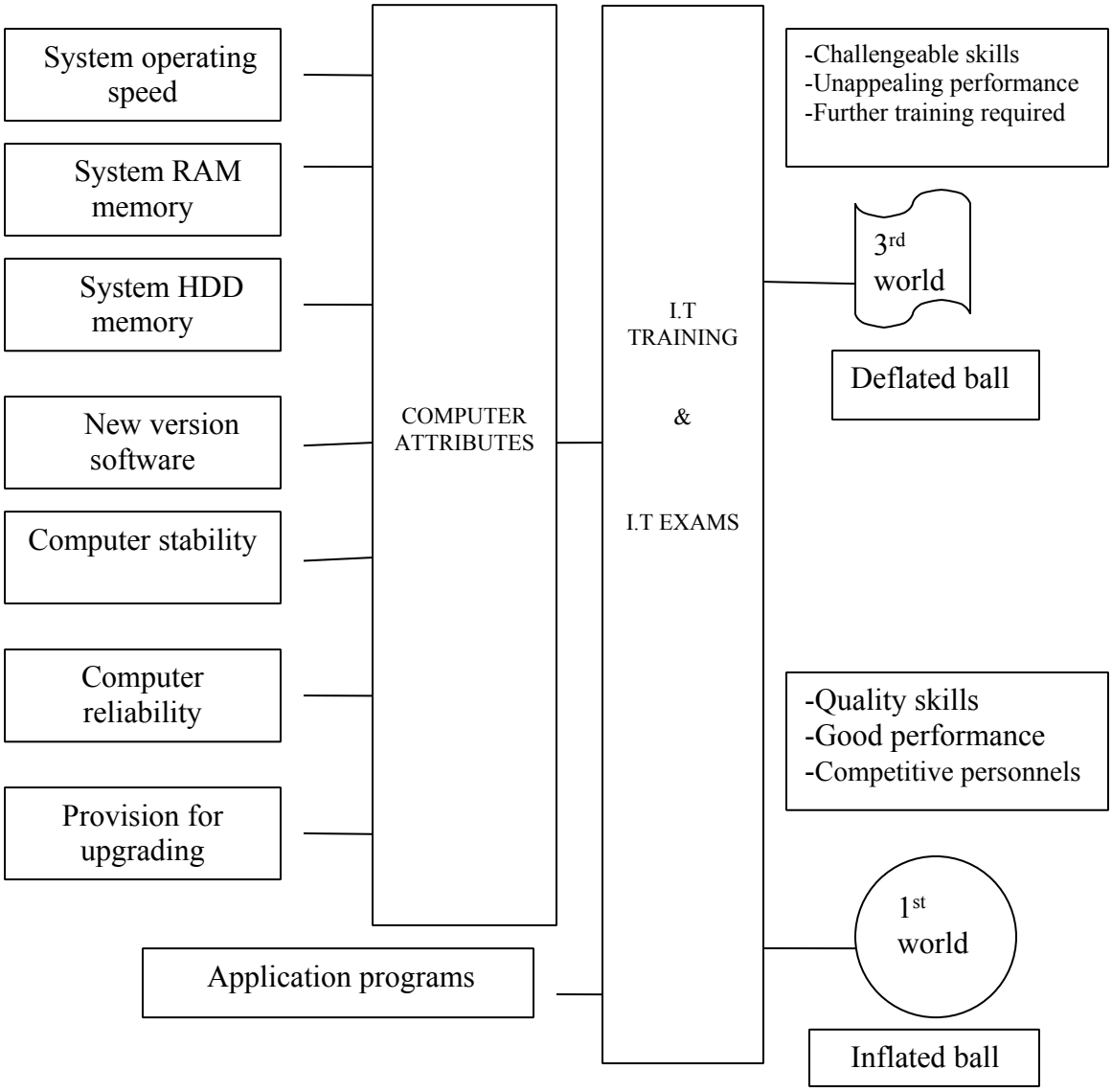
System operating speed
System RAM memory
System HDD memory
New version software
Computer stability
Computer reliability
Provision for upgrading
COMPUTER ATTRIBUTES
Application programs
I.T TRAINING & I.T EXAMS
-Challengeable skills
-Unappealing performance
-Further training required
3rd world
Deflated ball
-Quality skills
-Good performance
-Competitive personnels
1st world
Inflated ball

Fig. 1: Conceptual framework

The well formed ball for the first-world represents a well equipped IT graduate who has been exposed to the state-of-the art computer software and hardware. These graduates are literally competent in computer applications requiring their skills, and who are competitive in the world of work. The simile of a perfect ball used in this case represents the ability to achieve both IT and developmental goals in the given society.

The dependent variables in consideration include Operating systems, RAM size, HDD size, newer versions of software, Microprocessor speed, Computer stability and reliability, and 'dead' computers. While the independent variables are Application programs, IT content and Students' performance. The dependent variables will be the indicators on how the independent variables will perform. In conclusion, learning must be placed in a rich context, reflective of the real world context, for this constructive process to happen and transfer to the environments beyond the school or training classroom (Bednar, Cunnigham, Duffy and Perry, 1995).

1.11 Operational Definition of Terms

The following terms are defined as by the way they are used in the text:

Application Programs: - they are the computer skills to be acquired by the students through computer software designed to perform specific task.

Computer reliability: - refers to the trustworthiness to do what the system is expected or designed to do.

Computer stability: - refers to the ability of the computer to withstand system fluctuations like power surge and long hours of operations.

Computer generation: - it is an advancement stage in computer industry characterized by a major technological development that fundamentally changed the way computers operate, resulting in increasingly smaller, cheaper, more powerful, more efficient and reliable devices.

Computer obsolescence: - this is when a computer has gone into disuse, either because o becoming outdated or because it is damaged or too old to perform what it was intended for.

Information Communications Technology:- the term used to describe the tools and the processes to access, retrieve, store, organize, manipulate, produce, present and exchange information by electronic and other automated means (UNESCO, 2003).

IT content matter: - the syllabus for IT training to be covered.

Microprocessor: - it is the main processing unit of the computer.

Modern computer:-one that has the latest state-of-the- art computer technology in terms of speed, memory size, upgrading, power consumption among other factors.

Older version computer: - one that lacks the latest state-of-the-art computer technology in terms of processing speed, memory capacity, compatibility with modern peripheral devices and power consumption. Such computer has its CPU being a generation(s) behind the technological advancement frontier.

Operating Systems: - they are the software which manage the computer operations and program execution.

Quality: - the difference in worth, in relation to what is common.

RAM sizes: - refer to capacity of the virtual memory of the computer.

Specification: - standard hardware and software functional requirement of a computer.

Students' performance: - refers to the mastery of the computer skills.

Technological change:-it is the invention of a computer technology, the continuous process of improving the computer technology and its diffusion throughout the computer industry.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

In a project conducted in New Zealand whose purpose was to progressively develop and field tested new types of integrated curricula across Grade 8 to 11 as alternative to traditional approach. Within these curricula, computer-application plays a key role. Over the life of the project the computer configuration within the classrooms had changed a number of times in response to teacher's needs, operational difficulties experienced with hardware and software, and a developing concept of how they might be best used (Karm, Larkspur and Lily, 2005).

Configuration, in computer science, in reference to a single microcomputer, is the sum of a system's internal and external components, including memory, disk drives, keyboard, video, and (generally) less critical add-on hardware such as a mouse, modem, or printer. In conclusion, ICT pilot projects should not take more than three years to complete since the obsolescence rate of present-day technologies is increasing (UNESCO, 2004).

2.2 Integration of computers for teaching and learning purposes.

The place of the computer in the classroom has increased drastically over the past decade. Many educational institutions have begun to incorporate; on a large or small scale, the use of self-instructional learning packages which enable students to progress at their own pace uninhibited by group based teacher centered instruction (Rodgers, 1988). It is within this educational setting, together with the decreased cost of computing power, that computers are beginning to play a major role in classrooms with 'much computer-based educational courseware and software (being) developed locally by teachers on their own initiative' (Hayton, 1984). 'The computer alone, as a piece of equipment, is of little direct interest in education' (Bork, 1985). Only the development of a variety of educational tools and materials based on sound curriculum principles will allow the computer to be useful in education. To understand how computers could best serve learning process, then a review of what learning is and how it occurs in a more general sense is necessary (Pellone, 1991). Computers can allow students to cover course materials at their own pace and involve them to play an active role in learning process. Computers provide interaction and students learn best when they take an active role in the learning process. This active learning has been developed in response to cognitive theory of learning and suggests that students feel most motivated and learn most efficiently when they do so through their own discoveries (Wilson and Cole, 1994).

By combining the teacher and computer, a medium of achieving the same learning gains in a more efficient way is availed. Computer-supported collaboration learning (CSCL) is

used in educational setting to support students in learning together effectively. The role of computer should be to promote and facilitate learners to maximize use of their intelligence and knowledge. With the increased actuality of applying computers as a mediating tool in learning situations, the term computer-supported collaboration learning (CSCL) has been introduced (Bannon, 1995). CSCL is concerned with situations where computers are used for supporting learning based on collaboration learning.

Computers are essential tools for preparing children for their future. Technology skills are already a major requirement for employment (Mary, Gilbert, Jeri and Mark, 1999). It is no longer an issue of whether or not technology should be implemented in education. Now the question is when and how do we implement the technology, how do we use it effectively, how do we make it accessible and how can we afford it? (Carole and Elliott, 2000).

It is interesting that there is little hard evidence linking familiarity with technology to how successful students become! The purpose of technology in the class is not for kids to 'look at computer screens all day; you want them to be creating things' (Rosenstock, 1985). David and Patrick (1989) noted that there was a need to specify how computers should be used in classroom as a tool for learning, as a medium which initiates practical applications, and as a vehicle for the integration of subjects. There is concern on how to bring teachers to implement the effective use of computers. Hence, teachers and curriculum developers need to negotiate computer configurations to meet the specified time frame for the computer subject. When deploying technologies to schools throughout the country, establishing a balance between equity and effectiveness is necessary. Old

PCs tend to malfunction, and more technical problems are encountered in schools that have existing PCs compared to those with brand new computers (UNESCO, 2004). One of the most serious issues that the educational community must confront concerns the question of uniformity versus multiplicity of standards of computers for ICT implementation in schools (UNESCO, 2003).

Rapid developments in ICT are bringing about significant economic and social changes. In this rapidly changing situation, schools must evolve accordingly and provide students with the skills they will require in this context. Schools must not only enable students to learn how to operate modern forms of ICT, they must also provide students with the opportunity to develop the information management and ICT-literacy skills required for effective participation in the emerging knowledge societies (UNESCO, 2007). SchoolNet can be described, in general, as a network which is set up to support effective use of the information and communication technologies (ICT), particularly the Internet, for enhancing education, and for encouraging greater communication and co-operation among a network of schools (UNESCO, 2004)

Technological developments in ICT are very rapid. Technology quickly becomes obsolete requiring new skills and knowledge to be mastered frequently. Keeping pace with technological development and the changing competencies required of both students and their teachers, requires a state-of-the-art curriculum and appropriate teacher development to be at par with the changes in the state-of-the art computer technology. With the emergence of new technologies and small devices, such as hand-held computers

and mobile phones, the potential of these devices as teaching and learning tools (as well as for classroom management) should be explored(UNESCO, 2002).

2.3 Computer obsolescence

Obsolescence, in simple terms, it means that something has gone into disuse, either because of becoming outmoded or because it is damaged or too old to perform what it was intended for. However, obsolescence is more than that, because of the rapid pace of technology "improvements" in recent years and because of marketing pressure from software and hardware manufacturers on the consumer to keep up with the latest technology. Obsolescence affects all types of computers, including laptops, servers, and most importantly, personal computers (PCs). It impinges upon computer components and peripherals such as processors, memory, printers, and scanners. Obsolescence also has an effect on all computer software available including operating systems, applications, and smaller software components. Its direct effect can be seen with the multitude of software versions and upgrades available. The obsolescence rate of present-day technology is increasing and therefore Information Communication Technology (ICT) equipment must be re-evaluated to conform to such changes (Ping, 2003). Older computers are more likely to have old operating systems that are no longer supported. They are more likely to have problems running current applications. Newer software requires more computing power and memory, and this makes even simple web browsing problematic. For example, older computers often have trouble with increasingly common multimedia features on websites. Pentium-level computers are now over five years old, and millions of them are being disposed of (Permalink, 2006).

Technological obsolescence occurs when machines that are still productive are retired because they are no longer near the technological frontier. Computer depreciation happens by allowing for technological obsolescence; this occurs when computers are retired while they still retain some productive capacity. Today's new PCs can process information considerably more efficiently than new PCs could five years ago. Given that computing power is an economically valuable product (people are willing to pay extra for more powerful computers), it seems more sensible to define the real output of the computer industry on a “quality-adjusted" basis. Embodied technological change occurs when new machines of type-i are more productive than new type-i machines used to be (Karl, 2000).

Computer hardware and software technology has grown at a near exponential rate in recent years. The more frequently this technology is upgraded, the more computer obsolescence occurs causing manufactured waste and user frustration. Since computers first became popular for public use in the 1970’s, computer hardware, operating system, and software application technology has grown at a near exponential rate (Juliussen, 1987). As computer technology improves and becomes more efficient, robust, functional, and user-friendly, the computer user is forced to make decisions about upgrading his or her computer system, operating system, and/or application version all too often. This “forced” obsolescence has a profound effect on the individual from the standpoints of either being at the cutting edge of technology at all times or having the ability to use an application that one is perfectly happy and comfortable with for a long time even though the operating system and hardware platform the application runs on are outdated and no

longer supported. This can be seen as both a benefit and a nuisance for users, depending upon their particular point of view, but it definitely presents a problem for most individuals either way (Juliussen, 1987).

