

Evaluation of the Extent of Achievement of the Objectives of NEPAD Schools' ICT Project in Kenya

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Abstract

The New Partnership for Africa Development (NEPAD) is a combination Project of the United Nations and World Bank aimed at developing an integrated socio-economic framework for Africa's renewal. Its three main areas of operation included economics, educational and social dimensions. NEPAD's aim was to have Africans develop homegrown solutions to the continents problems of poverty, illiteracy and disease. The infrastructure, especially Information and Communication Technology (ICT) were identified as a key priority action area in order to promote useful conditions for Education on Sustainable Development (ESD). To fulfill the continents ICT objective, NEPAD e-Africa Commission was tasked to develop and implement the NEPAD ICT program. This article reports the results of a study that examined the implementation of ICT application in NEPADs' Project Schools and Non-NEPAD schools in Kenya. The purpose of the study was to find out the input of ICT in NEPAD and Non-NEPAD schools. The study used a combination of descriptive survey and ex-post factor design to compare areas of ICT application. The study population consisted of 1600 form four students, 12 principals, 12 head of departments, 12 computer teachers, 7 education officers and 2 NEPAD officers. The sampling unit was the school and the actual sample included 570 form four students, 12 principals, 12 head of computer departments, 12 teachers and 2 KIE officers, Ministry of education official, and Ministry of education official and NEPAD representative. Data collection instrument was the questionnaire, interviews, and check list. Analysis of data was done using both descriptive and inferential statistic and the results that there was significance in ICT application areas. The study suggested further research on the state of other implementation of ICT in NEPAD schools.

Keywords: Secondary schools, information and communication technology, development, application, NEPAD

Abstrak

Gandingan Baru Pembangunan Afrika (New Partnership for Africa Development-NEPAD) adalah satu projek gabungan antara United Nation dan Bank Dunia bertujuan untuk membangunkan satu rangka kerja sosioekonomi yang bersatu bagi pembaharuan Afrika. Operasi utama NEPAD ini merangkumi ekonomi, pendidikan dan sosial. Tujuan NEPAD adalah untuk membolehkan bangsa Afrika sendiri menyelesaikan masalah-masalah yang berkaitan dengan kemiskinan, buta huruf dan penyakit di negara itu. Dari segi infrastruktur Teknologi, Maklumat dan Komunikasi (ICT) telah dikenal pasti sebagai bidang tindakan utama mendorong pembangunan pendidikan lestari. Untuk memenuhi objektif ICT negara, Suruhanjaya e-Africa NEPAD telah ditugaskan untuk membangun dan mengimplementasikan program ICT NEPAD. Artikel ini melaporkan keputusan dari satu kajian yang telah mengkaji pelaksanaan aplikasi ICT di sekolah-sekolah yang dikendalikan oleh NEPAD dan sekolah-sekolah yang tidak dikendalikan oleh NEPAD di Kenya. Tujuan kajian adalah untuk mengetahui hasil penggunaan ICT di kedua-dua jenis sekolah tersebut. Kajian ini menggunakan kombinasi kaedah tinjauan deskriptif dan faktor ex-post untuk membandingkan bidang-bidang aplikasi ICT. Populasi kajian ini terdiri daripada 1600 murid tingkatan empat, 12 guru besar, 12 ketua jabatan, 12 guru komputer, 7 pegawai pendidikan dan 2 pegawai NEPAD. Unit sampel adalah sekolah dan sampel sebenar merangkumi 570 murid tingkatan empat, 12 guru besar, 12 ketua jabatan dari Jabatan Komputer, 12 guru dan 2 pegawai KIE dari Kementerian Pendidikan dan wakil NEPAD. Instrumen pengumpulan data terdiri daripada soal selidik, temu bual, dan senarai semak. Data analisis dilakukan menggunakan kaedah statistik deskriptif dan inferens. Dapatan kajian menunjukkan terdapat kepentingan bagi aplikasi ICT. Kajian ini mencadangkan penyelidikan selanjutnya mengambil kira implementasi bidang ICT yang lain di sekolah-sekolah NEPAD.

Kata kunci: Sekolah menengah, teknologi maklumat dan komunikasi, pembangunan, aplikasi, NEPAD

Introduction and Background Information

Evaluation is the act of examining if a program is achieving its stated goals and objectives or examining the effect a program has had on its beneficiaries or determining if a program was able to make a difference. It may involve the use of rigorous (research) methods, and done irregularly either as baseline, middle, end of project evaluation. This particular study therefore could be classified as an end project evaluation. This is because the project, which was launched in November 2005, was to take only one year. In evaluating the NEPAD project, this study used comparative evaluation in that each NEPAD School had a control school within the same region to help control any regional disparities.

