

Full Length Research Paper

E-learning in secondary Schools in Kenya: A Case of the NEPAD E-schools

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The New Partnership for Africa's Development (NEPAD) schools were set up as centres of excellence in Information and Communication Technology (ICT) integration, so that other schools could copy their model in e-learning. It was for this reason that they were provided with computers, e-materials, internet appliances and trained personnel. But to gauge their levels of success as e-learning centres there was need to compare them to other schools offering ICT education in Kenya. It was for this reason that this study compared the application of the e-learning in NEPAD and non-NEPAD schools in Kenya. Specifically, the study: Identified significant differences in levels of integration of ICT in curriculum subjects; surveyed the differences in use of e-materials in education research; examined availability of e-libraries; identified significant differences in academic performance of NEPAD and non-NEPAD schools attributed to e-learning. The study used a combination of an exploratory approach using descriptive survey and ex-post-facto design. It was carried out in six of the eight provinces in Kenya, where the NEPAD schools are located. It targeted 1600 form four students from 35 secondary schools involved in ICT education (NEPAD schools included). Saturated sampling was used for the six NEPAD schools while six non-NEPAD schools were selected through simple random sampling. The sample consisted of three officials from the ministry of education, twelve principals and twelve heads of ICT department (HODs), and 570 of the form four students. The main data collection instrument was the questionnaire; administered to the students, the principals, and the HODs. The interview schedule was administered to the ministry of education personnel while an observation checklist was used as a confirmatory tool. Analysis was done using both descriptive and inferential statistics. The study found that, there was a significant difference in the application of e-learning in NEPAD and non-NEPAD schools. Based on these findings, it was recommended that schools involved in ICT education should intensify teacher facilitation and support teacher roles that are required in e-learning

Key words: E-Learning, ICT integration, ICT education, new partnership for Africa's development (NEPAD).

INTRODUCTION

Information and Communication Technology (ICT) consists of hardware, software, networks, and media for

collection, storage, processing, transmission, and presentation of information (voice, data, text, and images) according to the ICT Sector Strategy Paper of the World Bank Group (Batchelor and Nocrish, 2005). E-learning on the other hand refers to the purposeful use of electronic systems or computer in support of the learning process (Allen, 2003). Therefore, the presence of ICT infrastructure in a school is a pointer to an enabling environment for e-learning. It means that e-learning is only possible when ICT infrastructure has been put in place. The Sessional Paper No.1 of 2005 emphasizes that ICT skills play a key role in promoting the economic development

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Abbreviations: **NEPAD**, New partnership for Africa's development; **ICT**, information and communication technology; **MOEST**, ministry of education, science and technology; **DSTV**, oracle corporation and digital satellite television; **BOG**, boards of governors; **PTA**, parents teachers association.

of a country (MOEST, 2005). As a result, the government recognizes that an ICT literate workforce is the foundation on which Kenya can acquire the status of a knowledge economy.

The government as a result has made education the avenue for equipping the nation with ICT skills in order to create a vibrant and sustainable economic growth. The National ICT policy was launched in 2006 in response to issues raised in Sessional Paper No. 1 of 2005 according to MOE (2006).

It was also meant to assist the nation to achieve part of the Millennium Development Goals. Its principal objective was to facilitate sustainable economic growth and development, and poverty eradication through productive and effective technologies. It further aims at pursuing progress towards full socio-economic inclusion of citizens through universal access (e-learning). It was on this background that New Partnership for Africa Development (NEPAD) was initiated to address challenges facing African countries like Kenya.

ICT infrastructure was identified as a priority action area for inducement of conditions for sustainable development. In 2003, NEPAD prioritized efforts towards bridging of the digital divide between Africa and the developed world. One of the six high priority areas identified was the NEPAD e-school initiative. Its main aim was to integrate ICT in the delivery of education curriculum at secondary and primary school levels in order to improve access, quality and equity in education among member states. In Kenya, the participating schools were Maranda boys, (Nyanza province), Chavakali boys (Western province), Menengai High (Rift Valley), Wajir girls (North Eastern), Mumbi Girls (Central province) and Isiolo girls (Eastern province). The pilot project was launched in all the countries in the year 2005 with the Kenya launch taking place at Isiolo girls in Eastern province.

Piloting took just one-year from the time of the launch after which the programme was officially handed over to each country for expansion on a wider scale. According to NEPAD e-Commission (2003), 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. 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 an ICT programme have limited the number of candidates who 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, Business Studies, and Physics and so on. This could be done more easily if schools had access to e-materials and the relevant ICT infrastructure including the internet. The NEPAD schools were set up as

as model centres of excellence in ICT education for other schools to copy (MOE, 2006). This is what made it necessary for these schools to be fitted with the necessary ICT infrastructure. The main ones being computers, e-materials, internet appliances and trained personnel. But to gauge their success, as centres of excellence there was need to survey their contribution to the school and the surrounding community and provide information on ICT implementation especially the e-learning component in comparison to other schools already offering ICT education but not supported by NEPAD (non-NEPAD schools). This would only be possible if their usefulness to the school and surrounding community in terms of their e-learning programme was checked against the contribution of the already existing programmes to justify the investment. It was for this reason that this study compared the application of e-learning in NEPAD and non-NEPAD schools in Kenya. Specifically, the study: Identified significant differences in levels of integration of ICT in curriculum subjects; surveyed the differences in use of e-materials in education research; examined availability of e-libraries; identified significant differences in academic performance of NEPAD and non-NEPAD schools attributed to e-learning. As a result the following questions were formulated to direct the study: Is there a significant difference in NEPAD and non-NEPAD schools in the:

- (I) Levels of integration of ICT in the curriculum subjects?
- (II) Surveyed use of e-materials in education research?
- (III) Quantity of available e-libraries?
- (IV) Contribution of e-learning in academic performance?

