Malaysian Journal of Educational Technology
Volume 9, Number 1, June 2009

A Comparison of Information and Communication Technology Application in NEPAD and Non-NEPAD Schools in Kenya

Mildred A. Ayere & F. Y. Odera
Department of Educational Communication Technology, Maseno University, Kisumu, KENYA

Abstract

This paper reports of a study that compared Information Communication Technology application in NEPAD ICT Project secondary schools, and NON-NEPAD secondary schools in Kenya. NEPAD stands for NEW PARTNERSHIP for AFRICA'S DEVELOPMENT. The purpose of the study was to find out the input of ICT in NEPAD and NON-NEPAD schools by comparing ICT application areas and s a result suggest guidelines for future implementations and integration of ICT in all curriculum subjects. The study used a combination of descriptive survey and ex post factor designed to compare areas of ICT application. This was because the descriptive survey helped to determine the reasons for the existing differences in the programs while ex post factor design yield objective data that already existed before the study was done. The study population consisted of 1600 form students in 37 secondary schools that teach computer studies of which 8 schools were in Vihiga, 2 in Isiolo, 3 in Wajir, 9 in Muranga 2 in Bondo, and 11 in Nakuru Districts where the six NEPAD schools were situated. The sampling unit was the school and saturated sampling technique was used for the NEPAD schools while simple random sampling was used in selecting the non-NEPAD schools. The sample consisted of 339 people made up of 3 specialists and 396 in the consumer categories. The data collection instruments were the questionnaire, interview and check list. Analysis was done using both descriptive and inferential statistics. The results from the research indicated that there was significant difference in ICT application areas. The learners in NEPAD schools performed much better than their non-NEPAD counterparts in the KCSE examinations. The NEPAD schools (Mean=6.65+0.360) posted a higher mean grade than the non-NEPAD schools (MEAN=5.70+0.297). But there was no significant difference in the professional qualification of teachers in NEPAD and Non-NEPAD schools. The study suggested further research on the state of ICT programmes, modes of implementation, and possible models private sector involvement.

Ayere, M.A. & Odera, F.Y. (2009). A Comparison of Information and Communication Technology Application in NEPAD and Non-NEPAD Schools in Kenya. *Malaysian Journal of Educational Technology, 9*(1), pp. 17-27.

Introduction and Literature Review

New partnership for African 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 include economic, educational and social dimensions (Oracle, 2005). NEPAD's aim is to have Africans develop home-grown 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 fulfill 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).

The NEPAD e-school initiative is a multi country, multi stakeholder initiative that intended to impart ICT skills to young Africans in both primary and secondary schools in order to improve the quality of education and to bring information closer to the people. It is multi stakeholder because it involves different private companies in the ICT sector willing to partner with each participating country.

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).

NEPAD (2005) project team explained that 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 (T.V), 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. Within the school, each classroom was to have a computer served from the laboratory for the teacher's use. Besides the kits, Microsoft and oracle were also mandated to train the teachers in the Kenyan schools on how to adapt these programmes.

However, in 1996 the Government through the minister of education declared that all secondary schools should introduce computer studies. It was not clear how schools were to acquire the computers, as a result most schools failed to comply (Odera, 2002). The Government in the same year approached UNESCO to fund its computer education programme. UNESCO responded by not only supplying some national schools with computers but also trained the principals and a few of the teachers to start off the programme. To date less than ten percent of secondary schools offer computer studies despite its perceived role in the nation's socio-economic development (Okuogo, 2006). The few schools that have had an ICT programme, limited the number of candidates who can take up the subject, considering it a specialty whereas this is an essential subject just as would be compulsory subjects like mathematics and languages. The ideal situation would be where ICT was mainstreamed in all school subjects such that it would be seen in Geography, History, Commerce, Physics and so on.