Computer obsolescence produces a great waste of resources, creates an environmental threat, and generates frustration and unnecessary costs for users. There is a significant need for change as the technology keeps improving and expanding at home and in the workplace (Jeff, 2001). Finally, computer obsolescence even causes a "human obsolescence" in the form of skills and knowledge of computer hardware and software becoming obsolescent. The increasing quantity of training and certifications available for people to learn new hardware and software further illustrates the extent of the obsolescence paradigm (Jeff, 2001).

Personal computers rapidly lose economic value. Within two years after purchase, the price of a used computer falls to one-third of its price when new. This rapid loss in value occurs even though the two-year-old computer can do exactly the same computations it did when it was new and suffers only small changes in reliability, physical appearance, or in other observable attributes. New computer models are typically both cheaper and more powerful than older ones. Computers also become obsolete because they become incompatible with new operating systems or software, or do not have hardware that becomes standard in new models (e.g., CD readers, Internet adapters). Computers can lose productivity because of changes in technology. This reduction in productivity relates

not to the physical operation of the computer, but to its inter-operability with other computers or with current software (www.computerhope.com/os.htm).

The number of generations the CPU is behind the frontier is broadly a measure of incompatibility of an existing computer with current software and operating systems. The lower cost of computer hardware spurred software designers to write more versatile programs that were more demanding on the hardware. The newer software does not run well on the limited capabilities of older machines. Moreover, one cannot simply set up two or more older machines to achieve the same capabilities of a newer machine; if a program needs 400 MHz to run well, setting up two 200 MHz machines will not solve the problem. (Michael, Valerie and Mathew, 2006).

Old software does not work with new printers. The old computer cannot run new software, and new software might have been necessary to read a dataset. Hence, even though an old IBM AT computer can perform a certain task and is still physically operational, i.e., has not depreciated physically, its productivity has declined. Thus, as technology evolves, a serviceable old technology becomes unproductive as the network and infrastructure for operating it vanish (Jeff, 2001). Aaron, Oy and William (2005) noted that, we're strung along with minor improvements in each subsystem: CPU speeds increase, bus interfaces change, RAM access times decrease, cache memory becomes integrated. Each little step keeps us psychologically hooked, but the hope is that we'll throw out the entire baby with each refill of bath water.

William, (2006) once noted that Steven Wright famously said:

> "You can't have everything. Where would you put it?"

So you get rid of the old stuff, but what makes it old? A new PC that does something different, or adds new capability or adds new features is an obvious incentive for a consumer to replace the old machine. The idea of products built not to last irks us, but for a variety of reasons we routinely discard devices that work just fine. Obsolescence by any other name has helped nourish a sweet economy, but a hidden cost is coming due fast, in the poisonous waste quickly overwhelming the world's capacity to deal with it. In making sure the old computers become obsolete or break down soon, this then become a way of selling new computers at a faster rate. Such practice of "death-dating" is what most people think of when they hear the term "planned obsolescence." As computer technology evolves, equipment is retired at an alarming rate. The EPA has estimated that by 2008 more than 315 million computers will become obsolete throughout the United States (Giles, 2006).

Leasing equipment from private companies can be one solution to the problem of rapidly increasing obsolescence rate of present-day technologies. Technology changes very fast and schools have to cope with emerging technologies. Outdated computers cannot be discarded and replaced with new ones, unless they have been used for a certain period of time, usually five years, according to the Government's current procedures concerning hardware procurement (Aaron, Oy and William, 2000). To cope with the rapid

development of technologies, some schools have resorted to leasing ICT equipment from private companies (UNESCO 2004).

The value of installed computers falls rapidly and therefore computers have a very high user cost. Obsolescence is accelerated by the decline in replacement cost of computers, cheaper computing power drives developments in software and networks that make older computers less productive even though their original functionality remains intact. Giles, (2006) noted that:

> "We are standing on the precipice of an insurmountable e-waste storage problem that no landfill program so far imagined will be able to solve."

This assessment frames Slade's examination of the various kinds of obsolescence that contribute to the problem. A new machine that does something different (the PC), or adds new capability (cell phone versus land line) or adds new features (cell phones with Internet, etc.) is an obvious incentive for a consumer to replace the old machine. But besides the apparent progress of the new and improved, there are other factors that encourage consumers to buy and rapidly throw away products. Changes in style (the annual model change adopted by the auto industry being the best-known example) and appeals to status encouraged by massive advertising are major forms of "psychological obsolescence," specifically designed to create demand for new versions of old and still usable products (Giles, 2006).

2.4 Computer configuration

The configuration of a computer system affects the way it works and the way it is used (Microsoft, 2005). Software (the operating system and various device drivers), the user's choices established through configuration files such as the AUTOEXEC.BAT and CONFIG.SYS files on IBM PCs and compatibles, and sometimes hardware (switches and jumpers) are needed to "configure the configuration" to work correctly. Although system configuration can be changed, as by adding more memory or disk capacity, the basic structure of the system—its architecture—remains the same (Microsoft, 2005). Did you know that you can order what you think is a 500MHz computer, pay what you think is a 500MHz computer, get what you think is a 500MHz computer, but in reality it's only 333MHz, and there's almost no way you can ever tell the difference until the computer fails to run your desired programs?! (Karl, 2000).

2.5 Issues about computers that are ignored

There is something 'beyond' computers that we haven't discovered yet (Peta, 2005).

A computer, like any other machine, needs maintenance. Regular maintenance enhances a computer's performance and ultimately its user's performance. Leaky memory inevitably occurs as a part of a computer's operation. Such commonplace tasks as opening programs, saving work, and closing programs all day long cause the computer's memory to leak, because when these tasks are completed the memory that was allocated to perform them is not completely reallocated to Windows. This causes the computer to begin running inefficiently, because computers run on their memory (Peta, 2005).

Emerging technologies; dealing with rapid development of technologies– How does your programme respond to emerging technologies and go about updating your existing ICTs with new ones as required? Is there a plan for updating and responding to the rapid development of technologies? What do you do with the old ICTs? How do you determine which new technologies your programme should acquire? Is there a budget allocated for this? (Wang and Woo, 2007).

2.6 Donated used computers

Even though computer prices continue to fall, many educational institutions are still under-equipped or not equipped at all. Since the institution could probably not afford new computers for classrooms and so they are considering donated or ‘’recycled’’ units, then they should be aware that these computers are typically far behind the curve in speed and features, but many still offer them the opportunity to integrate technology in their classrooms (John, 2000).

Students are our future, and they most certainly do! Providing the best opportunities means stretching precious school funds. Using second hand computers for basic applications actually frees up money to be spent on wiring, networking, software, or faster machines where more computer power is necessary (Tim, 2005). A second hand computer is one which is bought from or donated by its previous owner after use for sometime. The general theme for those who acquire/buy second user computers is that they need a computer to do tasks for which a new computer is expensive overkill (Second Chance, 2008)

John (2000) once said:

> ‘So you have finally decided to upgrade and purchase a new computer. You will soon get rid of that old computer in favor of a brand new desktop or a laptop computer with fastest processor, lots of RAM hundreds of gigs of storage. You therefore decide to sell the used computer, and if that does not work out (resale prices of secondhand computers can be dismally low), you will donate it to school or charity organization that will pass on the machine to someone in need’.

Older donated computers can present many technical challenges. Teachers seeking these donations should have a clear idea of what hardware they need to meet their goals; resource people to help with upgrade and repairs and knowledge of the donated computer’s capacities such as memory and processor speed (John, 2000). Schools and libraries face the enviable position of being on the receiving side of large numbers of donated Macs these days. It is quite common that donated Macs arrive without any hard disk drive (Shiparo, 1999). The reality is that these items are not build to last and many times donating them is just transferring the burden of disposal on to the needy schools, since computer donation = computer dumping (GreenCitizen, 2006).

Many second hand computers are likely to require memory and hard drive upgrades to run newer software. Once computers are installed in schools, users will need regular support, and hardware and software will require regular maintenance (Peter, 2001).

The decision to accept or decline an offer of donated / second hand computers for your school can be complicated. There are many important questions to ask, including:

(i) Will the computer run the software that your school currently uses?

(ii) What is the cost of integrating the hardware into your existing networks?

(iii) Will your teachers or students need additional training to use the computer?

(iv) Do you have the appropriate documentation and CDs for the original operating system? And are the PCs name brands or cloned?

O'Chee, (1998) observed that:

> 'Partners in Learning" empowers teachers in the neediest schools by helping them get the latest computer technologies at the lowest possible cost, and offering them the training they need to make the most of those technologies. Most schools use donated PCs, and Microsoft offers them copies of Windows 98 or 2000 free of charge. They also offer free upgrades to Windows XP Professional for newer computers that are already in the classroom, and are making copies of Office XP Pro available to schools at just a few dollars a copy'.

Donated computers often need memory upgrades to run current software and operating systems, they may need operating system upgrades and they often come without the original set-up and reference disks. Once the machine is properly upgraded and configured a special "image" needs to be created for that machine. The reality is that after spending $350-$500 and numerous hours to upgrade a donated computer the end user winds up with an older, slower processor and an older more limited hard drive. In addition to the costs of getting the machine functioning on the network, maintaining it for the next few years is complex; therefore more expensive compared to newer computers

on the network. After all, three year old donated computers can be a significant cost to the taxpayers and a liability for our schools (Peter, 2001).

From a public relations standpoint turning down free computers will be difficult for financially strapped schools. There will be many in the community who feel that donated computers are fine for kids, after all, "Why do they need state of the art technology?"
But organizations should still be cautious about accepting just any computer that is offered to them. You may think an older computer will fulfill your needs, but consider exactly what programs (and what versions of these programs) you need to run. Check the minimum system requirements first, and don't accept any computers that don't meet or exceed these requirements. Even if you find an older computer acceptable, you might have a difficult time finding the software that will run on it. Software makers do not typically sell older versions of their software. In fact, older software can be nearly-impossible to find. Be sure you can find the software you'll need before accepting an older computer. Remember that older computers need older software; new software just won't work. You may be able to find a 150 MHz computer for free, but a 350 MHz computer in good working order that you get for a nominal cost may be more useful to you, and it will be useful for longer (TechSoup, 2003). South African government views secondhand computers as inferior and felt Africa was being used as a dumping ground for obsolete technologies (Lesley, 2007).

Frequent unresolved computer breakdowns are experienced in many countries (very often with donated, second-hand computers). Donated computers that have exceeded their

lifespan may be redeployed for other uses or offered to needy students in other schools, to government organizations or to charities (UNESCO, 2003). The burden of maintenance is a problem associated with donated computers. Old computers that have exceeded their lifespan will entail maintenance and support expenses (Anita, 1998). Second hand computers or outdated ones that are in good conditions can still benefit some schools despite their limitations in running some application software (UNESCO 2004).

An outdated/old version IBM AT computer 15 years ago would get the job done almost as well as the Pentium IV laptop. Certainly, the current statistical software and word processing software is easier to use and runs faster, but the 15-year-old technology would suffice to get the job done, presumably with no effect on the quality of the analysis or quality of the writing. Using the 15-year-old technology to write this thesis now would, however, be considerably more difficult. Media for storing and transferring data have changed (Michelle, 2007).

Donated computers in schools could also be evaluated by posing the following questions; has your school received donated computers? From whom, how many and for what purpose? Also describe the conditions of the computers when received. Have they been used without any problems or if they have problems and are not usable, what specific problems prevented them from being used? What were the costs of using donated computers and how did you manage the process of receiving and repairing these donated computers? What are the advantages and disadvantages in receiving donated computers? (UNESCO, 2003).

Donating electronics that have a one little thing broken can be like donating socks with holes in them. Sure, in theory it is possible for a recipient to patch up the socks, but at that point, it‘s more cost-effective to buy new socks. Remember, if it is not cost-effective for you to have your old electronics repaired, it will most likely not be cost-effective for a potential recipient to have it repaired; as opposed to buying a newer, more reliable item (GreenCitizen, 2007).

2.7 Computer technological developments.

In order to see how much computers will improve, we must understand the current technological status of computers. In the last 20 years, the spectrum of computers has proliferated until today there are nine distinct, but overlapping, computer product segments. The improvement in computer technology has been phenomenal in the last 35 years. In this time span, the performance of the fastest computers has increased nearly a million times. At the same time, the price of entry-level computers has decreased by a factor of 1000. And, there is no end in sight (Murali, 2004).

For instance, as computers have progressed and developed so have the types of operating systems. Some operating systems will allow for multiple users use the same computer at the same time and/or different times, others are capable of supporting and utilizing more than one operating system e.g. Linux, Unix and windows 2000. Similarly there are those which are capable of allowing multiple software processors to run concurrently like Linux, Unix and windows 2000. Graphical user interface (GUI) operating system contains graphics and icons and is commonly navigated using computer mouse like

system 7.X, Windows 98 and windows CE. Computers, as in other fields, have a variety of grades of parts available. In a typical computer, the major parts that are shoppable are as follows: CPU, amount of RAM, size of the hard drive, speed of the CD/DVD, size of the monitor, and what kinds of parts are in the box (Rump, 2008).

The performance of computers will continue to improve at breakneck speeds. In the next five years the average memory size will increase threefold for mainframe computers and tenfold for personal computers. The performance measurement is Dhrystones per second which is a good measure of processor performance (except floating point speed). There will be tremendous change in hardware technology and in application software. But many of the current computer architectures will remain standards although one thing is certain, many existing computer architectures will slowly fade away. However, remember that nothing dies harder than obsolete technology! (Giles, 2006).

By using faster and/or smaller components, performance increases and price declines. Software technology must improve in order to take advantage of all the hardware advancements. Artificial intelligence (AI) is the technology that has the potential to revolutionize software. AI is not an application but a technology that will have tremendous impact on nearly all types of programs. AI is also needed to realize the potential of speech recognition and image processing (Juliussen, 1987). The history of computer development is often referred to in reference to the different generations of computing devices. Each generation of computer is characterized by a major technological development that fundamentally changed the way computers operate,

resulting in increasingly smaller, cheaper, more powerful, efficient and reliable devices that we use today (Jupiter-media, 2008).

