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E2012-23: NEPAD e-School Project: The Kenyan Case

Mugoh D. Gitumu
Karatina University College, davidgm200@yahoo.com

Abstract

In July 2001, during the 37th summit of the Heads of States the African Union (AU) adopted an integrated social-economic development framework for African renewal called the New Partnership for African Development (NEPAD). The objectives of NEPAD were well linked to the millennium development goals but centered around eradicating poverty levels in Africa, accelerating sustainable development, and halting the marginalization of Africa from the globalization process. These objectives would be achieved through capacity building and improvement of infrastructure in ICT, education, energy, transport and health sectors.

An offshoot from NEPAD was a program known as the "NEPAD e-School Project" which was born and launched in Durban South Africa, at the African Summit of the World Economic Forum, in June 2003.The NEPAD e-school project aims at imparting ICT skills to primary and secondary schools, and harnessing ICT technologies to improve, enrich and expand access to education in Africa. Sixteen (16) countries acceded to the memorandum of understanding of NEPAD peer review mechanism and the pilot phase was launched in Algeria, Burkina Faso, Cameroon, Congo, Egypt, Gabon, Kenya, Lesotho, Mali, Mauritius, Mozambique, Niger, Rwanda, Senegal, South Africa and Uganda. In Kenya, the pilot phase was initiated in six (6) Kenyan secondary schools in the year 2004. During the pilot phase, the program has registered achievement and challenges that

this paper wishes to address. The paper explores and reviews the extent of use of ICT in the classroom, examines and provides data related to access of ICT equipment by students, analyses the competencies of the teaching staff in ICT integration, and describes the environmental acceptability of the NEPAD e-school initiative by the school community. The paper ends by giving its recommendations to individuals and institutions wishing to fund future ICT programs for schools in Kenya and in Africa.

BACKGROUND

Introduction

This study sought to obtain data on the success and challenges facing the NEPAD's e-School project in Mumbi Girls' secondary school in Murang'a District of Central Province, Kenya. The study explored the extent to which the e-learning facilities are being used to facilitate learning during science lessons. The study further sought to find out the extent of teacher preparedness in the use of the e-School facilities in Kenyan Secondary schools. ICT simply means information communication and technology. ICT can be seen to encompass a wide range of technologies including telephone, fax machines, televisions, video, compact disk (CD) players, compact disk read only memory (CDROMs) players, personal organizers, programmable-remote operated toys, as well as computers (Ohara 2004:ix). In the early years of its development, ICT was formally known as Information Technology (IT), and widely revolved around the computer itself. However today, computers form only a component of ICT. While the term ICT was used in this study, the term computer has frequently been used, without suggesting that the wider context of communication and other related equipment are being omitted or overlooked.

Though appearing as a new concept, ICT can be traced back into antiquity, about a hundred thousand (100,000) years ago, when **Homo sapiens** begun using intelligence to meet and further his goals. The first recorded ICT device is the abacus, believed to have been made in the oriental China, around 3,000 B.C. The abacus, a primitive calculating device, was a bead and frame device which was developed for adding large sets of numbers. Although the abacus is credited to the oriental China, the ancient Babylonians are known to have used series of lines on sand and stones on a wood platform to make calculations. The idea of the ancient Babylonians was harnessed by the Chinese to make the abacus, an amazing accurate ancient calculating device that is still popular today (William 1995: A1).

The abacus remained the primary calculating device through the early human history. Two thousand years (2,000) years later, water clocks were made in China, Egypt and Assyria. The records of the works of Plato reveal inclination of the human thought towards the mechanics of machines. At around 415 B.C., Plato founded an academy for the pursuit of science and philosophy, an institution which formed a fertile ground for the development of mathematical theory. The outcomes of the academy was solid geometry, concepts which resulted to production of more elaborate automata during the European renaissance (William 1995).