The NEPAD programme was expected to integrate ICT in all subject areas and to empower the school community with ICT skills. There is no clear evidence that this mandate is taking place. At the same time, there was little information to justify the kind of investment (20 million in six schools) the Government decided to make in six schools instead of expanding the provision of computers to more secondary schools in the country. It appears that the NEPAD schools were being set as experimental centers of excellence in ICT education so that other schools could copy their model. To gauge their success, as centers of excellence there was need to survey their activities and provide information on the same. Therefore this study sought to compare ICT application areas in NEPAD and non-NEPAD schools in Kenya as a means of verifying these claims.

Here we report the results of a comparative study that used a combination of descriptive survey and ex factor design to compare areas of ICT application in NEPAD and Non-NEPAD secondary schools.

Previous study by Kinyanjui and Nderitu (2005) and UNESCO noted the value of ICT integration in education. They explained that integration involves the fusing of both technology and pedagogy in different measures that allows for students exploration during learning. As such, the government encouraged private sector to assist in the promotion of ICT in secondary schools (Wafula & Wanyonyi, 2007). As a result, a number of bodies are involved in the financing ICT in public schools. According to Wangari (2008), Okutta (2007) Krige and Okono (2007), noted that the financing included computers for schools Kenya, Kenya Education Network, ICT Trust Fund, and NEPAD. Farrel et al (2007) pointed out that NEPAD project was multinational, multidimensional and also multi-sectorial in nature, making it appealing to Governments. The non-NEPAD programme on the other hand was funded through the Parents Teachers Associations (PTAs) and Board of Governors (BOGs) according to Wafula and Wanjohi (2007).

Geisert and Furtell (2000) pointed out that ICT is useful in the teaching process while Sadker and Sadker (2000), Docstader (1999), Mcnara (2003) all reported that the other ICT application areas were mainly in administration, record keeping, computer literacy, education research, assistive technologies, and as source of employment. At the same time, Shrum and Dehoney (1998) noted that teachers who were computer literate used the technology to publish their work, creation of videos, portfolio design, communication and professional development through the Internet.

Despite all the potential of technology, Tilya (2007) reported that the main factor affecting ICT application area in a school was leadership. Education Insight (2006), Okuogo (2006), Wandari (2008) gave other facotors affecting use of ICT in a school as high cost of equipment, teachers' ICT literacy status, school ICT policy, type of sponsor for the programs and the number of hardware available in a school.

The other important factor that hinders the implementation of technology is lack of trained manpower. Tilya (2007) stated that the development of any country depends very much on the level of education of its citizens Trucano (2005), explained further that many governments were using the introduction to ICT as a way of providing teachers with new skills and introducing new pedagogy into the classroom.

Purpose of the Study

The purpose of this study was to find out the input of ICT in NEPAD and non-NEPAD schools by comparing ICT application areas in education and development. The main objectives that guided the study were to examine the ICT human resource level and training available in NEPAD and non-NEPAD schools. It also sought to identify the ICT equipment and material resource available for use in NEPAD and non-NEPAD schools. It also compared significant ICT application areas in NEPAD and non-NEPAD schools. At the same time it was to identify factors that influence ICT application areas in NEPAD and non-NEPAD schools. The study also compared learner achievement in the KCSE examinations in NEPAD and non-NEPAD schools. Lastly it suggested guidelines for ICT implementation and integration in secondary schools in Kenya.

Conceptual Framework

Figure 1 represents the conceptual framework used in this study. It 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). Its aim was to guide this study by identifying the major problem in ICT education; which is lack of impact of ICT education and its infrastructure in the school and surrounding community. It further explored the possible factors affecting ICT application in a school. It then considered the possibility of using the NEPAD programme in the school and the surrounding community as an intervention. Lastly, it considered the expected impact of NEPAD as an intervention.

Research Questions

This study was guided by the following research questions:

1. What ICT human resource levels and training are available in NEPAD and non-NEPAD schools?

2. What ICT equipment and materials resource are available in NEPAD and non-NEPAD schools?

3. What were the significant differences in ICT application areas in NEPAD and non-NEPAD schools?
4. Which factor influenced ICT application areas in NEPAD and non-NEPAD schools?