New partnership for Africa's Development (NEPAD) is a combined project of the United Nations and the World Bank aimed at developing an integrated socio-economic framework for Africa's renewal. Its three main areas of operation included economic, educational and social dimensions (Oracle Corporation, 2005). NEPAD's aim was to have Africans develop homegrown solutions to the continent's problems of poverty, illiteracy and disease. The infrastructure especially Information and Communications Technologies (ICTs) were identified as a key priority action area in order to promote conducive conditions for Education on Sustainable Development (ESD). To fulfil the continent's ICT objectives, NEPAD e-Africa commission was tasked to develop and implement the NEPAD ICT programme. Among the ICT high priority projects identified by the commission's headquarters in South Africa was the NEPAD e-school initiative (or NEPAD ICT Pilot Schools Project).

This project was to cover all the African countries according to Oracle Corporation (2005) however, only 16 countries participated in phase one of the NEPAD e-school initiative. They were Kenya, Algeria, Burkina Faso, Cameroon, Gabon, Ghana, Mali, Mauritius, Nigeria, Rwanda, Senegal, South Africa, Uganda, Mozambique, Egypt and Lesotho. Senegal, Algeria, Egypt, Nigeria and South Africa were mandated by the Organization of African Unity (OAU) to head the African Commission whose aim was to develop an integrated socio-economic framework for Africa. The NEPAD e-school initiative was therefore a multi country and multi stakeholder initiative that was intended to impart ICT skills to young Africans in both primary and secondary schools. This was necessary in

order to improve the quality of education and to bring information closer to the people.

During the conceptualization stage, demonstration or piloting was introduced as a crucial initial step in the implementation of this program. Six schools from each participating country were selected for piloting the project. In Kenya, the participating schools were Maranda boys, (Nyanza province), Vihiga boys (Western province), Menengai High (Rift valley), Wajir girls (North eastern), Mumbi girls (Central province) and Isiolo girls (Eastern province).

According to Oracle Corporation (2005), the Ministry of Education, Science and Technology (MOEST), in partnership with three companies; Microsoft Corporation, Oracle Corporation and Digital satellite Television (DSTV) did the program implementation in Kenya. Microsoft sponsored the programmes in Maranda; Vihiga and Wajir girls while Oracle sponsored the programmes in Mumbi, Isiolo and Menengai high schools. Altogether, the schools were to provide infrastructure to be used while each company was to provide the kit for hardware and the soft ware. DSTV provided to all the schools a satellite dish, 20' Television (TV), Videocassette recorder and their decoder as well as a Very Small Aperture Terminal (V-SAT) system to Internet their satellites by connecting all of them from the African Computer Services Centre in Nairobi. In the original plan, each classroom was to have a computer served from the ICT laboratory for the teacher's use. Besides the kits, Microsoft and oracle were also mandated to train the teachers in the pilot schools on how to adapt these programmes. One of the objectives of the NEPAD project was to determine 'best practice' and exemplary working models for the large-scale implementation of the NEPAD e-Schools Initiative, which aimed at equipping more than 550,000 African schools with ICTs and connect them to the Internet by 2020 according to Farrel, Isaac and Trucano (2007).

Before the NEPAD program came to Kenya, there were a number of secondary schools already teaching computer studies. They did this by contracting commercial college tutors to teach their students computer literacy, which was paid for by the parents. The curriculum that these colleges followed was not streamlined, but from the way the programme was received, the ministry saw the need to incorporate computer studies in its secondary school curriculum (Odera, 2002). This was done to

streamline training and offer standard evaluation. Even though the ministry realized the importance of this course in national development, they also came to the realization that the Government could not fund the program especially in the provision of the necessary equipment especially the computers, Internet facilities and materials. This was due to the economic constraints facing the Nation as well as the Government's cost sharing policy in education. The NEPAD programme could therefore have been a relief to the Government because of the involvement of private sector in its implementation and especially the provision of the much needed equipment and materials to the schools. But this may not have been the only reason for its adoption. There must be some potential the Government saw in it such that it could add some value to the nation's ICT education program. The current research was undertaken to determine how much of the original objectives of the programme were achieved. The Government on its part needs to be certain of the suitability of the new programme in view of its own ICT policy framework in the education sector. That is why this study aimed at collecting data to provide evidence on the extent of achievement of the NEPAD schools' ICT project objectives in Kenya.

The objectives of the project according to NEPAD (2005) were to:

1. To provide ICT and knowledge to primary and secondary schools students that would enable them to function in the emerging information society and knowledge economy.
2. To make every student in school computer literate.
3. To provide every teacher with ICT skills to enable them use ICT as a tool to enhance teaching and learning.
4. To provide school managers with ICT skills so as to facilitate effective management and administration in the schools.