Since the time of Plato, the world of computing showed tremendous innovations leading to the development of new hardware, software and applications. Computers found specific applications in business, industry, government institutions and amongst wealthy individuals. This exciting technology has also descending onto our learning institutions, where it has found interesting application in school administration, delivery of classroom instructions and pedagogy, and has opened new frontiers of knowledge, such as computer science and computer electronics. More so the school children are today growing up in societies with widespread desire to use technological devices. This positive attitude can be harnessed for an educational advantage (Ohara 2004). With the increased craving for ICT in education, the New Partnership for African Development (NEPAD) vision for e-School was born. The NEPAD e-School initiative aims at imparting ICT skills to young African primary and secondary schools, and harnessing ICT technologies to improve, enrich and expand education in African countries. A body called “the Information Society Partnership for African Development” (ISPAD) was selected as the vehicle for the private sector involvement in the NEPAD e-School initiative. ISPAD would bring together fiscal, human resources, ICT infrastructure, curriculum material for the private sector partners and the civil society, so as to merge them to the Africa e-School initiative. The private partners identified by ISPAD have already initiated pilot projects in sixteen (16) countries that acceded to the memorandum of understanding of the NEPAD African peer review mechanism. ISPAD was mandated to organize and manage the project. The NEPAD e-School project set up its objectives. First, the e-School projects endeavored to provide a hardware infrastructure such as computers, radios, Television set, communication equipment, scanners and copy printers to African schools. For all the equipment, appropriate software was provided. Secondly, the e-School project aims at providing African schools with connectivity to the internet, while providing satellite networking of all schools in the continent. The project also aims at providing ICT training for teachers while

mobilizing the community to be involved and own the e-School ICT project. Lastly, the project focuses its efforts towards proving a health point within the school. The NEPAD e-School project was to be executed in a period of ten (10) years, with secondary schools being completed in the first five (5) years, which was to end in June 2008. Over six hundred thousand (600,000) schools in Africa were set to benefit.

In Kenya, the NEPAD e-School project was launched in the year 2004. The pilot phase is in progress in six (6) Kenyan secondary schools, namely Mumbi Girls in Murang'a District of Central Province, Isiolo Girls, Isiolo District of Eastern Province, Menengai High School in Nakuru District of the Rift valley province, Chavakali High school, Western Province, Wajir High School of the North Eastern province, and Malanda Secondary School in the Coast Province.

Statement of the problem

The NEPAD e-School project is a welcome idea aimed at automating the schools' operation in line with the technological advances taking place globally. The program, which is at its fourth year of the pilot phase, has registered profound achievements. However the project faces challenges and obstacles that needed to be documented and addressed. More so, no study has been done to document the competence and willingness of teachers in utilizing the NEPAD e-School facilities.

Objectives of the study

a) To document the e-School hardware and software equipment at Mumbi Girls' secondary school, and relate them to access of the e-School technology to teachers and students
b) To find out the extent to which the e-School facilities are being used for classroom instruction during science lessons
c) To find out the extent to which the science teachers are trained to handle the e-School facilities

Delimitations of the study

a. Being a case study, the study was done in one NEPAD e-school only - Mumbi Girls secondary school. The sampling was done with regard to the limitation of time available for the research work and distance between the researcher and other NEPAD e-Schools, However, the findings of this study are expected to reveal the scenario being experienced in other NEPAD e-Schools which were not involved in the study.
b. A larger sample size, which would be more representative, could not be obtained for the study. The sample size was by virtue limited to the number of science teachers that Mumbi Girls' secondary school has.

c. The study school was selected for the fact that it is under the NEPAD e-School program. Other schools under different ICT programs were not involved in the study

REVIEW OF RELATED LITERATURE

Theoretical framework

The use of ICT in school teaching and learning process is based on the principle that linkage between content and methodology is crucial in determining the teaching-learning outcome (Tony 1992:1). What is being learned and how it is being delivered holds a special importance for the learner. The use if ICT resources allow the involvement of the self: - body, thought, feelings and action, not just the mind. Thus the learner and the teacher are engaged as a whole person. In the use of ICT resources, the learner is regarded as an active rather than passive participant. In this process, the focus of control is shifted away from the teacher in the direction of the learner. The teacher facilitates the active learning process, resulting to desirable learning outcome.

Conceptual framework

The use of ICT resources to facilitate teaching and learning process is highly justifiable. ICT in the strict sense is a fairly recent innovation, so by and large, in the traditional classroom, teaching and learning was facilitated by other resources and not ICT. The outcome of the traditional classroom was pointed towards two expectations, desirable outcomes or undesirable outcomes. The extent to which desirable learning outcomes can be obtained is crucial in any teaching learning process. The use of ICT resources opens up new methodologies of instruction, which can make the learning of sciences more interesting and exciting. If the ICT resources are utilized effectively by the teacher and the learner, better indicators of the learning outcome would be obtained.