The five Generations of Computers:

A generation refers to the state of improvement in the development of a product. This term is also used in the different advancement of computer technology with each new generation. The circuitry has gotten smaller and more advanced than the previous generation before it (Murali, 2004). These generations include:

(a) First Generation: 1940-1956 (vacuum tubes)

The first computers used vacuum tubes for circuitry and magnetic drums for memory, and were often enormous, taking up entire rooms. They were very expensive to operate and in addition to using a great deal of electricity, generated a lot of heat, which was often the cause of malfunctions. First generation computers could only solve one problem at a time.

(b) Second Generation: 1957-1963(Transistors)

Transistors replaced vacuum tubes and ushered in the second generation of computers. The transistor was far superior to the vacuum tube, allowing computers to become smaller, faster, cheaper, more energy-efficient and more reliable than their first-generation predecessors. Though the transistor still generated a great deal of heat that subjected the computer to damage, it was a vast improvement over the vacuum tube.

These were the first computers that stored their instructions in their memory, which moved from a magnetic drum to magnetic core technology.

(c) Third Generation: 1964-1971 (Integrated circuits)

The development of the integrated circuit was the hallmark of the third generation of computers. Transistors were miniaturized and placed on silicon chips, called semiconductors, which drastically increased the speed and efficiency of computers.

Instead of punched cards and printouts, users interacted with third generation computers through keyboards and monitors and interfaced with an operating system, which allowed the device to run many different applications at one time with a central program that monitored the memory.

(d) Fourth Generation: 1971 (present: Microprocessors)

The microprocessor brought the fourth generation of computers, as thousands of integrated circuits were built onto a single silicon chip. What in the first generation filled an entire room could now fit in the palm of the hand. As these small computers became more powerful, they could be linked together to form networks, which eventually led to the development of the Internet. Fourth generation computers also saw the development of GUIs, the mouse and hand-held devices.

(e) Fifth Generation: Present and Beyond (Artificial intelligence)

Fifth generation computing devices, based on artificial intelligence, are still in development, though there are some applications, such as voice recognition, that are being used today. Quantum computation, molecular and nanotechnology will radically change the face of computers in years to come. The goal of fifth-generation computing is to develop devices that respond to natural language input and are capable of learning and self-organization.

2.8 Factors affecting the performance of a computer

The efficiency of a computer is affected by processor speed, processor instructional set, Bus width or path, Bus speed, chipset, cache memory, system memory speed, system memory amount, operating system, how full the hard drive is, fragmented hard drive and the number of programs and utilities that automatically startup (Carole and Elliott, 2000).

Characteristics/attributes of a computer include the amount of RAM, the size of the hard drive, the speed of the CPU, the type of CPU, the speed of the CD drive (if any), and the make. Computers can lose productivity because of changes in technology. This reduction in productivity relates not to the physical operation of the computer, but to its interoperability with other computers or with current software (Frederick, 2002).

2.9 Comparison of old and new computers

The range of dates the specific computer model was manufactured is given, just as are the specific attributes of the model, including monitor type and size (if one was included in the purchase price of the computer), speed, amount of random access memory (RAM), hard drive storage space, type of hard drive, type and speed of CD-ROM or DVD-ROM, Ethernet card or modem, and type of processor (Pentium, Celeron, 286, AMD Athelon, etc.). Old PCs tend to malfunction, and more technical problems are encountered in schools that have existing PCs compared to those with brand new computers (UNESCO, 2004). A new computer has high performance and powerful features. If your main reason for buying a new computer is to replace an older computer, consider what really needs

replacing. Quite a lot of that older computer's hardware may find a home inside or alongside the new computer (John, 2000).

2.10 Recycled and refurbished computers

The distinction between refurbishing and recycling computers is that, when refurbishing a computer, a refurbisher handles newer equipment that they fix-up for re-use i.e. new components are fixed on to the computer for it to be re-used, while recyclers handle old equipment that they fix-up for re-use i.e. old components from other machines or units are fixed on to the computer for re-use. What can be recycled? Monitors and Cathode Ray Tubes, desktop computers, keyboards, mice, laptop computers, mainframe computer systems, modems, telephone boards, hard drives, floppy drives, CD ROMs, phones, faxes, printers, computer boards, CPUs, memory chips, circuit boards, connecting wires, and cables (Kuntz, 2008).

2.11 Computer virus

A virus is basically a piece of software which infects your computer and sets out to spread as much as it can through emails and will destroy any file(s) it can on your windows system. Common symptoms associated with these infections include redirecting of your startup homepage, formation of unknown toolbars and shortcuts on your desktop, reductions in system speed, pop ups and the inability to open up your web browser. Anti-virus tools are the answer to removing a computer virus and even if you don't surf the internet you are still at risk of receiving this infection (Michelle, 2007).

2.12 Computer quality

There is a vast difference between various types of motherboards, hard drives, RAM, etc. and usually you won't find out until much later that it actually ends up costing time and/or money down the road due to problems with inferior parts (Technical support services, 2008). For instance, some manufactures use motherboards with integrated sound, video and modems to cut costs. As you progress, you want to upgrade these parts, but in many cases you will discover that there are problems doing so and therefore you must replace the motherboard to replace other parts. There is advantage in speed gained by use of a good motherboard and a fast hard drive can gain you a half-hour a day –how much is your time worth? The difference between a good monitor and inexpensive monitor can mean the difference between serious eye strain and long-term comfort that can mean a difference to your health (Juliussen, 1987).

CHAPTER THREE

3.0 RESEARCH DESIGN AND METHODOLOGY.

3.1 Introduction

Methodology refers to the rationale and philosophical assumptions that underlines a particular study. It is a philosophical assumption of what constitutes knowledge claims and general procedure of inquiry (Crotty, 1998). It involves anything and everything that can be encapsulated for a series of process, activity and tasks in a research (McNeill,

1990). It is also defined as the analysis of the principles of methods, rules and postulates employed by a discipline (Masri and Abdullah, 2004).

3.2 Rationale for the methodology

In this research, the researcher embraced mixed- method approach in pursuit of attaining his research objectives. Such methodology was suitable for the study because of its nature of inquiry that sought to find how effectiveness of older version computers would affect IT training, particularly the practical lessons. This stance does not depend on reality and laws of nature but the truth is what works at a time (Creswell, 2003).

3.3 Research Design

Research design is the researcher's overall strategy for achieving the research objectives (Crotty, 1998). It is a blue print for conducting the research (Ary, 1985). Research design is a conceptual structure within which research is conducted. It informs the arrangement of the conditions for the collections and analysis of the data in a manner that aims to combine relevance to the research purpose (Kothari, 2003, Kitainge, 2003).

The researcher adopted cross-sectional survey design. The survey design provides quantitative and numeric descriptions of the population and was suitable for this research due to its ability to rapidly collect data and the extensive nature of the research (Willis and David, 2005). This enabled the researcher to collect data simultaneously at various levels of IT training in public technical training institutions. In this case, the problem was most important and thus post-modern theoretical perspective was used to give the researcher an opportunity to explore the problem extensively. It calls for using pluralistic

approaches to derive knowledge about a problem. Therefore triangulation technique was employed to allow the researcher to draw inquiries from both quantitative and qualitative approaches as he engaged in his research.

This kind of inquiry in this study sought to establish the minimum older version computer specifications suitable for IT content coverage in training institutions to ensure better performance in examinations and computer usage competency. In addition, the information obtained is an 'indicator' of how fast computer technological changes are being embraced in the classroom in an attempt to describe the rate and magnitude of computer obsolescence for the units purposely meant for IT training. Such approach would seek to gather opinions of users of these computers to determine if they find/experience any difference in effectiveness in which these computers perform the computing task. Therefore, in the investigation of the effectiveness of older version computers in technical training institutions in the coverage of IT syllabus, the survey design was used to describe and establish the capability of different computer specifications in meeting the intended academic instructional goals.

3.4 Research Variables

The dependent variables of this study were computer processing speed, computer memory capacity, ability to run new application programs, examination performances, stability and reliability, obsolescence rate and 'dead' computers. The independent variables include application program and time allocated for IT practical lessons. Application software is viewed in terms of the computer skill to be acquired by the learner as defined by the curriculum and in accordance with the Constructivism Theory.

3.5 Research Area

The study was conducted in Nairobi Area, following the Nairobi province boundary, between January 2008 and June 2008 using survey design. Nairobi bounders Central, Eastern and Rift Valley provinces. Nairobi Area was ideal to conduct the research within since its choice was purposive and influenced by a number of factors; first, there are several public technical training institutions staggered within it and therefore it could take the researcher a reasonable time to carry out the research. Secondly, the location is within resources and could make a better representation of the other cases with respect to trickle effect. Thirdly, the participants had an added advantage of exposure to latest technological developments and could therefore make acceptable comparison of what they have and what they should be having in terms of computer sets.

3.6 Research Logistics

These included all those processes, activities or actions the researcher addressed or carried out to ensure successful completion of the research process. There were three categories of such logistics as follows:

a) Pre-field work logistics.

This involved those activities that the researcher had to carry out before embarking on data collection in the field. Hence the researcher had to accomplish/undertake the following:

i) Formulation of research instruments which included questionnaires, interview protocol and observation forms.

ii) Acquire research permit from the Ministry of Science & Technology, and later cleared by the Nairobi Provincial Technical Training Officer to carry out the research in Nairobi Area. In this case the researcher was issued with a research permit from the Ministry after meeting the requirements for such issuance on paying a postgraduate fee of Ksh. 500.00, presenting two proposal drafts and completing the application form.

iii) Establishing a work plan or research protocol which is a plan of action that outlined details of various tasks which needed to be done in the whole of the research process and the time frame for each task.

iv) Sampling of the research subjects. In identifying the random sample that the researcher was to use, the major assumption was that a comprehensive sampling frame was to be developed. Hence, the researcher was required to list all respondents in the population from which he was to draw a random sample using purposive and simple random sampling techniques. Since no sampling frame was available, the researcher constructed a sample frame from records available in the Ministry of Education, Science & Technology – department of Technical Education.

v) Pre-testing the research instruments. The pilot study was done to ensure that the items in the instruments were stated clearly and had the same meaning to all respondents. The respondents on which the instruments were pre-tested did not make part of the selected sample. During the pilot study, the researcher was able to assess the clarity of the research instruments and the ease of use of the instruments. The researcher was also able to assess the time taken to

administer the instrument. The pilot study enabled the researcher to modify and/or omit items identified as sensitive, confusing or biased in any way. Thus, the information obtained during the pre-testing was used to revise the research instruments. Similarly, the data obtained during the pilot study was analyzed and the results used to develop dummy tables that were eventually to appear in the final research draft once actual data was collected and analyzed.

vi) Distribution of the research instruments. The researcher made appropriate arrangements for printing enough copies of the instruments. All pages and sections of the instruments were carefully and properly bound (stapled) together to avoid incidents of missing parts while in the field. The instruments were hand-delivered to the sampled institutions and subsequently administered.

b) Field work logistics

It involved the actual research process of data collection. In order to have a meaningful raw data collected, the researcher had to ensure that the mechanisms of data collection were efficient. The researcher was acquitted with the probable problems likely to be encountered in the field as well as appropriate tactics of conducting field work.

c) Post – field work logistics

These included the processes of getting the completed instruments from the field to the point (center) where data coding and analysis was to be done. The completed instruments were collected by the researcher from the institutions where they were administered. Data coding and entry started as soon as the completed instruments were collected. This

reduced the time required to code and enter the data. Once the data had been transferred from the instruments to the desktop, the instruments were kept safely for future reference.

3.7 Ethical Issues

Confidentiality of the information given by the respondents was guaranteed and the identities of the respondents were protected and their names were only coded to serve for cases of follow-up. The researcher disclosed clearly the purpose of the research/study so that the respondents could voluntarily participate in responding to the items. Obtaining a valid data entails infiltrating ones professionalism and institutional facility standards which itself is an infringement on the confidentiality of the respondents and critique of the institution. However, the respondents had the freedom to ignore items that they did not wish to respond to as well as their identity was withheld.

The Kenyan research ethics and regulations provided the baseline/guide to the researcher's conduct and behavior. The researcher was not to use the information obtained in the course of the research work in a manner prejudicial to the interest of the public as described in the research authorization certificate. The researcher bond to the scholarly requirements/integrity of authoring. He acknowledged all the works and ideas of others making part of his thesis. Similarly, no attempted data fraud as the researcher actively obtained primary data from the field.

The researcher was quite aware of his academic freedom to discuss and publish his findings without fear of any negativities resulting from reactions of the work's readers, in addition of safeguarding his intellectual property rights. The researcher did not purposely

avoid pertinent issues related to research and therefore he examined all appropriate areas without any prejudice.

3.8.0 Population, Sample and sampling methods

In this section the population, sample and sampling procedures are respectively discussed.

3.8.1 Population

The concept of population can be wider and need to be examined at manageable levels. There are two such levels of population, namely: target population and accessible population. Target population refers to the total number of subjects or the total environment of interest to the researcher (Willis and David, 2005). Accessible population is the part of the target population which the researcher can actually reach in case the population investigated is too large or too scattered that a sample can not logically be drawn from the whole population (Willis and David, 2005). The population comprised of computers, in all public technical training institutions, meant for Information Technology training at certificate and diploma levels.

3.8.2 Sample

According to Kerlinger (1983) and Gall et al (1996), researchers have suggested that when the population is small, the sample should be hundred percent of the population. In other cases, the larger the sample, the more the study findings are representative of the target population. Gay (1981), Anderson (1988) and McNeill (1990) contend that:

> 'In large scale studies, data intended for statistical analysis should be collected from at least ten percent (10%) to twenty percent (20%) sample of the population'

3.8.3 Sampling Procedure

The study was conducted in computer rooms/laboratories of purposively sampled public institutions which offer IT courses and computer studies. This kind of sampling was used to collect focused information since it selects typical and useful cases only. The researcher decided which training institutions to include. The research population comprised of all computers meant for IT training in the 42 public technical institutions, which included 21 institutes of science and/or technology, 17 technical training institutes and 4 national polytechnics. Out of these, the target population had 12 institutions, within Nairobi Area, in which 7 institutions composed the research sample.