The Purpose and Objective of the Study

The purpose of this study was to examine and compare ICT application areas in NEPAD and Non-NEPAD schools and as a result suggest guidelines for future implementation and integration of ICT education in Kenya's secondary schools. From that purpose, the specific objectives that guided this research were:

1. To identify materials resources available in NEPAD and Non-NEPAD schools.
2. To identify humane resource available in NEPAD and Non-NEPAD schools.
3. Compare learners achievement in NEPAD and Non-NEPAD schools,
4. Compare significant ICT application areas in NEPAD and Non-NEPAD schools.
5. Examine the achievement of the objectives of the NEPAD school ICT.
6. Identify factors that influence ICT application in the NEPAD and NON-NEPAD schools.
7. Suggest guidelines for ICT implementation and integration in NEPAD and Non-NEPAD schools.

The Conceptual Framework and Literature Review

The conceptual framework used in this study was adapted and modified from the current situation analysis (CSA). The CSA is an equivalent of strength, weakness, opportunities and threats (SWOT) analysis (Oriwo 2002). It guided this study by identifying the major problem in ICT education; which was lack of impact of ICT education and its infrastructure in the school and surrounding community. It then acknowledged the impact of the NEPAD programme in the school and the surrounding community as an intervention measure. It further guided this study in comparing the actual outcome of the NEPAD programmes in the Kenyan secondary schools to the variables identified under impacts in the diagram. The movement from impact back to the problem (Figure 1), signifies the evaluation process which should be a continuous process.

UNESCO (2003) conference in Bangkok came up with five major indicators for measuring the impact of ICT in education. These were the ICT policy; ICT infrastructure and access; ICT curriculum; Teaching and teaching support staff; and the learning process and outcome. All these indicators formed part of the present study.

An evaluation report (Farrel, Isaac and Trucano, 2007) of the NEPAD e-schools demonstration project in Africa, which included the Kenyan

demonstration schools revealed the following outcomes in summary: Students indicated that their ability to use e-mail, word processing, and web browsing had increased; Teachers felt that their IT skills increased, as did their confidence in using technology; Pedagogy evaluation showed that there was little shift towards a more student centred learning environment; The community stated that they had access to ICT facilities in some cases for the first time especially in the remote locations. These outcomes from all the project schools in the entire continent gave a good yardstick when crosschecked against the Kenyan schools in the project. The unanticipated outcomes from the NEPAD project according to Farrel, Isaac and Trucano (2007) included more action by member nations on Government policies. This meant that the Demonstrations was having a major impact on governments in terms of awareness of the importance of adopting ICT in their strategic education plans. This may be the greatest achievement to date in those countries that did not have an ICT in education policy already in place, as had been the case in Kenya. Other unanticipated outcomes included public/private partnerships model initiated by the e-Africa Commission, which has been replicated in at least one country, Kenya, and was being considered in some others; local partners were proving to have a major effect on the ease and efficacy in the implementation of the project and in providing support to teachers; community impact has been much more comprehensive than was anticipated. Teachers from neighbouring schools that had no ICT facilities were being trained to use the Internet at the demo schools and community groups were being encouraged, for a fee, to use the school as a 'learning resource centre' during non-school hours. The current evaluation was to ascertain the variation of the outcomes from the NEPAD schools in Kenya against the continental outcome.

Batchelor and Nocrish (2005) came up with general guidelines on evaluation of ICT projects in education. In their guidelines they stated that the measures of success should ensure that ICTs were incorporated into education and institutional administration (including record keeping and decision-making); functional access to technology in the whole school regardless of geographic location; computers being used in the instruction of all content areas; computers with Internet access to be available to all students and teachers during, as well as outside of formal class time. They further maintained that the factors that were deemed the most crucial in order to achieve success in incorporating ICTs in the education sector.

These were strategic leadership and management, which were critical to the creation of visionary strategies and policies. They also indicated that collaboration between major stakeholder groups were necessary to ensure successful implementation of these strategies; physical infrastructure would need to be upgraded in schools in preparation for ICT introduction; basic literacy was the foundation to computer literacy, therefore emphasis should not be shifted away from basic literacy in favour of computer literacy; regional and international collaboration was important to help developing countries learn from the successes and mistakes of other countries; curricula and teaching methods needed to be modified to incorporate the use of technology; Teacher involvement in planning and change was crucial for ensuring acceptance and support. For instance: An ICT pilot project may wish to demonstrate the influence of computers in a school. It may show how the addition of a computer to a school changes the motivation of teachers. Data can be recorded on how many pupils use it and their subsequent change in test scores or computer literacy. As such it would contribute evidence on how computers might affect educational needs in a school.

Research Questions

The following research questions guided this study:

1. What materials resources were available in NEPAD and non-NEPAD schools?
2. What human resources were available in NEPAD and non-NEPAD schools?
3. Was there significant difference in learners' achievement in NEPAD and non-NEPAD schools?
4. What were the significant difference in ICT application areas in NEPAD and non-NEPAD schools?
5. Which factors influenced ICT application areas in NEPAD and non-NEPAD schools?
6. What were the acceptable guidelines for ICT implementation and integration in Kenyan secondary schools?