Argument for ICT resources in schools

Since the emergence of microcomputers in the late 1970's, developed countries have embarked on ambitious projects to introduce the technology into schools. On 12th April 1989, UNESCO organized a congress in Paris, covering the application of computers in education. The aim of the congress was to recommend how computers can best be used in education. The congress observed that computes can be used "to develop …the education system, educational progress, and the education process" (Njine G.C. 1989:5). According to the congress, the use of ICT in the teaching process would help the teachers and students to appreciate their capabilities and to demystify the mystery with which it is sometimes associated with. Jonathan (1986), Makau (1989) and Njine (1989), provide us with argument for the role of ICT resources in the school environment.

First, ICT can be used as a catalyst to initiate changes in teacher pedagogical perceptions and practices. The integration of ICT in school learning has been argued to be an ideal way of improving or even reforming the traditional curriculum process and pedagogy. On this issue, Makau (1989: X) suggested that

> "The computer is capable of transforming the teaching-learning transaction form being dull teacher-dominated activity, geared to dishing factual knowledge, to an exciting learner centered process which nurtures confidence, initiative and mental skills"

Makau (Ibid) further amplifies the sentiments of (Njine1985) by saying that the multimedia capabilities of the new technologies open a new pedagogical paradigm

> " the irreversible move from teaching to learning (sometimes called the new paradigm) calls for production and distribution of educational (computer) packages which are multimedia, and more interactive about various subject matter, must replace the more traditional educational methods and render learning easier and more pleasant"

Secondly, the effective use of the ICT technologies offers new ways in which the quality, effectiveness and flexibility of education can be improved. On this vein, the new technologies in the secondary schools can have various impacts: ICT can be used as a tool that can enhance the teaching of school subjects, especially mathematics and sciences. ICT resources can be used in the teaching of informatics, popularly known as computer science at secondary schools. ICT can further be an effective mode of delivery of distant education through the e-learning concept. Again, ICT resources can help in the automation of the management and administrative processes such as timetabling, administration of exams, duty allocation to teaching staff and support personnel, and can provide a very effective tool for financial monitoring and control. Lastly, ICT can provide fast means of communication for staff and students, while providing effective tool for doing business with suppliers, examiners, career trainers, colleges and policy makers in the ministry headquarters (Jonathan: 1986). Thirdly, a very crucial role of ICT technologies is that it has opened some new bodies of knowledge. Of particular interest is in the area of informatics, otherwise known as computer science (Jonathan: 1986)

Integration of ICT in science learning

ICT assumes deep and strong presence in nearly all daily human experiences. ICT contain the necessary ingredients to push the change that the society needs. The school provides a space where construction of knowledge and social improvements are operated (Gome 2005).
It is this scenery that technologies can be fitted to guarantee that the students takes the best out of the learning experience. To achieve this, the teacher and the student must orient their teaching and learning approach in order to answer the demands of the modern science classroom. This can be achieved by integrating ICT both in learning and teaching experience.

The concept of e-learning therefore emerges. E-learning is the integration of ICT in the learning teaching process, such that teachers and learners use the technology to meet their learning needs. ICT integration is key for countries of the world, and Africa in particular to achieve their set national goals and the millennium development goals (MDGs) (Republic of Kenya: 2006)

The efficient integration of ICT in daily classroom experience revolves around four (4) issues. The first has to do with access of the technology while the other three are outlined below as discussed by Gome (2005): Integration of curricular content, integration of pedagogical approaches and teacher formation with a view of meeting the demands of the new technology. This study will examine these tree issues and how they shape the integration of ICT in Kenyan secondary schools.

Teacher competence in the utilization of ICT resources

This is the information age, and is technology driven, and therefore technology dependent. Any academic qualification devoid of basic ICT skills is perceived to be without a critical component. Universities and teacher training institutions need to take a leading role in promoting ICT education, preparing the student teacher to utilize ICT and in-service practicing teachers to orient their methodologies towards ICT adaptation. Teachers should be sensitized and equipped with skills in ICT so that they can promote and utilize the technology in schools.