5. Was there a significant difference in learner achievement in the KCSE Examination in NEPAD and non-NEPAD schools?

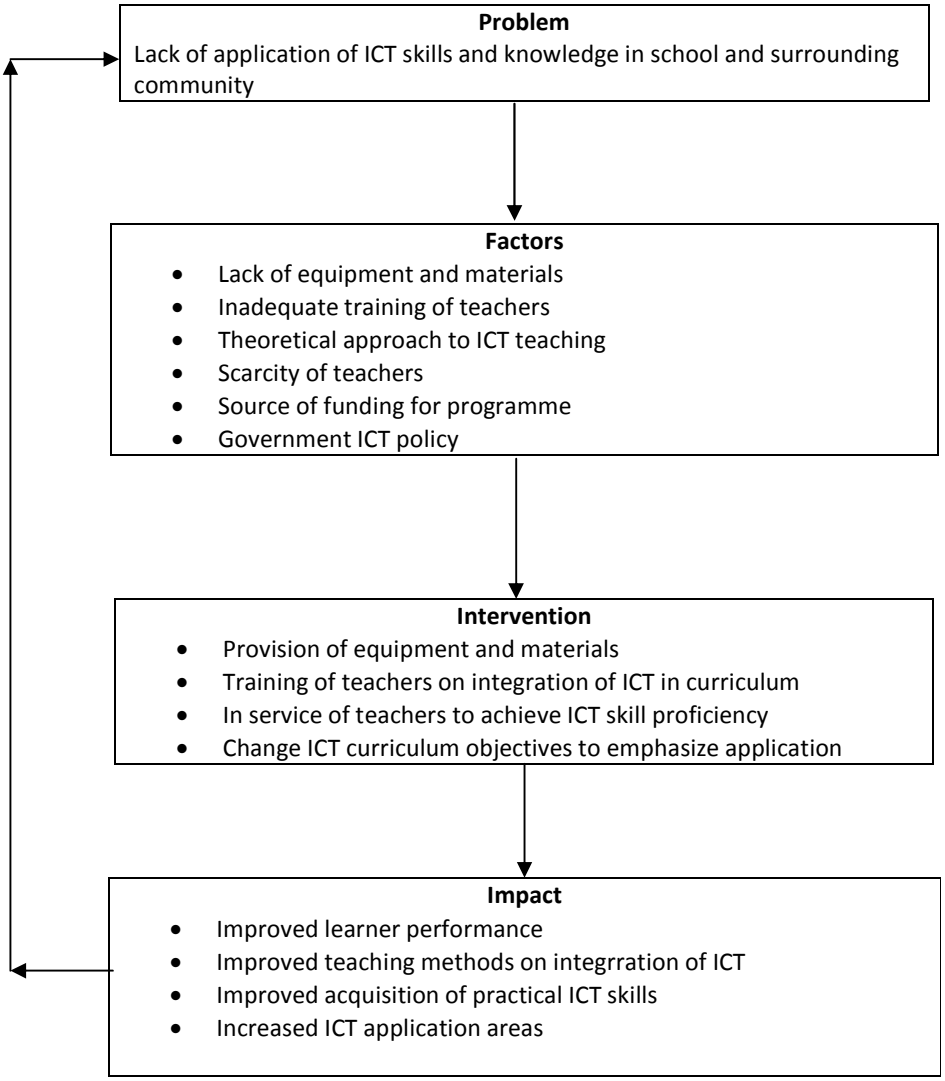

Figure1 Conceptual framework of ICT application in secondary schools.

Methodology

Research Design

This study used a combination of an exploratory approach using descriptive survey and ex-post-facto design. These were used to compare ICT application areas in NEPAD and non-NEPAD schools in Kenya. According to Gall (1995), a descriptive survey design is used in a preliminary and exploratory study to allow the researcher to gather information about the current status of the subjects under study. The subject under study in this case was the NEPAD pilot schools' project on ICT integration implemented through the NEPAD e-African commission in selected schools in Kenya. 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 groups where evidence exists before the study is done. In this case the researcher needed to compare performance of NEPAD and non-NEPAD schools by examining already existing documents in these schools.