Methodology

Looking at the complexity of the issues that were to be evaluated and compared from the participants, a combination of an exploratory approach using descriptive survey and ex-post-facto design was adopted for this study. These were used to evaluate and compare the extent of use of ICT in NEPAD and non-NEPAD schools in Kenya by evaluating the differences in the outcome in their ICT programmes. According to Gall, Borg and Gall (1996), a descriptive survey design is used in preliminary and exploratory studies to allow the researcher to gather information about the current status of the subjects under study. Using the ex-post-facto design was to counteract the 'ceiling and floor' effect from the descriptive survey design, which normally arises from respondent biases. At the same time ex-post facto design, according to Gay (1996) attempts to determine the cause or reason for existing differences in the status of the groups where evidence exists before the study was done.

The study was carried out in six of the eight provinces in Kenya where the NEPAD schools were located. Precisely, the study area included Bondo District in Nyanza province where Maranda high and Lwak girls were located, Vihiga District in Western province where Chavakali and Vihiga High School are, Nakuru District in the Rift Valley where Menengai and Afraha High are situated, Wajir District in North Eastern Province where Wajir Girls and Wajir boys are located, Murang'a District in Central Province where Mumbi and Mugoiri Girls are, and lastly Isiolo District in Eastern province where Isiolo girls and Isiolo boys are located. It was worth noting that out of the six NEPAD schools three were for girls, two for boys while one was a mixed school. At the same time, the six control schools consisted of the same combination.

Orodho (2004) explained that exploratory descriptive survey studies have two crucial categories of respondents, namely, the informed specialists and the consumers. The study population therefore targeted in the consumer category 1600 form four students taking computer studies from 35 secondary schools teaching ICT in the study districts. The 35 schools were distributed in the study districts such that 8 were in Vihiga, 2 in Isiolo, 3 in Wajir, 9 in Murang'a, 2 in Bondo, and 11 in Nakuru districts where the NEPAD schools were situated. Together with the students, the consumer population also consisted of 36 schools' principals and 36 heads

of ICT department in the study schools. The specialist category consisted of four quality assurance personnel in charge of computer studies at the MOEST headquarters, three computer studies subject personnel at the Kenya Institute of Education (KIE), and the two representatives from NEPAD secretariat namely; the national liaison person at the head office.

The sampling unit was the school, and saturated sampling was used for the NEPAD schools because they were only six. At the same time simple random sampling was used for the non-NEPAD schools by listing all the schools teaching computer studies in each NEPAD school's district and choosing one randomly. As a result a sample frame was prepared to ensure that the total respondents selected in each category were acceptable for research work. The results were presented in Table 1.

Table 1 Sample frame for research

Category of participant	Total population	Sample selected	Percentage
Principals	36	12	33
ICT HODs	36	12	33
Students	1600	570	36
KIE representatives	3	1	33
MOEST representatives	4	1	25
NEPAD representatives	2	1	50

It should be noted that random sampling was used to select 30% of the students from the population in each school. At the same time, it should be noted that out of 570 students sampled for the study only 384 returned their questionnaires representing 67 percent returns. All the 12 principals and all the 12 HODs returned their questionnaires, representing 100% returns. Therefore the consumer category was composed of 384 students, 12 teachers who were ICT HODs, and 12 principals. As a result the entire sampling matrix yielded a total sample of 411 respondents, including those from the specialist category.

For this study, the main data collection instrument was the questionnaire; it was administered to the students, the principals, and the teachers. The interview schedule was administered to the national quality assurance personnel in charge of computer studies, the KIE computer studies' specialist, and the NEPAD national liaison person. Meanwhile the

researcher, to confirm the information gathered through the questionnaires from all the 12 study schools used the checklist.

Data analysis was done using both the descriptive and inferential statistics. The descriptive statistics consisted of the use of frequency counts, percentages, and mean calculations. The inferential statistics used consisted of correlation coefficients, analysis of variance (ANOVA), and the chi-square.

Results and Discussion

Introduction

To carry out meaningful analysis, the information from the study schools' administrators, ICT teachers, and students were analysed using the SPSS and recorded in tables, figures and graphs. These responses were verified by the responses from the interviews of the KIE subject specialist in computer studies, the national quality assurance personnel at MOEST in charge of computer education, and the NEPAD national liaison person. Further verification of the information was done using the checklist. All these pieces of information were consolidated to bring out the results of the research, which are presented and discussed in the remaining parts of this report in an attempt to answer the research questions. To identify significant differences in the outcomes in NEPAD and non-NEPAD schools, further analysis was carried out using ANOVA, chi-square, t-test, and Pearson correlation measures.