In Kenya, literature does not reveal a projected demand for capacities by teachers training colleges and universities to provide teachers for teaching ICT. The Daily Nation observes "… a majority of our Kenyan two hundred and sixty thousand (260,000) teachers are not ICT capable, and there is no program to train them in the subject." (Aduda D. Daily Nation 21st February 2000, page 20 column

1&2). Republic of Kenya(1999), emphasized the observations made by Adam(1985) in its report on Totally Integrated Quality Education and Training by saying:

> "Although the content of teacher education(in Kenya) is fairly adequate, it is deficient in a number of areas, and would need to be revised with the view of revamping it, and expand it to address recently emerging issues such as computer science, information technology and the recent developments in communication technology"

Agreeing on the importance of teacher's competence in ICT, Adams (1985) argues that the ICT resources can perform "mundane instructional tasks, and can provide subject matter with a greater intellectual depth". So without ICT skills, Adams observes that '…the teacher is excluded from many experiences and events." Commenting on the same, Makau (1988)

> "… the computer is capable of transforming the teaching-learning process from being a dull teacher-dominated activity, geared to dishing factual knowledge, to an exciting learner centered process which nurtures confidence, initiative and mental skills. … educational computer packages, which are multimedia and more interactive about various subject matter, must replace the more traditional education methods and render learning easier and more pleasant.

It is important to realize that in-depth knowledge of ICT and its operation is not necessarily a requisite for using the ICT resources in teaching and training. However a large scale of ICT equipment "require a trained staff to design and support systems while helping potential users who may not be skilled programmers'(Rushby 1984:9). This explains why training of science teachers in ICT utilization would not be an effort in futility. Consequently, this study will try to find out if there are existing programs to train teachers in ICT skills, and perhaps make recommendations based in the finding.

DATA ANALYSIS, PRESENTATION AND DISCUSSION

Hardware and software equipment in relation to access

The study documented the variety if hardware at the Nepad e-school. Table 1 represents the data obtained

Table 1 A profile of hardware equipment at Mumbi Girls' ICT laboratory

TYPE	BRAND	QUANTITY	WORKING CONDITION		
			Good	Fair	Salvage
DSTV DECODER	DSTV	1	√		
KEYBOARD, SYSTEM UNIT, MONITOR, MOUSE	MECER	21	√		
WHITE SCREEN	EPSON	1	√		
COMPUTER SERVER	MECER	1	√		
UNINTEUPRED POWER SUPPLY	MECER	1	√		
MODEM	DirecWay	1	√		
SATELITE DISH	AphSAT Kenya	1	√		
PRINTER	XEROX	5	3√		2√
EARPHONES	N/A	21	√		
TELEVISION SET – 29 INCH	SHARP	1	√		
VIDEO RECORS PLAYER	SONNY	1√	√		
COMPUTER PROJECTOR	EPSON	1	√		

All equipment was in good condition, except the copier printer which was grounded. The copier printer had stalled due to a technical fault, yet the ICT champion (the NEPAD e-School project manager in the school) was not mandated by the Xerox Company to carry out repair and maintenance of the printer.

Table 2: Computer student ratio in Mumbi Girls Sec School

CLASS	ENROLLMENT	COMPUTER:STUDENT RATIO
Whole school	520	1 : 25
Form 1	135	1 : 7.0
Form 2	135	1 : 7.0
Form 3	18	1.16 : 1
Form 4	15	1.4 : 1

The results in table 4.2 indicate a ratio of 1 computer for every twenty five (25) students in the school. This means that if all students were to access the computers at any one time, twenty five (25) students would be sharing one computer at such a time. These ratios are very high if compared with the international standards of two is to one (2:1) ((www.scott.k12.va.us)

This study therefore observes that the facilities are barely enough to provide sufficient access for e-learning resources during a normal science lesson. Secondly, the placement of the ICT resources in one laboratory is greatly limiting access.

Software. Software is always bubbled in hardware. Consequently the challenges that face science teachers and students when accessing hardware are by virtue, experienced when handling software. This study documented the following concerning software

Table 3: Software in the ICT laboratory

TYPE	**BRAND**	**QUANTITY**	**VERSION**		
			Recent	Fairly recent	Obsolete
aSc-Timetable	Hemmisoft Solutions	Enough		√ 2004	
Microsoft Office	Windows XP Professional	Enough		√ 2003	
Internet explorer	Microsoft	Enough		√ 2003	
Digital Library	Ms Encarta	Enough		√ 2003	
e-School	Oracle	Enough		√ 2002	
Thinkpad.com		enough			
Letts Revisions Series	GCSE mock papers (Physics /Biology)	Enough		√	

Two revelations from the table above are striking. First, there are no home made programs tailored to meet the objectives of the Kenyan secondary school science syllabus. The **Letts series** is a revision program for the General Certificate of Secondary Education, which is a British curriculum. The **Microsoft Encarta** is a digital library program containing topical content in almost all subjects. It is not systematically programmed for use by Kenyan Students. Though the science teachers and students can use these programs, they are faced by the never ending hassle of sieving the material over and over until the desired content is achieved.