Study Location

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 School is located, Vihiga District in Western province where Chavakali High School is, Nakuru District in the Rift Valley where Menengai High is situated, Wajir District in North Eastern Province where Wajir Girls is located, Murang'a District in Central Province where Mumbi Girls is, and lastly Isiolo District in Eastern province where Isiolo Girls is located. It is worth noting that out of the six NEPAD schools three were for girls, two for boys while one was a mixed school. The non-NEPAD schools were also of the same kind.

Target Population

The study targeted 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 Muranga, 2 in Bondo, and 11in Nakuru districts where the NEPAD schools were situated. Orodho (2004) explained that exploratory descriptive survey studies have two crucial categories of respondents, namely, the informed specialists and the consumers. Consequently this study targeted four quality assurance personnel in charge of computer studies at the Ministry of Education, Science and Technology (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, all of which formed the specialist category. The consumer category included the 36 schools' principals, 36 heads of ICT department in the study schools, and the 1600 form four students in all the schools within the population.

Sample and Sampling Procedure

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. This was done except in special instances where it was necessary to randomly choose a school after matching it's obviously skewed features. For example where the NEPAD School was mixed day then it was necessary to confine oneself to mixed day schools. This helped to reduce the effects of the intervening variables. As a result the control schools were chosen randomly by listing all the public secondary schools teaching ICT in the NEPAD district. This rule was ignored in Bondo and Isiolo districts where only two schools had computer studies in progress in their districts.

The sample therefore consisted of three specialist personnel namely; one subject specialist from K.I.E, the national Quality Assurance and Standards personnel in charge of computer studies, and the NEPAD national liaison person. The consumer category consisted of the twelve principals from the study schools, twelve ICT teachers, and 570 form four students in each study school. The ICT teacher chosen for the study from each school was the head of department computer studies or the ICT champion as they were referred to in the NEPAD schools. It should be noted that out of 570 students sampled for the study only 384 returned their questionnaires representing 67 percent returns. At the same time, all the 12 principals, and all the 12 HODs returned their questionnaires, representing 100 percent returns.

Data Collection Instruments

The data collection instruments for a study using this kind of design were the questionnaires and interview schedules (Mugenda & Mugenda, 1999). Therefore, the study mainly used 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 used the checklist to confirm the information gathered through the questionnaires from all the 12 study schools.

Reliability and Validity

This study used the test-retest (coefficient of stability) method to estimate the degree of reliability of the instruments. Spearman's rank order correlation was employed to compute the correlation coefficients. The computed correlation coefficients were approximately 0.79, 0.82, and 0.87 for the students, teachers, and the principals' questionnaire respectively. The results led the researcher to conclude that the instruments were reliable. Reliability was further enhanced by triangulation where the same facts are elicited for from different people in the same setting. In this particular instance, the researcher compared questionnaire results from the principals, the teachers, and the students in the same school, thereby enhancing the reliability of the results through triangulation. This study relied on content validity procedures using two sets of experts. They were needed to establish that the instruments' contents would be measuring what they were supposed to measure. The first set of experts consisted of the supervisors and a lecturer in the same department but at a different university. The second set of experts consisted of ICT lecturers at a Teachers' college. These experts gave their views on the comprehensibility, relevance, and clarity of the set items. All the questionnaires, interview schedule, and checklists were subjected to this treatment. All the experts then provided feedback and there recommendations were incorporated in the final instruments used in this research.

Data collection Procedures

The data for the study was collected through the use of the questionnaire, interview, and checklist analysis as stated earlier. The questionnaires were taken to each of the schools by the researcher except Wajir girls and Sabunley boys where the questionnaires were sent online to the teachers. Due to the time of year (October), all the schools requested to be left with questionnaires for students, which were completed and mailed to the researcher. The questionnaires for principals and teachers were filled and carried away by the researcher on the same day.

Method of Data Analysis

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. The information collected through the questionnaires, interview schedules and checklists were tabulated using frequency counts and percentage tables with the help of a computer package (Statistical Package for Social Sciences or SPSS). Comparison of the available equipment, materials and other learning resources were done using multiple bar graphs, line graphs, and circle graphs drawn from the worked out percentages and frequencies.