ICT Policy in Education

In answering the question what was the impact of the NEPAD programme on ICT policy formulation in education sector in Kenya? The quality assurance personnel in-charge of computer studies responded by indicating that NEPAD programme had brought into focus the need for a coordinated ICT policy in education, which had not been there before. This was telling because just before the launch of the NEPAD project in 2005, the Government of Kenya with the help of UNESCO and UNDP launched a National Information and Communication Policy Framework to enhance the capacity of the national information and communication

sector in 2004. The framework was to propose Kenya's ICT policy, which currently is in its draft form according to Wafula and Wanjohi (2007).

When the principals and the ICT HODs were asked to indicate if they had an ICT policy guiding them in the school, they all indicated that they all did not have any. However, the NEPAD schools implied that they were in the process of formulating a policy. This tended to suggest that they were aware that they should have an ICT policy but they had not formulated one. The non-NEPAD schools on the other hand did not seem to be aware of a need for a policy all together. In conclusion then, it was possible to state that the NEPAD ICT schools' project sensitised its schools on the need for an ICT policy, even though the schools seemingly lacked the technical knowledge on the implementation.

Improvement of School Services

One major application of the ICT programme in a school is the general improvement in the way a school's services are run (Okuttah, 2007). This study identified the following as some of the services that a school having ICT facilities was able to provide in an improved version: Administrative functions; examination services; improvement of the teaching-learning process. These particular services were chosen because they had a direct bearing on a school's core mandate which is to prepare learners to attain required academic grades needed for future careers. For this reason, an improvement in these specific services would lead to improved school performance. Therefore if an ICT programme could impact these specific areas it would have impacted the whole school performance.

The teachers indicated that of all the beneficiaries of the school ICT services, the administrators benefited the most, followed by the learners and then the teachers. Those who always benefited from the ICT programmes according to the study teachers were mainly the school administrators (92%) followed by the learners (50%) then teachers (33%). The others who benefited minimally from the use of the facilities were teachers from neighbouring schools and other members of the community. The teachers' responses were analyzed to see how frequently the administrators from NEPAD and non-NEPAD schools benefited from use of ICT in administrative functions. The outcome indicated that all the study schools (100%) used ICT for administrative purposes according to

the teachers. These administrative functions included services such as typing, photocopying, record keeping, accounting, and store keeping. The principals' responses concurred with the teachers' view since they indicated that all their schools benefited from these services. They further indicated that the highest consumer of the schools ICT facilities was the school administration.

Human Resource Levels and Availability

The other research question in this study focused on the type of ICT personnel that were present in the NEPAD and non-NEPAD schools. Specifically the research question was: What ICT human resources were available in NEPAD and non-NEPAD schools? The human resource referred to both the teaching staff and the non-teaching staff. Analysis in this area was done in terms of Teacher professional qualification, teacher ICT qualification, funding of teacher's ICT training, in-service of teachers, and teaching support staff availability and funding.

Table 2 Teachers in ICT department

Type of school	No. of teachers	Average experience	Qualification			
			Cert	Dip	Tech	Degree
NEPAD	21	6	7	3	0	11
Non-NEPAD	9	3	1	4	1	3

Table 1 shows the checklist results which indicated that the number of ICT teachers in the NEPAD schools were much higher than that in the non-NEPAD schools. This was because four of the non-NEPAD schools had only one ICT teacher each, while the other half had only two ICT teachers each, giving an average of 1.5 ICT teacher per school. This was in contrast to the NEPAD schools that had at least three ICT teachers per school with one school having a total of five ICT teachers. They all had teachers with ICT qualifications ranging from certificate, diploma, technical education, and degree. In terms of teachers' ICT qualification therefore, there was no significant difference in NEPAD and non-NEPAD school. However the NEPAD schools had more ICT teachers making their student to teacher ratio in ICT lower than that of the non-NEPAD schools (2:1 and 3:1 respectively). This may have had some impact in their learner performance in the ICT related fields.

Both the principals and teachers were asked to indicate if they had ICT technicians in their schools. The responses from this question brought out the fact that none of the schools employed an ICT technician except for one NEPAD and one non-NEPAD school that had teachers with technical training in ICT that also doubled up as technicians in their schools.

ICT Infrastructure and Access

The second objective of this study was to identify the ICT equipment and material resource available for use in NEPAD and non-NEPAD schools. To meet part of this objective, it was necessary to ascertain the type and number of equipment for teaching ICT in the schools. The researcher used the checklist to record the existing ICT equipment in the study schools and the results were presented in Table 3.

Table 3 Number of ICT equipment in the study schools

School	Computers	Laptops	Scanners	Printers	LCD projector
NEPAD	298	1	8	23	6
Non-NEPAD	123	1	3	13	0

Table 3 shows that in the schools, the desktop computer was the most common equipment. The NEPAD schools had 298 computers, giving an average of 50 computers per school. The non-NEPAD school had 123 computers, giving an average of 20 computers per school. It meant that averagely every NEPAD School had more than twice the number of computers in the non-NEPAD school. Besides the laptop, NEPAD schools had double every other equipment in the non-NEPAD school according to Table 3.