Secondly the **HEMMISOST SOLUTIONS,** which has installed time table program- **aSc time table**-, raises a policy question:- within which policy framework do private software developers operate, and how do they infiltrate into the school ICT laboratories?

Qualifications of the respondents

Professional and academic qualifications. The respondents were classified as follows based on their major teaching subject

Table 4 Number of respondents by their major teaching subject

RESPONDENT	NO OF TEACHERS	PERCENTAGE	CUMMULATIVE
Biology teacher	2	28.6	28.6
Chemistry teacher	3	42.6	71.4
Mathematics	1	14.3	85.7
Computer	1	14.3	100
Total	7	100	

Form this table it is evident that Biology and chemistry was handled by teachers who were qualified to handle the subject. 71.4% of them being specialists in the listed subjects, the teachers were armed with sufficient subject matter during pre-service. The ongoing assumption is that the respondents would spend more of their free time experimenting with newer methodologies (such as ICT integration in the instruction of sciences) rather than acquainting themselves with subject matter.

Age of respondents

The respondents were asked to indicate their age, highest academic and professional qualifications, and the institutions in which they attended their professional training. Upon data analysis, the information captured is represented below.

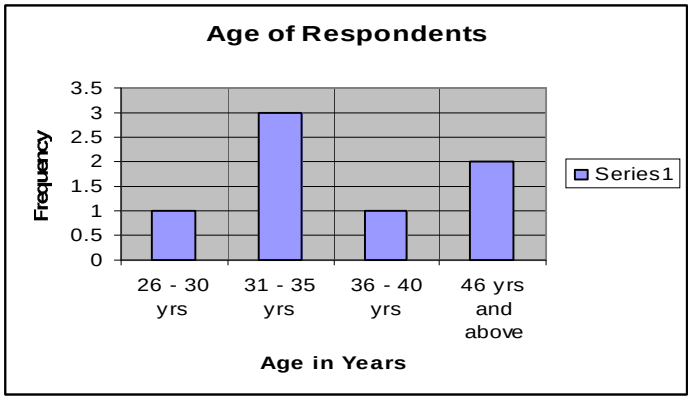

Figure 2 Ages of the Respondents

The majority of the respondents (71.4%) are between age twenty six (26) and forty (40). This age bracket represents a group of individuals who must have attended their pre-service training after 1990, when ICT was taking root. These individuals, due to their orientation towards science would most likely be expected to have taken a keen interest in learning ICT. It is further expected that the same should show high degree of enthusiasm in the use of ICT resources to further their instructional objectives based on exposure to ICT at an earlier age. The respondent beyond the forty (40) year bracket is expected to display the normal resistance to change.

Academic qualifications of respondents

With regard to academic and professional qualifications, all the seven (7) (100%) respondents had either a college diploma or a university degree. A college diploma or a university degree is an indicator that the respondents possess highly developed cognitive structures. This information is represented in the table below.

Table 5 Highest academic and professional qualifications of the respondents

		Number of teachers	Percent	Valid Percent	Cumulative Percent
Valid	College	4	57.1	57.1	57.1
	University	3	42.9	42.9	100.0
	Total	7	100.0	100.0	

The information regarding academic qualifications reveals that the respondents possess dispositions that confer them the flexibility to emerging issues, both in their formal life and in their professional practise. This argument is validated by Makau (1989) who observes

> "…education disposes the beneficially to readily adopt to change… hence academic qualifications are a facilitating factors in the implementation'' of any educational program"

The expectation is that the respondents would embrace the emerging pedagogical approaches readily.

The qualifications of teachers in ICT. The researcher, in finding out the qualifications of the science teachers, further compared the college which the respondents attended and the institution which offered the first training in ICT. The table 6 confirms that all the seven (7) received their pre-service training in respected public teacher training institutions.