Results and Discussion

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 SPSS to work out ANOVA, chi-square, t-test, and Pearson correlation measures.

Human Resource Levels and Availability

The first research question of this study focused on 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 Teachers professional qualification, Teachers ICT

qualification, Funding of teachers ICT training, In-service of teachers, and Teaching support staff availability and funding.

Table1 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 that the checklist results indicated that the staffing levels in the NEPAD schools were much higher than that in the non-NEPAD schools. This is 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. The non-NEPAD teachers had 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, espectively). This may have had some impact in their learner performance in the ICT related fields.

Availability of ICT Equipment

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 2.

Table 2 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 2 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 doubled every other equipment in the non-NEPAD schools according to Table 2.

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. It was therefore not surprising when further analysis through chi-square revealed that there was a significant difference (χ^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.

Significant ICT Application Area

The third research question that needed to be answered in this section was: What were the significant differences in ICT application areas 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. There responses were analyzed and recorded in tables 3 and 4.

Table 3 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 3 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 4 ANOVA for Use of ICT in non-NEPAD Schools

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

Table 4 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 impact was not significant enough to have an effect on teaching/learning process.

Identification of Factors Influencing ICT Application Areas

The fourth question that needed to be answered by this study was: Which factors influenced ICT application areas in NEPAD and non-NEPAD schools? This question was answered by comparing the students' rating of a list of factors that they felt influenced their usage of ICT in the individual schools. The students' responses indicated that the highest number of students (78%) indicated that availability of computers was the single factor that greatly affected their use of the computer laboratory. The other factors that were identified by the students included rules and regulations from the ICT department (48%); number of computer literate teachers in the school (47%); school rules and regulations (35%); school administration policy on computer use (23%); regulations from the ICT funding bodies (20%); and the daily schedule of the school (10%).

Comparing Learner Achievement in NEPAD and Non-NEPAD Schools

The fifth 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 caused a significant positive impact on the schools' KCSE performance.

Suggested Guidelines for Implementation and Integration of ICT in Schools

The last question that this study needed to answer was: What are the acceptable guidelines for ICT implementation and integration in the Kenyan secondary schools? From all the results and information gathered in this study, the researcher suggested a guideline to be followed by an institution seeking to set up an ICT programme. Briefly, the researcher suggested that each school should develop an ICT policy in line with the ministry of education policy targeting complete curriculum reforms, Instructional reforms, Assessment reforms, Teacher development, School organisation and administration, and Community participation in the programme. Once the policy is in place, a source of funding must be identified. The funding should be adequate to provide for intervention on design, infrastructure, teacher training, and the development of a digital education content.

Conclusion

The presentations of the findings of this research were based on the research objectives that guided the study. The conclusions from the research analysis, which presented the findings, are explained in the remaining part of the report. 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 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 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. Further more, 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 ICT programmes 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 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.

The three main factors that affected students' use of the ICT facilities in the computer laboratory were the number of computers in a school, rules and regulation from the ICT department, and the number of computer literate teachers in the school. From the research results, the researcher suggested that each school should develop an ICT policy in line with the ministry of education policy targeting complete curriculum reforms, Instructional reforms, Assessment reforms, Teacher development, School organisation and administration, and Community participation in the ICT programme.

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 study:

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 and 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 take 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 learners would perceive ICT as a useful tool in learning 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 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 serve as a learning resource centers to all learning institutions and the community in that division. This would provide ICT resources to the community and in particular the teaching fraternity in that locality. They could be encouraged to make monthly membership subscription, which to a small extent could subsidize the 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.

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. School ICT laboratories should be located in such places as would allow the community to access the facility without being a security risk to other infrastructure in the school. This would mean enough reinforcement and external security arrangement with the community and the building being closer to the outer gate so that outsiders could access it without necessarily getting into the school compound.

References

AbdulSamad, A. (2006). Rural School Set Pace in IT. *Daily Nation Newspaper pp.23.* 19th July 2006, Nairobi: Nation Media.