The researcher initially carried out a detailed examination of the - state - of – the -art technology of a modern computer whose specifications formed the bottom line of comparison with the older version computers in the training institutions. The study analyzed the type of computers available in such institutions in terms of computer speed, system memories, stability and reliability, application program versions run, non-functional units and OS. Also of concern was whether the computers were stand-alone, networked, branded and cloned. The study adopted systematic and simple random sampling to select 384 computers in these institutions from a target of 689 computers. The sample size was obtained from the Fisher formula:

$$n \square \frac{Z^2 pq}{d^2}$$

Where; n – the desired sample size, if target population <10,000

Z – the standard normal deviation at the required confidence level

p – the proportion in the target population estimated to have the desired characteristics

q = 1- p

d – the level of statistical significance set.

It is noted that if there is no estimate available of the proportion in the target population assumed to have the characteristics of interest, 50% should be used as recommended by Fisher (1988). The simple random sampling ensured equal chances for all the computers in the selected institutions to be studied to avoid biasness. The systematic sampling was used to save time, as well as when it was impractical to have an exhaustive sampling frame; then every n^{th} subject from the randomized sample was selected.

3.9.0 Data Collection Instruments

Five types of research instrument were used to collect data**.** These include:

(i) Questionnaires for IT teachers in public technical training institutions.

(ii) Questionnaires for IT students in public technical training institutions.

(iii) Interview Protocols for IT teachers in public technical training institutions.

(iv) Interview Protocols for ICT center administrators.

(v) Observation forms/guidelines.

These research tools were adopted due to the nature of the data that was to be collected, the time available as well as the research objectives to be achieved. The general purpose of the study was to establish the capability of the older version computers, in technical

training institutions, to enable the coverage of practical lessons for IT courses. Hence, the appropriate information of these computers could only be collected via the techniques mentioned above.

3.9.1 Questionnaires

Questionnaires enabled the researcher to collect data within a shorter time since most of the information was to be easily described in writing. Questionnaires technique had the ability to source information associated with the intensive inquiry nature of the research. The respondents were expected to reply in writing since they are literate. Such information was used to establish the general rating of the students and teachers about the specifications of the computers they use and their appraisal in terms of how effective they are in accomplishing computing task required for IT training. This nature of information is best collected through questionnaires (Touliatos and Compton, 1998).

Questionnaires consisting of a number of questions printed in a defined order on a set of forms were administered. The questionnaires were self administered in which the respondents were asked to complete them by their own after the questionnaires were hand delivered to them. Pilot study for testing the questionnaires was carried out in order to identify weaknesses of the questionnaires and also the survey design/technique. The weaknesses were later addressed. Structured questionnaires were used so as to gather similar information from the respondents. The questionnaires had similar items with same wordings and in the same order to all respondents. The questions were a mixture of closed and open questions. In constructing the questionnaires, the question sequence was quite vital with the opening items intended to create a cooperative mood of the

respondents and subsequently leading to those important to the research issues while maintaining the connecting thread through successive questions.

There were two types of questionnaires used. They include:

(i) Questionnaires for IT teachers in public technical training institutions.

These questionnaires were administered to teacher handling IT courses in order to establish the features of the computers they were currently using for IT training in their institutions. The feedback from the questionnaires gave details on the type of computers in use, i.e. branded or cloned, performance of the IT students in the course, nature of inefficiency associated with their workstations, networking system, compatibility of the computers with other devices, computer virus management, OS used, system memory capacities, CPU series of the computers in use and the computing speeds.

(ii) Questionnaires for IT students in public technical training institutions.

These gave information about computer technical and computing problems encountered during the practical lessons, quality of the computer architecture/ accessories, stability and reliability of the workstations. Items for the two questionnaires use are defined on Appendix C and D respectively.

3.9.2 Interview Protocols

This technique calls for direct contact between the researcher and the study subject (Kothari, 2004). The method is often used to collect standardized information by interviewing a representative sample of some population. The researcher used the

following approach, while employing the interview technique, in order to 'break the ice' or create a rapport:

(i) Made a short talk upon first introduction.

(ii) Explained the purpose of the study.

(iii) Stated the usefulness of the information collected.

(iv) Re-affirmed confidentiality of the information and anonymity of the names (identity).

In this study, interview protocols were administered under the following categories:

(i) Interview Protocols for IT teachers in public technical training institutions.

In administering these interviews, the researcher aimed at establishing if the workstations for I.T training undergo upgrading when need arises to install advanced hardware and also determine the common malfunctions of the computers and the extent of computer waste as a result of obsolescence on failure to run high level software.

(ii) Interview Protocols for ICT administrators.

Information obtained from such interviews was to assist in defining the bottom line between a modern computer and an older version computer in terms of their characteristics. ICT centers have been kept on track as far as computer technological changes are concerned. The Kenya Polytechnic University College and the Ministry of Higher Education, Science and Technology ICT centers were considered. The interview items used in the two cases are spelt out on Appendix A and B respectively.

In applying the interview method, direct personal investigation mode of interview was used by the researcher to intensively investigate the latest developments in the computer industry from ICT center administrators whose data formed the baseline/reference of the research, as well as getting the general opinion, from the IT tutors, about the quality of the computers they use for course work training. Pre-testing of the interview guide was carried out to check for vocabulary, language level and how well the questions were to be understood. The interview guide helped in standardizing the interview sessions so that the researcher could ask the same questions in the same manner. Structured interviews, which involved formulated set of predetermined questions and of highly standardized techniques of recording, were used. In using this structured interview, the interviewer followed a rigid procedure laid down, asking questions in a form and order prescribed. The researcher used structured interview protocol due to its nature of being more economical, providing a safe basis for generalization and requiring relatively lesser skills on the part of the interviewer. It was also important for the researcher to use unstructured interview guide in the process of structured interview to enable him to probe the respondents to get deeper information.

3.9.3 Observation forms/guidelines

In this method, the researcher collects data on what is happening on the ground (Dunn, 1999; Kothari, 2004). The observation method gave first hand information on the state of affairs about the IT equipment (computers) in the training institutions investigated. Structured observation was used where pertinent data of observation was selected with standardized conditions of observation, in which the researcher was non-participant, and uncontrolled observation. Thus, the researcher utilized observation forms/check list to

record what he observed during data collection. In using this technique, the researcher had defined the parameters to be observed and developed a detailed list whereby the researcher checked off the presence of each of these parameters. These research tools were pre-tested before being administered to correct any anormality. Thus, the checklist was used to counter-check the specifications of the computers from the control panel. While observation forms aided in gathering information about the configurations and architecture of these computers. CDs of current software were issued by the researcher and tried in sampled workstations to establish if the computers could run them.

The performance of the computers was directly observed by the researcher during IT practical lessons. Information obtained through this technique included booting and operating speeds of the workstations, reliability of the internet services, computer virus attack and computer operating problems. This data collection technique was used in order to establish the general authenticity of the workstations. The observation form items are spelt out on Appendix E. Through these research techniques described above, both quantitative and qualitative data was collected from the sample chosen.

The pre-test sample used was 5% of the target population. This percentage was appropriate due to the size of the actual research sample as recommended by researchers, who give a range of 1% - 10%. The pre-testing helped in enhancing the reliability of the instruments in that it gave a consistent measure of the concept being studied (Mugenda and Mugenda, 2003). Each of the research tools administered to the respondents had a letter of transmittal (Appendix G) which gave a brief introduction of what the research

was all about. Again, since the target population was literate, the questionnaires, observational forms and interviews were adequately utilized as tools for collecting data.

3.10 Pilot Study

After the supervisor's approval of the appropriateness of the research instruments in achieving the research objectives, a pilot study was carried out in two public technical training institutions in Nairobi and Central Provinces. They are The Kenya Polytechnic University College and Thika Technical Training Institute respectively. Thika TTI is outside the area of study. It was chosen as a pilot institution for comparison purposes for the larger population.

The pilot study enabled the researcher to:

i) Ascertain that the data to be collected can truly be analyzed in accordance to the research objectives.

ii) Ensure that the research instruments used were able to elicit the anticipated data.

iii) Identify and rectify any ambiguities in the instruments. This helps the respondents to clearly understand the stated items.

3.11 Quality Control

This is the validity and reliability of the research instruments that were used (Willis and David, 2005). Randomization technique was used to ensure sufficient validity and reliability of the research instruments. Such technique was appropriate due to the size of the sample whose subjects are essentially similar in all the relevant variables that could influence the dependent variable.

3.11.1 Reliability

At data collection level, reliability of a research instrument is its ability to give consistency every time it is administered. A test is reliable to the extent that whatever it measures, it measures it consistently. There are three major categories of reliability for most instruments: test-retest, equivalent form, and internal consistency. Each measures consistency a bit differently and a given instrument need not meet the requirements of each. Test-retest measures consistency from one time to the next. Equivalent-form measures consistency between two versions of an instrument. Internal-consistency measures consistency within the instrument (consistency among the questions). For research purposes, a minimum reliability of 0.70 is required. Some researchers feel that it should be higher. A reliability of 0.70 indicates 70% consistency in the scores that are produced by the instrument. Many tests, such as achievement tests, strive for 0.90 or higher reliabilities (Cortina,1993).

Kuder-Richardson Formula 20 (K-R 20) and Kuder-Richardson Formula 21 (K-R 21). These are alternative formulas for calculating how consistent subject responses are among the questions on an instrument. Items on the instrument must be dichotomously scored (0 for incorrect and 1 for correct). All items are compared with each other, rather than half of the items with the other half of the items. K-R 21 assumes that all of the questions are equally difficult. K-R 20 does not assume that.

Cortina (1993) noted that:

‘ the Kuder-richardson Formula 20 (KR-20) first established in 1937 is a measure of internal consistency reliability for measures with dichotomous choices’.

In order to determine whether the questionnaires were to be reliable, the researcher established the reliability coefficient, using Kuder-Richardson (KR21) formula to gauge the extent to which the items in the questionnaires were consistent in requiring the same response every time they were administered. The formula is:

$$KR21 = \frac{K}{K-1}\left[1 - \frac{M(K-M)}{K(SD^2)}\right]$$

Where; K – number of items in the questionnaire.

M- mean of the sets of scores.

SD- standard deviation.

3.11.2 Validity

Correct operational measures for the concepts being studied were established to ensure construct validity was achieved. In this case, the researcher used multiple sources of raw data to capture the relevant data within a shorter time. Internal validity, ability of the research instrument to measure what it is supposed to measure, was provided for through explanation building in which the researcher elaborated the answers as they relate to the questions. While external validity was achieved by comparison approach to determine how suitable could the data, findings and conclusions are for generalization for the rest of the population.

3.12 Data Collection Procedures

This study used cross-sectional technique of data collection which included:

3.12.1 Questionnaires

After verification by the supervisors of their appropriateness, a pilot study necessitated items review with respect to the responses received. When the researcher was certain that the questionnaires were reliable and valid, he made enough copies and personally delivered them to the sampled public TTI. Through the heads of departments; IT, computer studies and ICT, the questionnaires were distributed to the subjects. Fortnight duration was allowed before the questionnaires were to be returned in order to give time to the respondents to do so with ease and avoid inconveniences which might have led to insincere responses.

After the elapse of the waiting period, the researcher went back to the institutions to pick the filled questionnaires from the HODs who had overseen their handling. Occasionally, the researcher was disappointed at the pace and rate of return of the filled questionnaires from some of the institutions but he kept on making follow up till he received adequate feedback for analysis. All the individual questionnaires had a transmittal letter attached to them, giving details of the purpose of the study, its usefulness and the authorizing institution. All the transmittal letters had the researchers' names and signature.

3.12.2 Interview schedules

The researcher contacted interview sessions using interview protocols. The items were specific to capture the relevant data. This technique was quite effective since clear information about the computers in use for IT training in these institutions visited could be obtained. In adopting this technique, the researcher made a brief introduction of

himself, stated the purpose of the study and its importance, followed by a brief chat to break-the-ice. He then began probing for the main items. Most of the sessions were successful except few cases when the researcher was interviewing computer laboratory technicians who might have been lacking crucial information about the computers in use.

3.12.3 Observation forms

The researcher prepared forms with characteristics/parameters to be observed about the computers. The observations were made during practical lessons in which the researcher checked and marked against the characteristic investigated on the observation form. In this case, the researcher obtained very reliable first hand data. The researcher liaised with the subject teacher via the HOD for permission into the computer laboratories as the class session was on.

3.13 Data Analysis Techniques

This is the organization, interpretation and presentation of the data collected. Inferential data analysis was used. The researcher grouped data from structured and unstructured questionnaires, observational forms and interview protocols; categorizing them on nominal and ordinal scales to represent frequency counts. Quantitative and qualitative methods of data analysis were employed. The analysis involved coding and organizing the data into concepts and themes. According to Mugenda and Mugenda (1999), in the qualitative paradigm, data collection and coding are done simultaneously in that codes are assigned to emerging themes. The descriptive data was put in frequency tables and percentages.

3.14 Statistical Analysis

The significance and relationships were tested at $\alpha = 0.05$ to give a confidence level of 95 percent. The degree of freedom depended on the particular case under investigation. The significance level chosen here is suitable due to the sample size of the subjects. The statistical package for social sciences (SPSS) was used to analyze the descriptive data.