Table 6 Institution respondents received their professional training

		Number of teachers	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Egerton University	2	28.6	28.6	28.6
	Kenyatta University	1	14.3	14.3	42.9
	Laikipia University College	1	14.3	14.3	57.1
	Kenya Science Teachers College	2	28.6	28.6	85.7
	Kagumo Teachers College	1	14.3	14.3	100.0
	Total	7	100.0	100.0	

However, table 7 below exposes that five (5) 71.4% against two (2) (28.6) of the respondents received their first ICT exposure not at their teacher training institutions, but trained in other institutions.

Table 7 Institution where respondents received their first training in ICT

	NUMBER OF TEACHERS	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
Mumbi Girls	4	57.1	57.1	57.1
Karatina Comm. Bureau	1	14.3	14.3	71.4
Egerton University	1	14.3	14.3	85.7
Kenya Science Teachers College	1	14.3	14.3	100.0
Total	7	100.0	100.0	

The implication is that the Teacher training programs are devoid of adequate training in ICT. Any training devoid without adequate exposure to ICT is lacking to a larger degree.

Extent of use of ICT resources by science teachers

The researcher asked the teachers to indicate the frequency with which they use the programs stated in the table to perform various tasks. These tasks were classified as follows: to support classroom use, personal use and for administration. The frequency of use was rated on a daily (D), weekly (W), monthly (M), termly (T) or never (N). Table 4.10 represents the data obtained for the never (N) and daily (D) frequencies and their percentages determined in relation to the totals.

Table8 Areas of ICT for which the respondents use ICT

	CLASSROOM USE		**PERSONAL USE**		**ADMINISTRATIVE**	
	N	**D**	**N**	**D**	**N**	**T**
INTERNET	71.4	28.6	57.1	14.3	100	0
W.W.W.	71.4	14.3	57.1	14.3	85.7	14.3
SATELLITE n. WORKING	85.7	0	71.4	0	100	0
Email	100	0	57.1	14.3	100	0
CDROM	71.4	14.3	85.7	14.3	100	0

FAX	100	0	85.7	0	100	0
E-LEARNING	57.1	0	42.9	0	100	0
WRD PROCESSOR	57.1	14.3	42.9	14.3	71.4	14.3
SPREADSHEET	57.1	14.3	57.1	14.3	71.4	14.3
DATABASE	71.4	14.3	71.4	14.3	85.7	14.3
DT PUBLISHING	85.7	14.3	71.4	14.3	71.4	14.3
ED. SOT WARE	71.4	14.3	71.4	14.3	85.7	14.3

The outcomes of the teachers' responses reveal inadequate use of ICT resources in almost all areas. First, though 100% of all the respondents have received training in the use of word processor, only one (1) 14.3% of the respondents use the program to further their classroom objectives. A similar percentage uses the word processor and spreadsheet software for personal and administrative purposes on a daily basis.

Competence of teachers to handle the e-School facilities

The competence of the respondent would be probed further by asking the frequency with which each of the respondent used the knowledge gained during training for the instruction of science lessons. Table 9 below represents the data captured.

Table9 Areas of ICT for which the respondents have received training

		Yes		**No**	
Area of ICT training	**no**	**No of teachers**	**Percent**	**No of teachers**	**Percent**
Internet & World Wide Web	7	**2**	**28.6**	**5**	**71.4**
E-mail	7	**3**	**42.9**	**4**	**57.1**
E-learning	7	**4**	**57.1**	**3**	**57.1**
Networking	7	**1**	**14.3**	**6**	**85.7**
Word Processing	7	**7**	**100.0**	**0**	**0**
Database Management	7	**3**	**42.9**	**4**	**57.1**

Spreadsheet	7	**5**	**71.4**	**1**	**14.3**
Desktop publishing	7	**2**	**28.6**	**5**	**71.4**
Networking with other teachers	7	**0**	**0**	**7**	**100**
Faxing	7	**1**	**14.3**	**6**	**85.7**
Video conferencing	7			**7**	**100**
Digital Camera	7	**1**	**14.3**	**6**	**85.7**
Digital scanner	7	**1**	**14.3**	**6**	**85.7**
Educational software	7	**0**	**0**	**7**	**100**
Online information sourcing	7	**1**	**14.3**	**6**	**85.7**
Digital timetabling	7	**3**	**42.9**	**4**	**57.1**
Web design	7	**1**	**14.3**	**6**	**85.7**
		7	**100.0**		