The other important finding of the study was that all the non-NEPAD schools had only three e-libraries all from one school sponsored by computer for schools, Kenya. In contrast, all the NEPAD schools had at least five different e-libraries with the leading school having fifteen different ones. The other notable fact was that only one non-NEPAD school had an Internet connectivity appliance, i.e., a blue tooth from a mobile phone provider. All NEPAD schools on the other hand had a V-SAT (Very Small Aperture Terminal) that could enable them to achieve Internet connectivity. The checklist however indicated that the Internet

connectivity were weak in all the NEPAD schools most of the time. This tended to discourage most of the users. It was therefore not surprising when further analysis through chi-square revealed that there was a significant difference ($\chi^2 = 9.00$, $df = 3$, $p < 0.05$) in the extent of achievement of access to online materials by NEPAD schools as compared to the non-NEPAD schools. Moreover, all the NEPAD schools had an e-library from the ministry of health (Health Matters). This meant that the learners in NEPAD schools had more information on health available to them than those from the non-NEPAD schools, thereby improving the learners' health literacy status.

Significant ICT Application Areas

Another research question that needed to be answered in this section was: What were the significant differences in ICT areas of usage in NEPAD and non-NEPAD schools? The results indicated that the most important ICT application area was in the integration of ICT in the teaching/learning process. This came out when students' responses to the question on how often they had been taught using ICT was analyzed. Their responses were analyzed and recorded in Tables 4 and 5.

Table 4 ANOVA for use of ICT in NEPAD schools

Source	DF	SS	MS	F	P
Category	1	20.02	16.03	0.000	
Error	46	57.46	1.25		
Total	47	77.48			

Table 4 shows that use of ICT in teaching other subjects in NEPAD schools was significantly more frequent, ($F = 16.03$, $df = 1$, $P < 0.05$) than in the Non-NEPAD schools. This could be explained by the fact that the NEPAD Schools had more superior ICT equipment suitable for use when teaching, especially the presence of e-content through the Internet.

Table 5 ANOVA for use of ICT in non-NEPAD schools

Source	DF	SS	MS	F	P
Category	3	13.50	4.50	2.90	0.060
Error	20	31.00	1.55		
Total	23	44.50			

Table 5 presents the same results for the non-NEPAD schools. The results indicated that teaching other subjects using ICT in non-NEPAD schools was not significant ($F = 2.90$, $df = 1$, $p < 0.05$). This meant that very little or no integration was taking place in the non-NEPAD schools. It meant that where ICT was used in teaching in these schools, the effects were not significant enough to have an impact on teaching/learning process.

The results in Tables 3 and 4 could also be pointers to the effectiveness of the training that the teachers in the NEPAD schools were exposed to. It could mean that after in-service training, the teachers from the NEPAD schools were better placed to use ICT in teaching other subject content areas than their counterparts from the non-NEPAD schools.

Comparing Learner Achievement in NEPAD and Non-NEPAD Schools

The last question that this study was to answer was: Was there a significant difference in learner achievement in the KCSE examinations in NEPAD and non-NEPAD schools? This question was answered by comparing the KCSE mean deviations in the two categories of schools in terms of overall school mean grades as well as mean grades in KCSE computer studies examination. The analysis of the correlation of type of equipment to schools' KCSE mean grade established that there was a positive correlation between the variety of ICT equipment available in a school and the school's performance in KCSE. The correlation analysis calculations indicated a significant positive relationship ($r = 0.421$, $df = 1$) between the KCSE mean grade to variety of ICT equipment found in a school. The correlation analysis further confirmed a significant positive relationship ($r = 0.421$, $df = 1$) between the KCSE mean grade and the variety of equipment in the school, the NEPAD schools having a much higher variety. The results above may not look convincing, as a result further analysis was done with the help of ANOVA. The analysis revealed that the presence of a wider variety of ICT equipment in the NEPAD

schools resulted into a significant (ANOVA, $F = 7.131$, $df = 6$, $P < 0.05$) improvement in the KCSE performance.

To be sure of the extent of significance of the difference in performance between the NEPAD and non-NEPAD schools, an investigation into the quality of the performance of the study schools was done by applying ANOVA to the KCSE examination result (Mean grades) collected through the checklist. The average mean grades were worked out for each school category. The outcome showed that overall the NEPAD schools (Mean = 6.65 ± 0.360) posted a higher mean grade than the non-NEPAD schools (Mean = 5.70 ± 0.297). This difference in mean grades was subjected to a test of significance. The results indicated that the differences in the KCSE mean grades in the NEPAD and non-NEPAD schools were significant (ANOVA, $F = 4.148$, $df = 1$, $P < 0.05$). This meant that the higher quantity and wider variety of ICT equipment and e-content available in the NEPAD schools together with the in-service training accorded to teachers from the NEPAD schools caused a significant positive impact on the schools' KCSE performance.