The hypotheses were tested as follows:

1. Chi-square (χ^2) test for independence and percentage distribution techniques were used to analyze the quantitative data of H_{01}, H_{03} and H_{04}. The Chi-square test is a statistical technique used to compare the differences between categorical frequencies when data is categorical and drawn from a population with a uniform distribution in which all alternative responses are equally likely (Willis and David, 2005). The chi-square was useful in establishing if there was any significant difference in computer specifications studied with regard to the type of microprocessor, memory size, operating system, networking, stand-alone, branded or cloning. The chi-square was suitably adopted in this study since it involved one -variable-many - levels of categorical frequencies.
2. One sample t-test was used to analyze H_{02}. Comparison was made to the known specifications of a modern computer to those obtained from the older version computers, in order to test if the mean of the single variable differed from the specified constant (Obure, 2002).

CHAPTER FOUR

4.0 DATA ANALYSIS AND INTERPRETATION

4.1 Introduction

Data from the study was coded and analyzed using SPSS software application. Frequency tables were used to show different situations as discussed in the following cases. Chi-square and T-test analysis techniques were found appropriate.

4.2 Descriptive Analysis

4.2.1 Demographic information about IT training levels.

The first three items on IT students' questionnaires that the respondents were requested to respond to were demographic items. They included levels of IT training modules at which they were training for and if they had undergone computer skills training there before. Such items were used to determine if the students could reasonably identify inhibiting characteristics, in terms of efficiency, that could be associated with the computers they use for their training. The data obtained in this case revealed that the students were able to give reliable information about the computers they use for IT training in their institutions.

Table 4.1: Training qualifications of the responding students

levels of training for IT		Frequency	Percent	Valid Percent
Valid	Certificate	12	12.0	12.1
	Diploma	87	87.0	87.9
	Total	99	99.0	100.0
Missing	System	1	1.0	
Total		100	100.0	
Modules of IT training				
Valid	Module 1	24	24.0	25.8
	Module 2	57	57.0	61.3
	Module 3	12	12.0	12.9
	Total	93	93.0	100.0
Missing	System	7	7.0	
Total		100	100.0	

From frequency table 4.1, it is deduced that 12.1% of the students who participated in this research were undergoing IT training at certificate level while 87.9 % were training for diploma in IT. Out of these students, 25.8%, 61.3% and 12.9% were studying for modules 1, 2 and 3 respectively. Among these students 40% of them had undergone computer studies there before while 60% had not, which makes a greater percentage of the students undertaking IT training in public technical training institutions.

4.2.2 Demographic information about computers for IT training in public technical training institutions.

The introductory questionnaire items on the IT teachers' questionnaires aimed at obtaining the break-down of the types of the computers in use for IT training in such institutions. Also the researcher aimed at establishing the number of computers in use and the mode of acquisition. The responses indicated that a number of the institutions

continue to receive computer donations which are either new or used. A mixture of branded and cloned computers is found in majority of the institutions considered.

The 100% representation of the number of computers in use for IT training in the institutions considered during the study is the figure 689. On acquisition of the computers, 50% of the institutions purchased their own computers while 16.7% received computer donations. The remaining 33.3% received donations as well as made their own purchase. Out of these computers acquired by the TTIs, 41.7% were new, 8.3% old/used computers while 50% was a mixture of new and old, as shown in appendix L.

Table 4.2: Percentage preference of the type of computers for IT training in public TTIs. visited.

Cloned computers		Frequency	Percent	Valid Percent
Valid	Twenty	3	25.0	37.5
	Fifty	1	8.3	12.5
	None	4	33.3	50.0
	Total	8	66.7	100.0
Missing	System	4	33.3	
Total		12	100.0	

Branded computers				
Valid	Fifty	4	33.3	57.1
	Four hundred and seventy six	1	8.3	14.3
	Twenty	1	8.3	14.3
	Five	1	8.3	14.3
	Total	7	58.3	100.0
Missing	System	5	41.7	
Total		12	100.0	

From table 4.2, it is shown that there are more branded computers than cloned ones in use for IT training in public technical training institutions. From appendix L, it is further shown that 16.7% of the computers were cloned and 33.3% branded while 50% was a mixture of the cloned and branded computers.

4.3 Statistical Analysis

4.3.1 Frequency Tables for information obtained from students.

Table 4.3: Drives identified with problems and causes of slow processing speeds

Drive problems	Count	Pct of Responses
Absence of CD/DVD drive	30	63.8
Insufficient USB port	5	10.6
Absence of hard disk/motherboard	3	6.4
Unknown password	2	4.3
Low memory	7	14.9
Total responses	47	100.0
Reasons for slow speeds		
Old computers	17	20.5
Overloading computers	8	9.6
Low speed processor	8	9.6
Poor maintenance	7	8.4
Low memory	6	7.2
Old version windows	2	2.4
Virus attack	32	38.6
Trouble shooting problem	1	1.2
Over usage	1	1.2
Don't know	1	1.2
Total responses	83	100.0

Fig.2 shows that majority of the computers have floppy disk drives making a percentage of 35% followed by cd/dvd drives comprising 32.7%, and finally the USB drive/port with 29.6%. Other auxiliary storage devices carry a negligible percentage of about 3%. The computers low memories have an attribute of 14.9%, cd/dvd drives and USB port problems contribute 63.3%, and 10.6% respectively. While problems associated with the motherboard contribute to 6.4%. Unknown passwords take 4.3% of the general inefficiency of the computers as shown on Table 4.3. The slow speed is attributed to 38.6% virus attack , 20.5% being old computers, 9.6% low speed processors , 9.6% overloading the computers , 8.4% poor computer maintenance and 7.2% low memory

capacity . While other cause likes use of old version windows contribute to 6% to the slow operation of the computers.

Table 4.4: Reasons for frequent computer freezes and solutions

Frequency of computer freezes	Count	Pct of Responses
Low memory	8	14.3
Poor maintenance	6	10.7
Overloading computers	4	7.1
Don't know	4	7.1
Virus attack	30	53.6
Old computers	2	3.6
Low speed processor	1	1.8
Obsolescence	1	1.8
Total responses	56	100.0
How to address the freezing problem		
Installing antivirus	44	77.2
Upgrading frequently	7	12.3
Set strict rules	2	3.5
Insert removable disk	1	1.8
Format cds/disks	2	3.5
Purchase new version	1	1.8
Total responses	57	100.0

The cause of computer freezing and hugging behaviors is attributed to 53.6% virus attack, 14.3% low memory capacity and 10.7% poor computer maintenance. Other causes like use of old computers and obsolescence contribute to 21.4%. This information is given in Table 4.4.

Results of fig.3 show the rate of computer virus attack in which 69.8% of the computers in TTIs for IT training frequently suffer from this problem making them unreliable while 30.2% of the computers have full protection against the virus menace. Solutions to this problem are outlined as follows: 77.2% installation of antivirus, 12.3% upgrading frequently, 3.5% setting strict rules and 3.5% formatting the hard disk drive. Other

measures take 3.5% as outlined on table 4.4.

Table 4.5: Computer monitor screens and their quality in the training workstations.

Type of computer monitor screen		Count	Pct of Responses
	Flat screen(LCD)	11.0	11.0
	Concave screens(CRT)	85.0	85.0
	Both	4.0	4.0
	Total	100.0	100.0
How quality of LCD/CRT affects learning			
Flicked screen		6	15.4
Occupy larger space		8	20.5
Low memory		8	20.5
Eye problem		1	2.6
Heat generation by concave screens		5	12.8
Don't practice		2	5.1
Slow speed		1	2.6
Sharing computers		8	20.5
Total responses		39	100.0

The quality of computer displays/monitor screens is described by table 4.5 in which 85% of the computers have cathode ray tube screens while 11% are of liquid crystal display. In some institutions, 4% representation of both displays was found to exist. IT training is also affected by the quality of the monitor screens. 12.8% is attributed to heat radiation from the screen, 15.4% flicking screens and 20.5% large space occupied by the CRT screens.

Table 4.6: Nature of problems associated with keyboards and mouse

Problems of keyboards	Count	Pct of Responses
Broken pins at the port	1	6.7
Some batons not working	1	6.7
Character not visible	2	13.3
Poor maintenance	2	13.3
Old models	9	60.0
Total responses	15	100.0
Problems of Mouse		
Poor maintenance	6	20.0
Have broken pins at the port	3	10.0
Cursor is failing to move	2	6.7
Old models	19	63.3
Total responses	30	100.0

The percentage quality of the keyboards shows that majority of the keyboards, 77.8%, are perfect while only 22.2% are defective. The problems associated to the keyboards are as a result of 60% old keyboard models, 13.3% worn out/missing characters, and 13.3% poor maintenance while other causes contribute to 13.4% as shown on the table above.

The causes of problems associated with mouse are outlined as 63.3% old models, 20% poor maintenance, 6.7% failure of the cursor to navigate. Other causes contribute to 10% as shown from the table above. Besides the factors discussed above associated with the computers, which affect the effectiveness of IT training, other causes include congested classrooms with students sharing computers and use of old model computer CPUs.

Table 4.7: Incompatible Devices with computers in use for IT training.

Incompatible Devices	Count	Pct of Responses
Audio devices	9	32.1
Printers	6	21.4
Scanners	7	25.0
They are disabled	2	7.1
Don't know	3	10.7
High Capacity RAM	1	3.6
Total responses	28	100.0
Inability to run new application program versions		
Inventor 2008	3	13.0
V.P PageMaker	4	17.4
Adobe page maker	3	13.0
Microsoft office 2007	1	4.3
Visual basis 2007	1	4.3
Windows XP2	1	4.3
Excel 2007	1	4.3
Access 2007	2	8.7
CR 17	1	4.3
AUTO CAD 2007	5	21.7
Internet Explorer	1	4.3
Total responses	23	100.0

Table 4.7 shows compatibility percentages. In this case, 32.1% of the computers are not compatible with audio-devices, 25% scanners, 21.4% printers and 7.1% are disabled. In general, it is deduced that 58.4% of the computers can not run some application programs while 41.6% do. Table 4.7 gives the percentages as 21.7% of the computers can't run AutoCad, 17.4% VP page maker, 13% Adobe page maker and 8.7% Access. Other programs which can't be run by the computers comprise 21.5%. From fig.4, it emerged that 57% of the computers are connected to uninterruptible power supply while 43% were not. Appendix L shows the factors which make the computers fail to run IT required

software examined by KNEC are 40% low system memory and 30% virus attack. Other factors contribute to 30%. Similarly, 81.8% of the computers run much slower on newer software while 18.2% of them have failed to run the necessary KNEC IT software.

4.3.2 Frequency Tables for information obtained from teachers.

Table 4.8: IT practical lessons

Factors affecting IT good performance.		Frequency	Percent	Valid Percent
Valid	Inadequate time allocated for IT practical sessions	2	16.7	33.3
	Inefficiency of the computers in use	1	8.3	16.7
	Many programs	3	25.0	50.0
	Total	6	50.0	100.0
Missing	System	6	50.0	
Total		12	100.0	
Nature of the computer inefficiency.				
Valid	Lack of appropriate software	1	8.3	50.0
	Virus attack	1	8.3	50.0
	Total	2	16.7	100.0
Missing	System	10	83.3	
Total		12	100.0	
Other causes				
Valid	Few workstations	3	25.0	100.0
Missing	System	9	75.0	
Total		12	100.0	

The challenges facing modern IT training could be associated with33.3% inadequate time allocated for IT practical lessons, 50% many programs to train learners and 16.7% inefficiency of the computers in use. The major cause of computer inefficiency, which emerged during the study, was 50% inappropriate software. Also inadequacy of computers has adversely affected the achievement of IT training objectives, particularly the practical lessons. 33% of the computers lack essential hardware while 50% of them

were to be upgraded to install new operating systems.

Table 4.9: Modes of computer interfacing

Computer Installation		Frequency	Percent	Valid Percent
Valid	Networked	10	83.3	83.3
	Stand-alone	2	16.7	16.7
	Total	12	100.0	100.0
Internet served				
Valid	Yes	8	66.7	66.7
	No	4	33.3	33.3
	Total	12	100.0	100.0
ICT Centre served				
Valid	Yes	5	41.7	45.5
	No	6	50.0	54.5
	Total	11	91.7	100.0
Missing	System	1	8.3	
Total		12	100.0	

Table 4.9 indicates that 83.3% of the workstations are networked with only 16.7% installed as stand alone. 33.3% of the workstations are not internet served while 66.7% are. Again, 54.5% of the workstations are not served from an ICT center leaving 45.5% being served from an ICT center.

In investigating and analyzing these variables with reference to IT training, the researcher noted that better results of computer performance on internet services largely depended on the internet service provider and the capacity of kilobytes per second accessible which was an indication of the speed of accessing information and the amount of time either

saved or lost during the training sessions.

Table 4.10: Memory Capacities and Processing speeds.

SERVER CAPACITIES **Main server**		Frequency	Percent	Valid Percent
Valid	1 GB	4	33.3	50.0
	256 GB	1	8.3	12.5
	512 GB	3	25.0	37.5
	Total	8	66.7	100.0
Missing	System	4	33.3	
Total		12	100.0	
Application server				
Valid	1 GB	1	8.3	33.3
	512 GB	1	8.3	33.3
	256 GB	1	8.3	33.3
	Total	3	25.0	100.0
Missing	System	9	75.0	
Total		12	100.0	
CPU SPEEDS **Branded computers**				
Valid	1.2ghz	1	8.3	9.1
	1.8ghz	1	8.3	9.1
	2.0ghz	3	25.0	27.3
	2.2ghz	1	8.3	9.1
	3.0ghz	4	33.3	36.4
	3.2ghz	1	8.3	9.1
	Total	11	91.7	100.0
Missing	System	1	8.3	
Total		12	100.0	
Cloned computers				
Valid	1.5ghz	2	16.7	50.0
	2.6ghz	1	8.3	25.0
	3.0ghz	1	8.3	25.0
	Total	4	33.3	100.0
Missing	System	8	66.7	
Total		12	100.0	

From the above data, it is shown that main servers have the following capacities; 50% 1GB, 37.5% 512MB and 12.5% 256 MB. The average processing speed of these servers is 2.0ghz. Such speed is 66.7% adequate in coverage of IT practical lessons in executing application programmes examinable by KNEC.