The frequencies and percentages obtained in table 9 indicate alarming revelations. There are high proportions of respondents with inadequate know-how on the crucial computer programs. Imperatively only two (2) (28.6%) have received training on how to use the internet, one (1) (14.7%) can source information from a computer network, zero percent (0%) can exchange educational views on Video conferencing, Zero percent (0%) can share electronic experiences with other teachers from other schools in Kenya and Africa. None of the respondents (0%) have previous exposure to educational software of any kind. The fore-mentioned areas are the core programs for the most acclaimed e-learning and the e-School concept. This argument is supported by the electronic wikipedia dictionary which states

> " e-learning is a form of advanced learning technology, which deals with the computer as a tool and associated methodologies in learning using networked and multimedia technologies. The internet and multimedia technologies are the basic enablers of e-learning."

ICT Laboratory Timetable

The time table is in line with the school policy of 10 lessons per day. The above timetable shows that the ICT laboratory is fully engaged for computer studies classes, Physical Education and Agriculture. The time table does not provide us with any evidence for incorporation of the **e-learning concept** during the normal working hours. Only fifteen (15) slots out of the fifty (50) available can be utilized for e-learning. This represents a meager thirty percent (30%)

CONCLUSION, RECOMMENDATIONS AND SUGGESTION FOR FURTHER STUDIES

Introduction

This study documented the e-School hardware and software in relation to access, examined the teachers' competence in handling the facilities and explored the extent of use of the documented facilities. The study also highlighted the achievements and challenges facing the e-School project in Mumbi Girls. This section gives a summary of findings and conclusion of this study. The chapter ends with a list of suggestions for further study.

Summary of the findings

The e-School Hardware and software in relation to access to ICT

a) Hardware. Concerning hardware this study made observations. Firstly, the facilities are barely enough to provide sufficient access for e-learning resources during a normal science lesson. A high student computer ratio of one to twenty five (1:25) at school level, and one to seven (1:7) at class level compares unfavorably with the international standards of one to one (1:1) or one to two (1:2)

Secondly the e-School facilities are not being used for e-learning in the most strict sense, rather as facilities for learning computer studies. Teaching computer studies is just a fraction of the objectives of the NEPAD e-School facilities. The provision of a forum for newly emerging e-learning approach is being overlooked to a large extent.

Thirdly, the placement of the ICT resources in one ICT laboratory is greatly limiting access. A centralized room can only be accessed one at a time. Teachers and students must wait until a computer lesson is over and when they are not attending another lesson.

Fourthly, the ICT laboratory layout exposes the issue of ergonomics. Students who must occupy the perimeter bench have to sit with legs towards the wall, as they look behind their shoulders, presenting strain to the lumbar and shoulder muscles. Closely related to this finding is the competition for the most comfortable middle bench amongst students

b) Software. Relating to software, this study made two observations: First, none of the programs installed are homemade or tailored to meet the objectives of the Kenyan secondary school science syllabus. The science teachers and students have to sieve through the existing programs until the desired content is achieved. This by itself has a time element which teachers are resisting.

Secondly, private software developers are making their own programs and infiltrating into schools and sell those programs. The contention to this observation is that policy issues relating to ICT should be developed and implemented in the strictest sense.

Professional and academic qualifications of the respondents

a) Professional and academic qualifications. With regard to academic and professional qualifications, the researcher observed that all the seven (7) (100%) respondents are graduates of with either a college diploma or a university degree. A college diploma or a university degree is an indicator that the respondents are highly qualified to grasp content in ICT training with ease. Secondly, being qualified, the teachers can spend more time experimenting with methodology, rather that content.

b) The qualifications of teachers in ICT.

The study observed that the science teachers' are deficient of adequate training and competence in the use of ICT. Teachers who are not well trained in ICT will shy off from utilizing such resources in classroom instruction.

Secondly the study revealed that five (5) (71.4%) against two (2) (28.6%) of the respondents received their first ICT exposure not at their teacher training institution, but training in other institutions. The implication is that the Teacher Training Programs are inadequate in preparing teachers in ICT.

Competence of teachers to handle the e-School facilities

This study observed that a high proportion of respondents do not have adequate skills to handle the hardware facilities and have difficulties in handling the installed software. Without knowledge of the installed programs teachers cannot facilitate their lessons using the e-learning approach.