Educational Research

This was one of the application areas studied as a means of answering to the research question: What are the significant ICT application areas in NEPAD and non-NEPAD schools? In this instance, the question could be answered directly and indirectly.

The teachers were asked to rate the extent to which the students in their schools used material in the ICT laboratory for educational research. Their responses were tabulated and presented in Table 5.

Table 6 Students Use of ICT in Educational Research

School	Achievement of educational research				
	All	Many	Some	Few	None
NEPAD	1	2	3	0	0
Non-NEPAD	0	0	1	1	4

Table 6 shows that all students (100%) in NEPAD schools were perceived by their teachers to be accessing materials for educational research. At the same time only students from two of the non-NEPAD schools (17%) accessed materials for educational research. This therefore points to a major difference in the way students from NEPAD and non-NEPAD schools used their ICT facilities for educational research.

At the same time the issue of educational research was implied in two other major areas that were studied. Its achievement could be judged based on how the students made use of the Internet and the e-libraries. Students were asked to indicate how frequently they used Internet services. The study established that overall; a reasonable number (53%) of the students used the Internet services in their schools. However, of these, 90% were from NEPAD schools and only 10% were from the non-NEPAD schools.

Education research becomes quite simple if electronic content (e-content) is available to a learner. To investigate availability of the e-libraries, the checklist was used to identify them in each school. The information from the checklists were tabulated and presented in Table 7.

Table 7 Comparing number of e-libraries and computers

School	Number of e-libraries	Number of computers	Machine: e-library ratio
NEPAD	40	277	1:7
Non-NEPAD	3	145	1:48

Table 7 shows that the NEPAD schools had a total of 40 e-libraries spread amongst them. This gave them an average ratio of at least five e-libraries in each school. The checklist further revealed that one of the NEPAD schools had a total of 15 different e-libraries down loaded in their computers. The checklist revealed further that the main e-libraries in the NEPAD schools were Mindset, Encarta, Wikipedia, and Health matters which students used for personal information search as they studied, while teachers used the same information when teaching. In the non-NEPAD schools on the other hand, there were only three e-libraries and that all the three were available in only one school, meaning that all the other five schools had none at all. This one school had its ICT programme funded by

an external donor unlike the others that were funded either by the BOG or PTA.

The most notable fact about the e-libraries was the fact that even though health matters was a free ministry of health initiative for sensitising learners on important health issues, it was only available in the NEPAD schools. This meant that a learner or teacher in a NEPAD school had more access to information on health matters than those from the non-NEPAD schools.

Research Findings

Conclusion

The presentations of the findings of this research were based on the research objectives that had guided the NEPAD project. Therefore in conclusion, it was clear that the NEPAD schools' pilot project achieved its mandate which had been to: To provide ICT skills and knowledge to primary and secondary school students that would enable them to function in the emerging Information Society and Knowledge Economy; to make every learner health literate; to provide teachers with ICT skills to enable them to use ICT as tools to enhance teaching and learning; to provide school managers with ICT skills so as to facilitate the efficient management and administration in the schools.

School Management

In terms of policy formulation, the study established that the NEPAD schools' ICT project succeeded in raising awareness level of the schools to the need to have a school ICT policy but not in ensuring each school had an ICT policy. But still the awareness level in the NEPAD schools was very good as compared to that in the non-NEPAD schools where they did not seem to know about the need for a school's ICT policy. The results further indicated that the highest consumer of ICT resources in any school was the school administration. These administrative functions included services such as typing, photocopying, record keeping, accounting, and store keeping, which were used equally (100%) in both the NEPAD and non-NEPAD schools. The highest indicator though of the NEPAD project's success in school management was in the fact that all

administrators (100%) in the NEPAD schools were ICT literate as compared to the administrators from the non-NEPAD schools that posted a literacy level of 67% only.

Teachers' ICT Compliance

The NEPAD schools had teachers with better professional qualification, higher computer literacy ratio and higher computer staffing levels than the teachers from non-NEPAD schools. At the same time, teachers from NEPAD schools benefited more from in-service in ICT especially because of the peer-training aspect practiced in the NEPAD schools, which was lacking in non-NEPAD schools. The study also noted that none of the study schools employed an ICT technician nor did they receive any funding from the Government for technical assistance instead the BOGs and the PTAs sourced and paid for technical assistance as the need arose.