Table 4.11: Analysis of Branded and Cloned computers.

HARD DISK Capacities **Branded computers**		Frequency	Percent	Valid Percent
Valid	20GB	3	25.0	25.0
	40GB	3	25.0	25.0
	80GB	6	50.0	50.0
	Total	12	100.0	100.0
Cloned computers				
Valid	20GB	5	41.7	100.0
Missing	System	7	58.3	
Total		12	100.0	
RAM Capacities **Branded computers**				
Valid	32kB	1	8.3	9.1
	64kB	1	8.3	9.1
	256kB	2	16.7	18.2
	512kB	4	33.3	36.4
	1 GB	3	25.0	27.3
	Total	11	91.7	100.0
Missing	System	1	8.3	
Total		12	100.0	
Cloned computers				
Valid	4kB	1	8.3	20.0
	64kB	1	8.3	20.0
	126kB	2	16.7	40.0
	256kB	1	8.3	20.0
	Total	5	41.7	100.0
Missing	System	7	58.3	
Total		12	100.0	

On the system memory, vast branded computers have 36.4% 512KB, 27.3% 1GB and 18.2% 256KB. Other capacities make 18.1%. The cloned computers were found to have 40% 126KB, 20% 256KB, 20% 64KB and 20% other capacities (table 4.20). 44.4% of

these capacities are not adequate for IT training. The hard drives of the branded computers have percentage of 50% 80GB, 25% 40GB and 25% 20GB. While majority of the cloned computers have capacities of 20GB. 45.5% of the hard disk capacity is inadequate for IT training with only 54.5% being adequate.

Table 4.12: Computer Generations and operating Systems

CPU generations **Branded computers**		Frequency	Percent	Valid Percent
Valid	Pentium 1	2	16.7	18.2
	Pent.3	8	66.7	72.7
	Pent 4	1	8.3	9.1
	Total	11	91.7	100.0
Missing	System	1	8.3	
Total		12	100.0	
Cloned computers				
Valid	Pent.2	3	25.0	75.0
	Pent.3	1	8.3	25.0
	Total	4	33.3	100.0
Missing	System	8	66.7	
Total		12	100.0	
Operating Systems **Branded computers**				
Valid	Win Vista	5	41.7	41.7
	Win XP 2	7	58.3	58.3
	Total	12	100.0	100.0
Cloned computers				
Valid	Win XP 2	5	41.7	100.0
Missing	System	7	58.3	
Total		12	100.0	

Most of the computers, 72.7%, in use for IT training, have Pentium 3 microprocessor for the branded while majority of the cloned computers have Pentium 2 microprocessors. Also 41.7% of the branded computers run on Win Vista operating system while 58.3% operate on Win XP2. A high percentage of the cloned computers operate on Win XP2 with very few cases of Win Vista. It is noted that the users of these computers, both

branded and cloned, find Win Vista and Win XP2 being adequate for IT courses as observed from table 4.12.

4.4 Statistical Hypotheses

4.4.1 Research Hypothesis One:

There is no significant difference between the processing speeds of older version computers in public technical training institutions and that of a modern computer.

In investigating this research hypothesis, the researcher had sought to establish if the processing speeds of the computers meant for Information Technology training in public technical training institutions were adequate for syllabus coverage, particularly the practical lessons. The results of this variable are as shown on table 4.22 and 4.23 for both branded and cloned computers respectively.

The researcher obtained such information as frequencies and therefore Chi-square test became an ideal method for analysis. The percentage counts for both cases, i.e. branded and cloned computer, on whether these speeds were adequate for IT training, the frequencies revealed that there is a significant difference between the computer speeds of older version computers and that of a modern computer in terms of IT syllabus coverage.

Adequacy of the CPU speeds, currently in use for I T training, in terms of syllabus coverage particularly the practical lessons:

Table 4.13: Branded-CPU Speed.

			Branded-CPU Speed						Total
			1.2ghz	1.8ghz	2.0ghz	2.2ghz	3.0ghz	3.2ghz	
Do you find these speeds adequate for IT training in terms of syllabus coverage particularly the practical lessons?	Yes	Count	2	0	0	2	8	2	14
		% within Do you find these speeds adequate for IT training in terms of syllabus coverage particularly the practical lessons?	14.3%	.0%	.0%	14.3%	57.1%	14.3%	100.0 %
		% of Total	9.1%	.0%	.0%	9.1%	36.4%	9.1%	63.6%
	No	Count	0	2	6	0	0	0	8
		% within Do you find these speeds adequate for IT training in terms of syllabus coverage particularly the practical lessons?	.0%	25.0%	75.0%	.0%	.0%	.0%	100.0 %
		% of Total	.0%	9.1%	27.3%	.0%	.0%	.0%	36.4%
Total		Count	2	2	6	2	8	2	22
		% within Do you find these speeds adequate for IT training in terms of syllabus coverage particularly the practical lessons?	9.1%	9.1%	27.3%	9.1%	36.4%	9.1%	100.0 %
		% of Total	9.1%	9.1%	27.3%	9.1%	36.4%	9.1%	100.0 %

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	22.000(a)	5	.001

11 cells (91.7%) have expected count less than 5. The minimum expected count is 0.73.

Table 4.14: Cloned-CPU Speed.

			Cloned-CPU Speed			Total
			1.5ghz	2.6ghz	3.0ghz	
Do you find these speeds adequate for IT training in terms of syllabus coverage particularly the practical lessons?	Yes	Count	0	2	2	4
		% within Do you find these speeds adequate for IT training in terms of syllabus coverage particularly the practical lessons?	.0%	50.0%	50.0%	100.0%
		% of Total	.0%	25.0%	25.0%	50.0%
	No	Count	4	0	0	4
		% within Do you find these speeds adequate for IT training in terms of syllabus coverage particularly the practical lessons?	100.0%	.0%	.0%	100.0%
		% of Total	50.0%	.0%	.0%	50.0%
Total		Count	4	2	2	8
		% within Do you find these speeds adequate for IT training in terms of syllabus coverage particularly the practical lessons?	50.0%	25.0%	25.0%	100.0%
		% of Total	50.0%	25.0%	25.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.000	2	.018

The Pearson chi-square analysis for the two cases has significant values below significant level of 0.05, i.e. branded computers = 0.001 and cloned computers = 0.018, leading to

the rejection of the null-hypothesis. Thus, there is a significant relationship between the processing speeds of the older version computers and coverage of IT course content.

4.4.2 Research Hypothesis Two:

There is no significant difference between the system memories of older version computers in public technical training institutions and that of a modern computer.

t-Test

Table 4.15 (a) **One-Sample Statistics**

	N	Mean	Std. Deviation	Std. Error Mean
Computer Memories in Technical Training Institutions	91	521.14	353.461	37.053

(b) **One-Sample Test**

	Test Value = 1024 (Memories of Modern Computers)					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Computer Memories in Technical Training Institutions	-13.571	90	.000	-502.857	-576.47	-429.25

In reference to this research hypothesis, the researcher had looked at various memory capacities of the computers in public TTIs in comparison of a modern desktop computer whose capacity was 1GB RAM and 160GB hard disk. Since the data involved in this case resulted to mean values, then t-test analysis became appropriate to establish if there was any significant difference between the two means. The t-test value, -13.571, obtained was less than the critical value and therefore the null hypothesis was rejected. Hence, the

results show that there is a significant difference between the system memories of older version computers in public TTIs and that of a modern computer.

4.4.3 Research Hypothesis Three:

The older version computers in public technical training institutions are not able to run the latest versions of information technology software examined by Kenya National Examination Council.

On discussing this hypothesis, the researcher established details of the computers for different characteristics which included Branded CPU speed, Cloned CPU speed, Branded processor type, Cloned processor type, Branded RAM size, Cloned RAM size, Branded HDD and Cloned HDD.

The results of this research hypothesis address the capability aspect of the computers in public technical training institutions to run newly developed programs. The percentage counts for branded and cloned computers for the CPU speed variables had results showing that the branded computers have a significant value of 0.743 while that of cloned computers is 0.901.

When the variable; type of processor of the computers was considered, the percentage count results and chi-square test results show that the branded computers have a significant value of 0.766 while that of cloned computers is 0.946. The RAM size variables yielded significant values of 0.638 and 0.647 for both branded and cloned computers respectively. To test this hypothesis further, the variable of HDD sizes indicated significant values of 0.525 and 0.868 for both cases, branded and cloned

computers respectively. In all these tests, the significant values obtained were above 0.05. Hence, the null hypothesis was rejected.

4.4.4 Research Hypothesis Four:

There is no significant relationship between exam performances in Information Technology courses when using either an older version computer or a modern computer.

Table 4.16: The general IT end course exam student's performance for practical sessions

			When using:			Total
			Older version computers	Modern computers	Both	
The general performance of students in IT end course exam for practical sessions.	Good	Count	2	6	2	10
		% within the general performance of students in IT end course exam for practical sessions.	20.0%	60.0%	20.0%	100.0 %
		% of Total	8.3%	25.0%	8.3%	41.7%
	Average	Count	0	2	10	12
		% within the general performance of students in IT end course exam for practical sessions.	.0%	16.7%	83.3%	100.0 %
		% of Total	.0%	8.3%	41.7%	50.0%
	Not applicable	Count	2	0	0	2
		% within the general performance of students in IT end course exam for practical sessions.	100.0%	.0%	.0%	100.0 %
		% of Total	8.3%	.0%	.0%	8.3%
Total		Count	4	8	12	24
		% Within the general performance of students in IT end course exam for practical sessions.	16.7%	33.3%	50.0%	100.0 %
		% of Total	16.7%	33.3%	50.0%	100.0 %

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	19.667	4	.001

In investigating this research hypothesis, the researcher looked at two categories of computers, namely modern and older version. This variable yielded the results given on table 4.33. The Pearson chi-square test indicated a significant value of 0.01 as shown on the table. This value is below the significant level of 0.05 and therefore the null hypothesis was rejected. The result establishes the fact that there is a significant relationship between the general performance of students undertaking IT courses and the type of the computers used, whether older version or modern.

4.5 Summary Results from Interviews

In order to study and understand the issues researched well, the researcher carried, out open interviews for two categories of samples, namely; ICT administrators and IT teachers. The first case was to establish the state-of-the art computer technology to outline the characteristics of a modern computer while the second case intended to determine the extent to which such new technologies are finding way into classrooms for IT training at the appropriate time before being deemed obsolete.

The results from the ICT administrators interviews reveal that Pentium 3 and below microprocessors can not handle 65% of the application programs that are run by a modern computer of Pentium 4 – Xeon. This is due to the memory capacities required, change in computer architecture and the inclusion of sophisticated/advanced features in these application programs. Lack of proper national ICT policies was cited as a major draw-back in acquiring modern computers for teaching and learning purposes.

Interview results from IT teachers show that 75% of the computers in use for IT training need to be upgraded or replaced with modern computers. Such computers were found to be slow and have low system memory capacities. Branded computers were preferred than cloned ones since they have proved to be stable and reliable. Maintenance and power surges were identified as major challenges. About 25% of the low level computers that were initially installed for IT training in these institutions have become obsolete as a result of frequent malfunctions and ineffectiveness in running the intended programs. Hence, they have been relegated to other departments for demonstration and experimentation purposes. These computer wastes continue to pile in such educational institutions and therefore it calls for a safe action to dispose such electronic waste.

4.6 Summary Results from Observations

The results from interviews and questionnaires could not give enough information about the state of IT training in public technical training institutions. Therefore, it was necessary for the researcher to carry out observations during the practical lessons. It was observed that the student computer ratio in most of the institutions was 4:1 resulting to computer overcrowding/congesting and mishandling. A few computers were observed to suffer from virus attacks and few could be seen to operate quite slowly. On access to internet, there was an established difference in terms of speed of browsing at different institutions. This difference was due to capacity of surfing provided by the internet provider. Thus, the institutions served by 256kbps were observed to lose handful time during their IT lessons compared to those served by 512kbps.

4.7 Summary of Descriptive Results

More than three-quarters percent of the students who participated in this study were studying IT training at diploma level. Slightly above half of the computers for IT training were found to have an operating problem which would affect the coverage of IT course defined by KNEC. These problems range from low system memory, lack of external drives, low speed, virus attack and overheating displays and towers. A number of the computers considered risk becoming obsolete since they could not run some recent programs which demand higher memory capacities and high speed CPUs. Majority of the computers are branded and a higher percentage of the workstations are networked as well as internet served. Pentium 3 and below microprocessor series were still found to be in use in technical training institutions for IT training and the results show that they are not suitable presently for such training.

CHAPTER FIVE

5.0 SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

Technological advancement in computer industry has been observed to impose vicious challenges on implementation of the new developments into learning institutions. The cost of adopting these changes is a major draw back which has resulted to third world and developing countries lag behind in such technologies. This has led to the use of out-dated computers in institutions. From the descriptive and statistical analysis results, it emerged that many educational institutions have continued to acquire/receive computers of older version which eventually become obsolete within a shorter time. The exposure of the IT students to the state-of-the-art computer technology has been pointed as the major challenge in IT training in majority of the public technical training institutions and by extension the entire IT training in most of educational institutions. This is due to the fact that computer technology is evolving faster than the institutions can afford to maintain or keep on track with by integrating/embracing these advancements as they occur.

5.2 Summary of finding

The findings from the study indicate that there exists a reasonably wider disparity in the computer specifications and consequently the performance of computers in public TTIs compared to that with the state-of-the-art technology (modern computer). In investigating the main research concern, ‘are the older version computers in public technical training institutions suitable for IT training currently?’ The researcher established the cases highlighted as follows; first, the research results show that there is a significant

relationship between the processing speeds of the older version computers and the coverage of IT, ICT and computer studies syllabi in educational institutions.