ACWICT. (2004). *ICT Policy Project.* Available online http://G:\ict-policy.html. Accessed on 1/7/08

Allen, M.W. (2003). *Guide to e Learning: Building Interactive, Fun and Effective Learning Program for any Company.* New jersey: John Wiley and Sons

Azita, M. (1999). Computers and School Mathematics Reform: Implication for Mathematics and Science Teaching. *Journal of Computers and Science Teaching,* Vol 2, pp. 21-47.

Batchelor, S. Evangelista, S. Hearn, S. Peirce, M. Sugdem, S. Webb, M. (2003). *ICT for Development: Contribution to the Millennium Development Goals.* Washington: InforDev.

Batchelor, S. and Nocrish, P. (2005). *Framework for Assessment of ICT Pilot Projects: Beyond Monitoring and to Applied Research.* Washington: InforDev.

Barter, B. Telem, M. and Gev, Y. (1995). *Information Technology in Educational Management.* London: Chapman and Hall

Blissmer, R.H. (1994). *Introducing Computers: Concepts, Systems and Applications.* New York: John Wiley and Sons

Bonyo, J. (2008).Zain Launches Internet Plan for Schols. *Daily Nation Newspaper pp.4.* 16th September 2008. Nairobi: Nation Media.

Borg, N.B and Gall, M.D. (1989). *Educational Research: An Introduction* (*4th Ed.).* New Jersey. Longman Publishers

Borg, W. R. (1987). *Applying Education Research: a practical Guide for Teachers (2nd Ed.).* New York Longman Publishers.

Clark, K.D. (2000). Urban Middle School Teachers' use of Instructional Technology. *Journal of Research on Computing in Education*. Vol 1, pp. 124 – 131.

Dugdale, S. (1994). Integrating Curriculum and Computers for Pre-Service Teachers: Towards a Classroom Based Experience*. Journal of Technology and Teacher Education*, Vol 2, pp. 249-271.

Edubuntu. (2007). *The Laare Community Centre.* Available online http: G:\ edubuntu.htm. Accessed on 3/7/08.

Elakami, O. (2007). *Integration of WEB-Based Learning Environment into the Senior Secondary School National Chemistry Curriculum.* Nairobi: Book of Abstracts.

Farrel, G. Isaac, S. and Trucano, M. (2007). *The NEPAD e-Schools DemonstrationProject: Project. A Work in Progress. A Public Report.* Washington: InforDev.

Fraenkel, J. R. and Wallen, N.E. (2000). *How to Design and Evaluate Research in Education (4th Ed.).* San Francisco. McGraw Hill

Gall, M.D.Borg, W.R. and Gall, J.P. (1996). *Educational Research-an Introduction (*6thEd). New York: Longman

Gay, L. R. (1996). *Educational Research: Competences for Analyses and Application (5th Ed.).* New Jersey. Prentice Hall

Geisert, P.G. and Futrell, M.K. (2000). *Teachers, Computers, and Curriculum: Microcomputers in the Classroom. (*3rdEd).Boston: Allyn and Bacon.

Grant, G. (Ed.). (2002). *Regional Initiative for Informatics Strategies: Sectoral ICT Strategies Planning Templates.* Ottawa: Common Network of IT for Development and The Commonwealth secretariat

Hawkridge, D. (1983). *New Information technology in Education*. Sydney: Groom Helm LTD

Heckman, G. (2006). *Thomson Nelson Guide to Web Research: 2005-2006* Toronto: Thomson Nelson.

Holland, P. (2001). Professional Development in Technology: Catalyst for School Reform*. Journal of Technology and Teacher Education. Vol.9 No.2 p245-267:* Retrieved on September10, 2006: http:/www.patholland @ uh.edu.

IDRC. (2005). *ICT for Development in Africa.Vol.1 p 1-12.* Retrieved on August 28, 2006: http:/www.idrc.ca-s/105553155801

ICT Set up in Schools Remains a Pipe Dream (2006). ***Education Insight.*** Issue 09-2006. Nairobi: Image Books.

Institute of Advance Technology (IAT). (2002). ***Basic Concepts of Information Technology*.** Nairobi: Institute of Advance Technology.