The study further observes that all the science teachers are trained to make basic computer files using a word processing program, spreadsheet and database management programs. The three areas form the basics of ICT training forming an opinion that the respondents are trained in the basics of the technology.

This study also revealed that all respondents (100%) are for the opinion that they require more training on how to utilize ICT resources for classroom instruction.

Extent of use of ICT resources by science teachers

This study revealed that inadequate use of ICT resources in almost all areas. The inadequate use was observed to be due to three factors.

Firstly, the ICT laboratory is fully engaged in the teaching of computer studies, so teachers can only access the facilities when such a room is not being used for any other purpose. The computer studies are given a first priority, and teachers must postpone their priority until such a time when they are free and the ICT resource room is free.

Secondly, the computer studies teachers are fully utilizing the ICT facilities when teaching their subjects, but the use of the resources to further the other objectives of the NEPAD e-School project, e.g. to harnessing ICT technology to improve, enrich and expand education, was observed to be at minimum.

Thirdly, due to inadequate time and facilities, teachers stream to the ICT laboratory over lunch hour, the same time when the students are completing their assignments and sharpening their ICT skills. This precipitates competition between teachers and students.

The study further revealed that a major impediment to ICT adoption and utilization is because the relevant programs tailor-made for the Kenyan schools are non-existent. In some cases, only

fragments of the syllabus can be covered by use of ICT. The existing programs are based on foreign syllabi or too detailed beyond the level of the student

Lastly, the study revealed that the low key utilization of ICT resources by teachers was due to inadequate exposure with the technology. Most teachers are not experts in the use of ICT resources.

Recommendations

This study revealed issues that led to the following recommendation

1. That the roll out of the NEPAD's e-School project be postponed until such a time when teachers are well mentored and exposed on how to incorporate the technology as a new instructional tool. Otherwise it may be impossible to sustain the project unless the teacher capacity is beefed up.
2. While in-service for practicing teachers is recommended, this study suggests that student-teachers must be oriented towards ICT adoption right from the first semester in campus. The student-teachers need to try out their ICT skills in lessons during microteaching, teaching practice and during their actual practice.
3. That the quality and standards office should become more aggressive in enforcing ICT adoption to schools. An ICT taskforce mandated to enforce ICT policies should be placed on a performance contract and its effectiveness monitored
4. A home made digital syllabus in line with the Kenyan syllabus need be developed. Digitizing should start with those subjects that require urgent methodology reform such as science and mathematics.
5. The Ministry should develop policies regarding timetabling, examination analysis and entry of school records. Teachers should be encouraged to present their exam scripts in form of soft copies. They should be encouraged to key in their continuous assessment tests and exam results on a spreadsheet, maintain a digital class register, and maintain other data electronically. The policy should be enforced at the school level by the Principal.
6. A revision of the teacher training curricular must be considered with a view of orienting it to the emerging issues in ICT.
7. The computer laboratory layout need be revised so that competition for strategic positions is reduced and ergonomic considerations are provided for.

9. The study proposes a comprehensive in-servicing oriented towards ICT for science teachers. The training should be voluntary, and viewed as part of teacher professional development, which should be used as criteria for promotion. Those lacking ICT skills, and those showing resistance to its use, should be demoted or phased out from service.
10. This study proposes that all NEPAD demo schools be declared regional support centers when the project is adopted nationwide.

Suggestions for further research

1. The study restricted itself to the study of the NEPAD e-School project. Other schools under a different ICT program were not covered. There is need for a study that can explore the achievements and challenges of other ICT programs in Kenyan secondary schools
2. This study examined the role ICT can play in the teaching and learning of Biology, chemistry and physics. However, ICT is not always suited for use by the science teachers and science students. The role of ICT in the teaching and learning of other school subjects can well be covered by another study.
3. The study did not address the details of the suitability of educational software, which form the core element of ICT use in education. There is need for a study to exhaustively cover the suitability of the existing education software with a view of providing sound recommendations to policy makers and program developers

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E2012-24: Perspectives of Stakeholders on the Effects of HIV and AIDS on Primary School Pupils' Drop Out in Kisumu Municipality, Kenya

Omondi J.A. Awuor[1], Simatwa E.M.W.[1] & Ayodo T.M.O[2].
[1]Maseno University, [2]Kabarak University, simatwae@yahoo.com

Abstract