Secondly, results obtained from investigating system memory capacities of the older version computer in use in the public TTIs, the results reveal that there exist a significant difference between the system memories of the older version computers and that of a modern computer. Interestingly, these computers are able to run the required application programs for IT training. Finally, the findings show that there is a significant relationship between the general performance of the students in IT courses and the type of the computer used, whether branded or cloned. In this case, branded computers had a higher rating on performance compared to their cloned counterparts. The higher ratings was attributed to their property of being stable and reliable, and therefore have a longer life-span before becoming obsolete as a result of being ineffective on task performance.

The Chi-square (χ^2) and T-test values obtained for the statistical hypothesis tested were as follows. Hypothesis One has a significant χ^2 for the operating speeds. Hypothesis Two yielded a one-sample t-test value which was significant with respect to system memory capacities. The χ^2 value associated with Hypothesis Three was not significant on investigating the ability of the computers to run required application programs. Finally, in analyzing Hypothesis Four, the resultant χ^2 indicated a significant difference in exam performance when using either older version computers or modern computers.

Results from interviews indicated that there is a disparity of the computers used for IT training in public TTTs and what currently exist in the market in terms of specifications of main system parameters. Pentium 3 and below computers were totally found not suitable for quality computer skills training. Piling garbage of obsolete computers in the stores is an indicator of the challenges posed by this growing industry. Mechanical problems on the computers were observed to be prominent and adversely affected the lesson session as time was lost in fixing them and even some could totally fail to be fixed.

5.3 Conclusion

Referring to the previous discussions, the study noted the importance to upgrade the computers used for Information Technology training in Kenyan public technical training institutions. An overall replacement with modern computer sets could have been the appropriate action to be taken in order to link well the job market and the skill training. Lower cadre computers in these institutions can be relegated to the educational institutions (primary and secondary schools) training basic computers skills to minimize computer obsolescence and delay the problem of e-waste disposal.

Computer specifications should be a major concern for any set to make entry into the educational institutions; otherwise it might yet be another useless shell for somebody to make business out of it while leaving the receiving institutions disappointed. Better computer maintenance practice and added efforts to curb the computer virus menace must be a priority if the computers are to offer satisfying services for IT, ICT and Computer studies training.

5.4 Recommendations

To some extent and by implication, the study has established that there is need to evaluate the performance of the computers in the Kenyan public educational institutions in an attempt to retire those out of date in comparison with the major developments in this industry for quality and better training of IT, ICT and Computer studies in these institutions. The following are the recommendations:

i. Emphasis should be placed on use of branded computers for Information Technology training and computer related courses in all educational institutions.

ii. The Ministry of Education, Science and Technology should have a main server, just like yahoo and Google to serve all IT training institutions.

iii. Government to set appropriate policies defining the minimum specifications / characteristics, in accordance with developments in the computer industry, for computers entering into the country to avoid the country being used as dumping site for obsolete computers. If such well-meaning legislation is adopted and the educational institutions made aware of the real cost of 'free', donated, used, second-hand, recycled or refurbished computers, that will be deposited on the classroom doorsteps, computer obsolescence will be minimized.

iv. Establishment of ICT board, just like KASNEB and KNEC, to monitor/oversee IT and related training in educational institutions to ensure up to date training since it is a major pillar in attaining Millennium goals and Vision 2030.

v. Computers in tertiary educational institutions that have exceeded their lifespan may be redeployed for other use or offered to needy students in other schools or be given to government organization offices for basic computer entries.

5.5 Suggestions for further Research

1) An institution or individual to implement the recommended networking of Ministry of Education, Science and Technology server.

2) Development of internal updating antivirus system which will automatically generate an amorphous software to inhibit recent emerging virus attacks from adversely affecting the computer, rather than having being connected to the internet for updates especially in the case of laptops and PCs not served by internet. This will eliminate the cost of buying expensive antivirus software.

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APPENDICES

APPENDIX A: INTERVIEW I (for ICT administrators)

1. Apart from Pentium 4 microprocessor, currently is there a new version of the microprocessor chip? If so, what is the brand's name and its processing speed?

2. In your opinion, do you find microprocessors of versions Pentium 3 and below still meaningful/appropriate for IT applications?

3. What are the latest versions of:
    - Windows and Unix Operating Systems?
    - Ms-Word and Corel perfect Word processing?
    - Spreadsheet?
    - Database?
    - Desktop publishing?
    - Financial Applications?
    - Computer Aided Designs?

4. What are the current Hard Drive and RAM sizes of a modern desktop computer, adequate to run on the emerging new software which are memory intensive? What minimum capacities do you recommend as appropriate for a normal task execution for a desktop basically for IT training?

5. In relation to computers, how significant are the aspects of reliability and stability in affecting the effectiveness of the computer? Do these factors cause a relative lose of computing time?

6. What are the factors contributing to computer wastage in an institution utilizing ICT services?

THANKS, *God bless you*

***APPENDIX B**: INTERVIEW II (for IT tutors in technical institutes)*

1. What are the general malfunctions associated with your institutional workstations?

2. What are the major challenges in ensuring quality IT training in reference to the computers available in your institution?

3. What is your view about how effective are these computers considering the emerging computer technological changes for both software and hardware?

4. In your opinion on IT training in technical training institutions, referring to the quality of the computers currently in use, is there a need to upgrade them or even prescribe to new specifications?

5. How frequently do these computers become obsolete in the sense of completely being out of order or simply being out of date to run the necessary application programs, and how many of such computers are there in your institution?

THANKS FOR GIVING YOUR TIME

God bless you.

APPENDIX C: *QUESTIONNAIRE I (for IT tutors in institutes)*

Directions:

(i) This is a survey intended to establish how suitable are the current computers for Information Technology (IT) training considering the present high rate of computer obsolescence.

(ii) The computers hereby referred are those for IT training workstations.

(iii) Do not write your name on the questionnaire. All your responses will be treated with confidentiality. The study is strictly for academic purpose.

Kindly complete the questionnaire accordingly by ticking where appropriate or commenting on the space provided.

1. How many computers are in use for IT training in your institution? { }
2. How were the computers for IT training in your institution sourced/acquired?
   [a] through institutional purchasing [b] through donation. [c] both

3 Were these computers

   [a] new computers? [b] used / old computers? [c] both

3. Are these computers

   [a] cloned computers? [b] branded computers? [c] both

   If [a] please answer question 5 and if [b] answer question 6.

4. How many cloned computers are there? { }
5. How many branded computers are there? { }
6. If the answer to question 2 is [b], then were these computers refurbished by the dealers or the selling agent?

   [a] Yes [b] No [c] Not applicable

7. How is the general performance of students in the end course IT exam for practical sessions?

   [a] good [b] average [c] poor

8. If the performance is not appealing, what could be the cause? Could it be:

   [a] inappropriate time allocated for IT practical sessions during the course?

   [b] inefficiency of the computers in use?

   [c] state any other reason……

……..

9. If the answer to question 8 above is (b), state the nature of the inefficiency associated with the computers in use……..

……

……

10. Are the expectations (objectives) of the practical lesson lessons met within the time allocated?

[a] Yes [b] No

If No, please state the reasons……

……

11. Do these computers run on the latest operating systems like Windows XP (SP2) and Windows Vista?

[a] Yes [b] No

12. Are the computers able to run on the latest versions of application software like AutoCAD2004, Word 20006 among others?

[a] Yes [b] No

13. Do the computers run on the latest utility software (antivirus programs) versions of Norton, Avira, Macfee among others?

[a] Yes [b] No

14. Did the computers need to be upgraded to run on the desired OS that you are currently using?

[a] Yes [b] No

15. Do some of the computers have missing but necessary hardware like network card among others?

[a] Yes [b] No

If the answer is yes, state the missing hardware ……..

……

……

16. Are the computers:

[a] networked? [b] stand-alone?

17. Has any of the computers suffered from incompatibility with peripheral units like

mouse, keyboards, printer, scanners e.t.c?

[a] Yes [b] No

If yes, state the incompatible unit……

……

18. Has any of the computers been notoriously crashed by virus?

[a] Yes [b] No

If yes, was the virus successfully cleaned?

[a] Yes [b] No

If yes, are the computers operating effectively as they used to before the virus crash?

[a] Yes [b] No

19. How many computers are operating quite slowly? And why?

state { }, why……

…….

20. Does either of the computers run much slower on newer software?

[a] Yes [b] No

21. Has either of the computers failed to run any of the software that is necessary for IT courses (training) as required by KNEC?

[a] Yes [b] No

If yes, state why……

……

22. Are the computers internet served?

[a] Yes [b] No

23. Is the institution served from an ICT centre?

[a] Yes [b] No

If yes, answer question 24 and 25.

24. What does the ICT architecture in your institution comprise of?

[a] main server [b] application server [c] firewall

[d] log in server [e] internet server

[f] state any other…….

25. What are the memory capacities of the servers?

Main server { }, application server { }

(NB: for the questions that follow, tick against the variable in the cell of the table).

26 What are the CPU processing speeds? Indicate in the table below.

	1.2ghz	1.5ghz	1.8ghz	2.0ghz	2.2ghz	2.6ghz	3.0ghz	3.2ghz	3.6ghz
Branded									
Cloned									

(i) For any other range, state……..

(ii) Do you find these speeds adequate for IT training in terms of syllabus coverage particularly the practical lessons?

[a] Yes [b] No

If No, which CPU processing speed range do you recommend as appropriate for that matter? State { }

27. What are the processor types/series of these computers? Indicate in the table below.

	80188	80286	80386	80486	Pent. I	Pent.2	Pent.3	Pent.4	Xeon
Branded									
Cloned									

(i) For any other classification, state……

(ii) Do you find any inadequacy of the category you are using currently in coverage of the I.T content?

[a] Yes [b] No

If yes, state, in your opinion, the appropriate classification minimally required for that matter. { }

28. What are the RAM capacities/sizes of these computers? Indicate in the table below.

	4kB	8kB	16Mb	32Mb	64Mb	126Mb	256Mb	512Mb	1GB
Branded									
Cloned									

(i) For any other range, state……

(ii) Can these computers take a higher capacity of the RAM? Yes { } No { }

(iii) In your opinion, do you find these memory capacities adequate for successful IT training? [a] Yes [b] No

If No, then suggestively, what could be the appropriate RAM capacities for that matter? State { }

29. What is the system (Hard Disk) memory size of these computers? Indicate in the table

below.

	20GB	40GB	80GB	120GB	160GB
Branded					
Cloned					

(i) For any other range, state……

(ii) Do you find these memory capacities adequate for successful IT training?

[a] Yes [b] No

If No, then suggest the appropriate capacity. State { }

30. The computers are operating on which OS? Indicate in the table below.

	Win Vista	Win XP 2	Win 2003	Win 2000	Win 98	Win 95	Win 3.x	Ms – DOS6.x	Ms –DOS5. x
Branded									
Cloned									

(i)For any other version, state……

(ii) Do you experience any disadvantage in using the OS you have stated?

[a] Yes [b] No

If yes, state the disadvantage and comment on which OS could be

Appropriate. State { }

THANKS FOR PARTICIPATING. God bless you.

APPENDIX D: *QUESTIONNAIRE II (for IT students)*

Directions:

(i) This is a survey intended to establish how suitable are the current computers for Information Technology (IT) training considering the present high rate of computer obsolescence.

(ii) The computers hereby referred are those for IT training workstations.

(iii) Do not write your name on the questionnaire. All your responses will be treated with confidentiality. The study is strictly for academic purpose.

Kindly complete the questionnaire accordingly by ticking where appropriate or commenting on the space provided.

1. What level are you training for IT?
   [ ] Certificate
   [ ] Diploma
2. Which module of IT training are you currently studying?
   [ ] module I
   [ ] module II
   [ ] module III
3. Have you undergone computer studies there before?
   [ ] Yes
   [ ] No
4. Do the computers, that you are using for IT classes, have the following drives: (tick where applicable).
   [ ] floppy disk drive
   [ ] USB drive/port.
   [ ] cd/dvd drive.
   State any other…….....
5. Do either of the computers have problems with any of the drives in item number (4) above?
   [ ] Yes
   [ ] No
   If yes, state the drive and the nature of the problem.…….
   ……...
6. Do you find some of the computers operating quite slowly?
   [ ] Yes
   [ ] No
   If yes, what do you think is the cause? ……...
   ……
7. Do either of the computers freeze or slow to crawl all (hung) too often?
   [ ] Yes

[ ] No

If yes, what could be the cause? ……..

……

8. Do these computers crash often as a result of virus infections which lower their reliability in doing simple tasks?

[ ] Yes

[ ] No

If the answer is yes, what do you suggest to rectify this? ……...

……

9. What type of computer monitor screens are in use in your workstations?

[ ] flat screens {LCD}

[ ] concave screens {CRT}

[ ] both

10. Does the quality of any of the items in 9 above affect the I.T practical session time?

[ ] Yes

[ ] No

If yes, state how? ……..

……..

11. What is the quality/condition of the following peripheral input devices?

(i) keyboard [ ] satisfactory

[ ] not up to satisfactory

If not satisfying, describe the nature of the cause……..

……..

(ii) mouse [ ] satisfactory

[ ] not up to satisfactory

If not satisfying, describe the nature of the cause…….....

……

(iii) any other…….....

……..

12. Are these computers compatible with the necessary hardware like printers, scanners, audio devices among others?

[ ] Yes

[ ] No

If no, state the device that is incompatible? .....

13. Are there some application programs the computers can't run? [ ] Yes [ ] No

If yes, name the program(s) …….

14. Are the computers connected to Uninterruptible Power Supply (UPS)?

[ ] Yes [ ] No

15. Comment on the stability of the computers referring to power consumption from the mains supply and the Uninterruptible Power Supply (UPS):

(a)Do the computer tower and monitor feel reasonably hot on operation?

[ ] Yes [ ] No

(b) Do the UPS sustain the computers for some time to allow you finish your work?

[ ] Yes [ ] No

THANKS FOR PARTICIPATING. **God bless you**.

