



# Computer Technological Change and Its Implication on Information and Communication Technology Training: a Case of Selected Technical Training Institutions in Nairobi Area, Kenya

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**Abstract-**The more frequently Computer hardware and software technology is upgraded, the more computer obsolescence occurs. Educational institutions must keep in pace with these rapid technological developments being experienced in the computer industry for meaningful Information and Communication Technology training. As computer technology improves, 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. In Kenya, a number of cloned and branded computers are making entry into the classrooms for ICT 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. The data was collected from purposively sampled public technical training institutions offering ICT 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 ICT 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 ICT courses. Based on the findings, recommendation is made on the use of branded computers rather than cloned ones for ICT training. Suggestions for further research include trapping the computer virus menace.

**Keywords-** *ICT, Hardware & Software, Obsolescence, Branded & cloned, Practical ICT lesson*

## I. INTRODUCTION

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). Therefore, as pertains to information and communication technology training in technical institutions, purchasing or receiving of older version computer donations from these dealers and 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 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). 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). Thus, an effective computer in technical training institutions will enable adequate coverage of the ICT content matter within the specified total time for the practical lessons. These lessons comprise of Operating Systems, Word Processing, Spreadsheet, Database, Desktop Publishing, Financial Applications and Computer Aided Drawing.

## II. MATERIALS AND METHODS

The presenter embraced mixed- method approach in assessing the suitability of the older version computers in public technical training institutions, meant for 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). A cross- sectional 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 ICT training in public technical training institutions. This kind of inquiry in this study sought to establish the minimum older version computer specifications suitable for ICT content coverage in training institutions to ensure better performance in examinations and computer usage competency. In addition, the information obtained was 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 ICT training. 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 ICT 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. 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 research population comprised of all computers meant for ICT 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 study was conducted in computer laboratories of purposively sampled public institutions which offer ICT courses and computer studies. It 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. Questionnaires, Interview Protocols and Observation forms were used as research instruments. The significance and relationships were tested at  $\alpha = 0.05$  to give a confidence level of 95 percent. The statistical package for social sciences (SPSS) was used to analyze the descriptive data.

## III. RESULTS AND DISCUSSIONS

The responses indicated that a number of the institutions continue to maintain or receive computer donations which are either new or used. A mixture of branded and cloned computers is found in majority of the institutions considered.

TABLE I. PERCENTAGE PREFERENCE OF THE TYPE OF COMPUTERS FOR ICT 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

The major causes of computer hanging were the virus infection, low memory and poor hardware and software maintenance as shown on table 2. This problem could be overcome by installing antivirus and upgrading both the hardware and software.

TABLE II. REASONS FOR FREQUENT COMPUTER FREEZES AND SOLUTIONS

Frequency of computer freezes	Count	Percentage 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

A number of computers were found not to be compatible with modern printers and scanners as well as audio devices that are useful in enhancing the process of learning and teaching of the ICT content matter. Similarly, new version application software were found not to run on the lower version computer hardware on use for ICT training which makes it difficult to

acquire competency on these application software when using the older version computers.

TABLE III. INCOMPATIBLE DEVICES WITH COMPUTERS IN USE FOR ICT TRAINING

Incompatible Devices	Count	Percentage 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
<b>Inability to run new application program versions</b>		
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 IV. MODES OF COMPUTER INTERFACING

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

In investigating and analyzing these variables with reference to ICT 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.

The memory capacities for most of the computers, servers and standalone work stations, were found to be lower than that of a modern computer system. This affects the ability of the computer to run and host memory intensive new version software, both application and system software. The operating speeds of the branded computers were found to be higher than that of the cloned computers which make them more suitable than the cloned computers for ICT training.

TABLE V. MEMORY CAPACITIES AND PROCESSING SPEEDS

Server Capacities		Frequency	Percent	Valid Percent
<b>Main server</b>				
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	
<b>Application server</b>				
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	
<b>CPU Speeds</b>				
<b>Branded computers</b>				
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	
<b>Cloned computers</b>				
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	

TABLE VI. 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	

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 ICT courses as observed from table 6.

#### IV. STATISTICAL HYPOTHESES

Adequacy of the CPU speeds, currently in use for ICT training, in terms of syllabus coverage particularly the practical lessons; the results from the research showed that there is a significant relationship between the processing speeds of the older version computers and coverage of ICT course content.

Disparity in the system memories of older version computers in public technical training institutions and that of a modern computer; the results indicated that there is a significant difference between the system memories of older version computers in public TTIs and that of a modern computer.

Ability of the older version computers in public technical training institutions to run the latest versions of information technology software examined by Kenya National Examination Council; in the tests done for this case, the significant values obtained were above 0.05 which shows that the older version computers in use for ICT training are able to run the latest ICT application software.

Relationship between exam performances in Information and Communication Technology courses when using either an older version computer or a modern computer; the result establishes the fact that there is a significant relationship

between the general performance of students undertaking ICT courses and the type of the computers used, whether older version or modern.

Interview results from ICT teachers showed that 75% of the computers in use for ICT 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 ICT 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.

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 ICT lessons compared to those served by 512kbps.

A.

Slightly above half of the computers for ICT training were found to have an operating problem which would affect the coverage of ICT 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 ICT training and the results showed that they are not suitable presently for such training.

#### V. 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 ICT 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 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 ICT training. Finally, the findings show that there is a significant relationship between the general performance of the students in ICT 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.

A resultant Chi-square test indicated a significant difference in exam performance when using either older version computers or modern computers. 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 and / or embracing these advancements as they occur.

Results from interviews indicated that there is a disparity of the computers used for ICT training in public TTIs 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.

## VI. CONCLUSION

Referring to the previous discussions, the study noted the importance to upgrade the computers used for Information and Communication 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.

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

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