Integration of ICT in other subject areas was noted to be an on-going process in NEPAD schools. This was because specific results indicated that there was a significant difference in the use of ICT in teaching humanities, languages, and mathematics in NEPAD and non-NEPAD schools but their use in science was not significantly different because usage was common in both categories of schools. Furthermore, the presence of free Internet connectivity and modern ICT equipment in the NEPAD schools were the factors that made NEPAD schools significantly better in their use of ICT facilities in the teaching/learning process. This was because it made education research and ICT integration in the curriculum subjects possible. Besides integration, the availability of ICT equipment in both the NEPAD and non-NEPAD schools resulted in improved administrative services in the schools.

The NEPAD schools had a wider variety and higher quantity of ICT equipment and materials. This resulted into wider application and higher access to online materials by students in the NEPAD schools compared to those from non-NEPAD schools. The presence of the Internet service and e-libraries in the NEPAD schools resulted into significant differences in ICT application areas in NEPAD and non-NEPAD schools. As a result the students in the NEPAD schools posted significantly higher mean grades in the KCSE examinations than those from the non-NEPAD schools.

All the results in this section point to the fact that teachers in the NEPAD schools were more ICT compliant than the teachers in the non-NEPAD schools and this showed in their teaching methods (ICT integration in the curriculum content) as well as their teaching outcomes (Higher KCSE mean grades in the NEPAD schools).

Students' ICT Skills and Knowledge

The study results indicated that NEPAD schools achieved computer literacy levels of only 32% for their learners. The results were worse in the non-NEPAD schools that achieved only 27% literacy levels. In terms of education research, 53% of the students used the ICT facilities. Of this total, 90% were from NEPAD schools and only 10% were from the non-NEPAD schools. This was mainly because all (100%) the NEPAD schools had an average of five different e-libraries each while 87% of the non-NEPAD schools had no e-library at all. At the same time all (100%) NEPAD schools had Internet connectivity while 87% of the no-NEPAD schools had none. It was therefore possible to conclude that even though the learner skills and knowledge in ICT was still low even in the NEPAD schools, the project has provided a very solid base upon which each school could build in order to improve learner skills and knowledge in ICT.

Students' Health Literacy

The study results indicated that only NEPAD schools had access to an e-content on health matters. This allows the learners to seeking information on health issues to have access, unlike in the non-NEPAD schools that had nothing. This fact exposed the biased nature of allocation of resources in the schools because this was a free e-library prepared by the ministry of health, which could easily have been availed to all schools having ICT equipment. This further points to the success of the NEPAD project because it can cause a government ministry to prepare a school programme for educational purposes.

Recommendations from the Research

The following are some of the recommendations the researcher hopes could help improve the state of ICT education in secondary schools in Kenya from facts noted during the evaluation:

Any school offering ICT education should employ an ICT technician who could make the computer laboratory available to learners all the time like a school library and be able to repair the hardware. This could enhance learner ICT literacy, which is currently very low. It would also encourage learners to use the facilities in personal study and at the same time ensure a majority of the hardware are kept in working condition. Alternatively, the ICT teachers could be taken through training as technicians to serve both as teachers and technicians taking care of repair of hardware as well.

The Government should provide in-service training to all teachers at least once in a year as this would enhance their ability to integrate ICT in their teaching subject and as a result make them more innovative in their use of ICT as a tool in the teaching/learning process. In this way schools would perceive ICT as a useful tool in the teaching/learning process and as a result enlarge their e-learning capabilities while at the same time teachers would find an avenue to share new skills and knowledge with each other.

The school BOGs with assistance from the government should look for private sector partners who could be able to install Internet facilities and e-libraries to the public schools having ICT facilities to enhance and improve teachers and learners' personal information base. This would assist the government to achieve their objective of making "education the natural platform for equipping the nation with ICT skills."

The government with the help of NEPAD should set up ICT laboratories in each educational division in the country to make existing learning resource centers ICT compliant. This would enable all learning institutions and the community in that division to have access to affordable ICT facilities. The teachers and schools could be encouraged to make monthly membership subscription, which to a small extent could subsidize the cost of maintenance of the facilities. In this way, information would be available to teachers and the wider community through the Internet and e-libraries even in the rural areas where the majority of the population may not afford such facilities in their schools or homes.

The ICT policy guidelines should be set from pre-school to tertiary institutions and be evaluated alongside the other curriculum activities by the quality assurance and standards officers to ensure adherence to set governmental policies which has not been the practice currently as per the

concluded study. This would encourage more administrators to have a plan on the development and improvement of ICT infrastructure.

The government should consider offering incentives to teachers to inspire them to be more technologically innovative in terms of pedagogy. These could include tax subsidies; special loans, scholarships, and bursaries to teachers pursuing studies in ICT related courses or buying a computer for the excelling teachers.

Local software companies to liaise with the education sector policy makers to provide country and curriculum specific software relevant to the needs of the nation. These companies could offer for instance to forward personnel to the KIE to fast track their change of curriculum content to e-content.

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