APPENDIX E: OBSERVATION FORM

OBSERVATION FORM

Class Level …….

Application Program ……..

Other relevant details ……

……...

	Parameter	Comment
1	Student computer ratio	
2	Booting and operation speeds (a) Branded (b) Cloned	
3	State of networking	
4	Internet served and reliability	
5	Computer virus attack/infection	
6	Computer freezing/crawling/hugging	
7	Number of non-operational computers used for IT training	
8	Number of totally 'dead' or obsolete computers once used for IT training	

APPENDIX F: PARAMETERS OF A MODERN COMPUTER

STATE – OF-THE ART COMPUTER TECHNOLOGY (up-to-date computer configurations).

1) Latest versions of :
    - Operating Systems.
        1) Windows: Win Vista/ Win server 2008
    - Application Programs examined by KNEC
        1) Word Processing: MS-word 2008
        2) Spreadsheet: MS-office 2008
        3) Database: MS-office 2008/MS-SQL 2005 Server
        4) Desktop Publishing: MS-suit 2008
        5) Financial Applications: SAGE/Quick books/Premier 2007
        6) Computer Aided Drawing: AUTO-CAD 2008
    - Utility software (antivirus programs)
        1) Symantec end point security 11.0

2) Current Memory capacities of:
    - RAM size: 1GB
    - Hard Disk size: 160GB
      (For a desktop computer tower)

3) Latest CPU Pentium series: Pentium IV – Xeon.

4) Current CPU processing speed: 3.0ghz

5) Computer screens: Flat screen: - Liquid Crystal Display.

6) The major computer makes: IBM, HP and Apple Macintosh.

8) In summary, the characteristics of a modern (up-to-date configured) computer are:
    - CPU Processing speed: 3.0ghz
    - System Memory size: 1GB
    - RAM size: 160GB
    - Operating System: Win Vista
    - Reliability & stability of the machine: Stable and reliable
    - Power consumption performance: Low power consumption.

APPENDIX G: LETTER OF TRANSMITTAL

15th March, 2008

TRANSMITTAL LETTER (letter of introduction).

Dear respondent,

The purpose of this study is to assess the suitability of the computers in training institutions for successful training of Information Technology courses. A major concern is on the older version computers encompassing the category of computers that lack the-state -of –the- art technology of a modern computer in terms of processing speed, memory size, power consumption, provision for upgrading among other advancing parameters.

The study intends to establish a common computer version (specification), necessitated by the high rate of computer obsolescence which currently is at an average of three years, for modern IT training to be at par with up to date computer hard/software developments. This will lead to a meaningful IT training required for quality computer skills in the modern world. Thus, the acquisition and use of refurbished/used computers should be based on minimum functional requirements in relation to the computer industry developments.

The established findings will be made available on request. Any information provided will be held confidential all times and anonymity will be adhered to the end and there after. This research is in pursuance of postgraduate academic requirements of Moi University. Reception of dully completed questionnaires will be appreciated by 25th June, 2008.

Katumbi N.M.
Moi University.

APPENDIX H: *LIST OF PUBLIC TECHNICAL TRAINING INSTITUTIONS.*

(TECHNICAL TRAINING INSTITUTIONS UNDER THE MINISTRY OF HIGHER EDUCATION, SCIENCE AND TECHNOLOGY).

NATIONAL POLYTECHNICS

1. The Kenya Polytechnic University College.
2. The Mombasa Polytechnic University College.
3. The Kisumu Polytechnic.
4. The Eldoret Polytechnic.

TECHNICAL TRAINING INSTITUTES

1. Bumbe Technical Training Institute.
2. Kabete Technical Training Institute.
3. Kaiboi Technical Training Institute.
4. PC Kinyanjui Technical Training Institute.
5. Kitale Technical Training Institute.
6. Machakos Technical Training Institute.
7. Maasai Technical Training Institute.
8. Mawego Technical Training Institute.
9. Meru Technical Training Institute.
10. Michuki Technical Training Institute.
11. Mombasa Technical Training Institute.
12. Nairobi Technical Training Institute.
13. N'kabune Technical Training Institute.
14. Nyeri Technical Training Institute.
15. Ol'lessos Technical Training Institute.
16. Rift Valley Technical Training Institute.
17. Sigalagala Technical Training Institute.
18. Thika Technical Training Institute.
19. North Eastern Province Technical Training Institute.

INSTITUTES OF TECHNOLOGY

1. Sang'alo Institute of Technology.
2. Rift Valley Institute of Science and Technology.
3. Kiambu Institute of Science and Technology.
4. Ramogi Intitute of Advanced Technology.
5. Gusii Intitute of Technology.
6. Murang'a College of Technology.
7. Siaya Institute of Technology.
8. Coast Institute of Technology.
9. Friends College Kaimosi Institute of Technology.
10. Moi Institute of Technology.
11. Rwika Technical Institute.
12. Kirinyaga Technical Institute.
13. Mathenge Institute of Technology.

14. Nyandarua Institute of Technology.
15. Kenya Technical Teachers' College.

APPENDIX I: RESEARCH TOOLS CONTROL SHEET

April, 2008

RESEARH TOOLS DISTRIBUTION CONTROL SHEET.

PILOTING	RESEARH TOOL	Kenya poly U C		Thika T T I	
		Issued	returned	Issued	returned
	Questionnaires (i) Teachers				
	(ii) Students				
	Interview guide (Teachers)				
	Checklist/Observation forms				

FIELD WORK	Nairobi TTI		Kenya TTC		Kabete TTI		pc Kinyanjui TTI		Kiambu IST	
	I	R	I	R	I	R	I	R	I	R
Questionnaires(i) Teachers										
(ii)Students										
Interview guide for IT Teachers										
Checklist/Observation form										

Key: I …….. issued

R ……. Returned

APPENDIX J: ADDITIONAL FIGURES

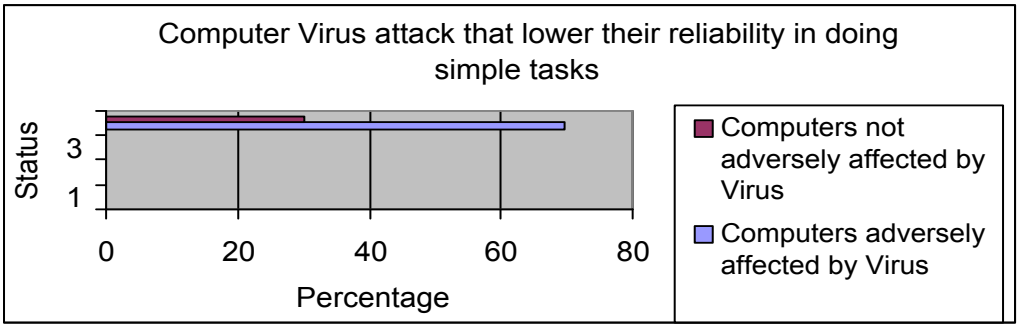

Fig. 2

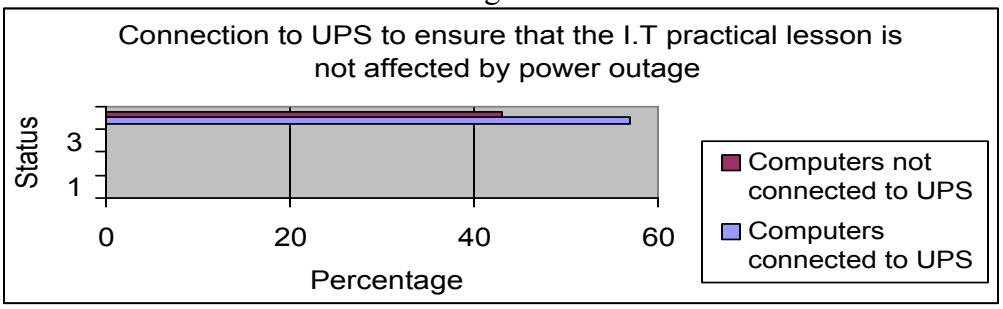

Fig. 3

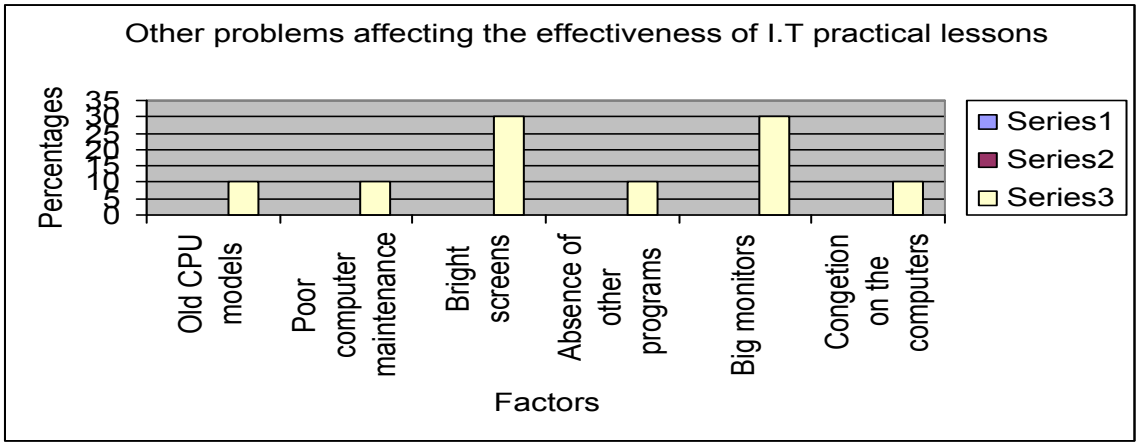

Fig. 4

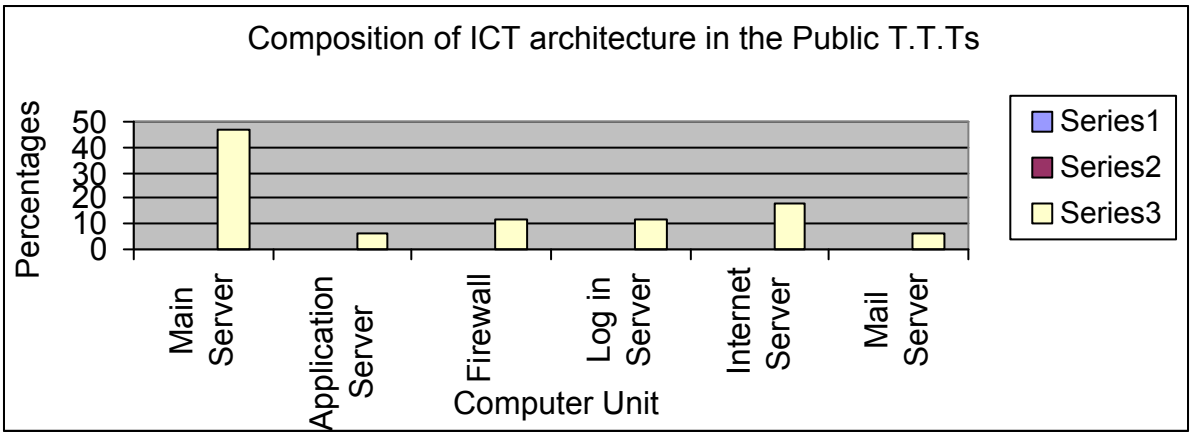

Fig. 7

APPENDIX L: ADDITIONAL TABLES

Branded-HDD Sizes.

			Branded-HDD Sizes			Total
			20GB	40GB	80GB	
Are there some application programs the computer can't run?	Yes	Count	10	11	24	45
		% within Are there some application programs the computer can't run?	22.2%	24.4%	53.3%	100.0%
		% of Total	13.0%	14.3%	31.2%	58.4%
	No	Count	10	5	17	32
		% within Are there some application programs the computer can't run?	31.3%	15.6%	53.1%	100.0%
		% of Total	13.0%	6.5%	22.1%	41.6%
Total		Count	20	16	41	77
		% within Are there some application programs the computer can't run?	26.0%	20.8%	53.2%	100.0%
		% of Total	26.0%	20.8%	53.2%	100.0%

Cloned-HDD Sizes.

			Cloned-HDD Sizes			Total
			20GB	40GB	120GB	
Are there some application programs the computer can't run?	Yes	Count	24	10	4	38
		% within Are there some application programs the computer can't run?	63.2%	26.3%	10.5%	100.0%
		% of Total	37.5%	15.6%	6.3%	59.4%
	No	Count	18	6	2	26
		% within Are there some application programs the computer can't run?	69.2%	23.1%	7.7%	100.0%
		% of Total	28.1%	9.4%	3.1%	40.6%
Total		Count	42	16	6	64
		% within Are there some application programs the computer can't run?	65.6%	25.0%	9.4%	100.0%

	% of Total	65.6%	25.0%	9.4%	100.0%

Analysis of the practical lessons

Factors affecting I.T training		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low memory	4	33.3	40.0	40.0
	Congestion of network	1	8.3	10.0	50.0
	Don't know	1	8.3	10.0	60.0
	None	1	8.3	10.0	70.0
	Virus attack	3	25.0	30.0	100.0
	Total	10	83.3	100.0	
Missing	System	2	16.7		
Total		12	100.0		
Percentage of computers unable to run KNEC I.T software		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	2	16.7	18.2	18.2
	No	9	75.0	81.8	100.0
	Total	11	91.7	100.0	
Missing	System	1	8.3		
Total		12	100.0		

Description of computers in use in public TTIs

Status of these computers on acquisition.		Frequency	Percent	Valid Percent
Valid	New computers	5	41.7	41.7
	Used/old computers	1	8.3	8.3
	Both	6	50.0	50.0
	Total	12	100.0	100.0
Branded or Cloned computers		Frequency	Percent	Valid Percent
Valid	Cloned computers	2	16.7	16.7
	Branded computers	4	33.3	33.3
	Both	6	50.0	50.0
	Total	12	100.0	100.0