METHODOLOGY

The study used a combination of an exploratory approach using descriptive survey and ex-post-facto design. It targeted 1600 form for four students taking computer studies from 35 NEPAD and non-NEPAD secondary schools teaching ICT in the study districts. The sampling unit was the school, and saturated sampling was used for the six NEPAD schools, while simple random sampling was used to select the six non-NEPAD. The sample therefore, consisted of three Ministry of Education personnel (subject specialist from K.I.E, national Quality Assurance and Standards officer in charge of computer studies and a NEPAD national liaison person), twelve principals, twelve ICT HODs, 570 form four students. The main data collection instrument was the questionnaire, one administered to students, another to principals and finally to ICT HODs. The interview schedule was administered to the ministry of education personnel while an observation checklist confirmed the results from the questionnaires. This study used the test-retest (coefficient of stability) method to estimate the degree of reliability of the instruments. The computed coefficients of reliability were 0.79, 0.82, and 0.87 for the questionnaires for students, ICT HODs, and the principals, respectively. The computed coefficients of reliability for the interview schedules were 0.74, 0.72, 0.85 and 0.91 for the quality assurance officer, subject specialist, NEPAD liaison person and checklist, respectively. The study relied on face validity procedures using two sets of experts. Data analysis was done using both the descriptive (frequency counts, percentages, and means) and inferential statistics (correlation analyses, analysis of variance (ANOVA), and the chi-square).

RESULTS AND DISCUSSION

The results were presented in the following subheadings and discussed for each section.

Integration of ICT in teaching and learning

One of the objectives of this study was to identify significant differences in levels of integration of ICT in curriculum subjects in NEPAD and non-NEPAD schools. It was for this reason that the teachers in charge were asked to indicate their ICT qualification in the department. Their responses indicated that non-NEPAD schools had better ICT qualified HODs than those from the NEPAD schools. This was because 67% of HODs from the NEPAD schools were holders of a certificate in ICT acquired after two weeks of inservice training as compared to 17% in the non-NEPAD schools having a certificate after two years of training while the rest (83%) had either a diploma or degree in computer studies. It would have been expected from these results that the integration of ICT would correlate positively with the qualification of the teacher in ICT and much more, the teacher in charge. This was not the case since the use of ICT in other curriculum subjects in NEPAD schools was significantly more frequent in NEPAD schools than in non-NEPAD schools ($F = 16.03$, $df = 1$, $p < 0.05$). Further investigation indicated that, there were more ICT teachers in NEPAD schools (At least 3 per school) than in the non-NEPAD schools (Just 1 teacher per school). The qualification of the ICT teachers varied in each school such that the NEPAD schools had teachers with certificate (33%), diploma (17%), and degree (50%). The non-NEPAD schools had teachers with certificate (11%), diploma (56%), and degree (33%).

This meant that in terms of computer studies qualification, non-NEPAD ICT teachers were more qualified (89% graduates and diploma holders compared to 67% of the same category from NEPAD).

Students were asked to indicate the frequency with which they were taught Mathematics, Languages, Sciences and Humanities using electronic media. Their responses indicated that more than half (More than 200 students out of 384) were never taught Mathematics, languages, and Humanities using any electronic media, even though more than half of them were taught Science using ICT. Approximately, 50% of the students experienced ICT related learning on a weekly basis in all subject areas, with science being indicated by 100% of the students. 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 was 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 and e-libraries. All NEPAD schools had LCD

projectors with half of them having smart boards, which none of the non-NEPAD schools had. These are equipment, which make it fairly easy for the teacher to incorporate the e-content in their instructional approaches. For example, it is fairly easy for a teacher to use power point lesson presentation when a smart board or LCD projector is available in the school. At the same time, all the NEPAD schools had e-libraries, which made integration much easier as teachers easily accessed e-materials, or directed learners to relevant sources.

The results indicated that, the use of ICT in teaching other subjects in NEPAD and non-NEPAD schools was established to be significantly different ($F = 72.58$, $df = 1$, $p < 0.05$). This meant that, the use of ICT in the NEPAD schools had greatly influenced the mode of lesson presentation in these schools. In other words, the mode of learning would greatly change in the non-NEPAD schools if they were provided with the same ICT facilities.

Educational research

This was one of the application areas studied as a means of answering the research question: Was there a difference in the use of e-learning in education research in NEPAD and non-NEPAD schools? In this instance, the question could be answered by examining how students used e-learning facilities in education research, mainly availability and use of internet and e-libraries. Results from principals and ICT HODs showed that all students (100%), in NEPAD schools had access to electronic materials for educational research. At the same time, only a few students from the non-NEPAD schools (17%) accessed materials for educational research. This pointed to a major difference in the accessibility levels of those students from NEPAD and non-NEPAD schools that had an attempt to use their ICT facilities for educational research. 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.

The internet

Students were asked to indicate how frequently they used internet services. They were expected to rate the usage in terms of daily, weekly, monthly, and termly or never used. Their responses were used to calculate the percentage number of students indicating usage of the service. From the calculations, the study established that overall; a reasonable number (53%) of the students used internet services in their schools. However, of these, 90% were from NEPAD schools. This meant that, 90% of students from the non-NEPAD schools never used internet services at all. The remaining 10 percent used services variedly with a very small number (less than 1%)

of students using the service daily. More than five percent used the service on a weekly basis, and the remaining 4 percent used the service on a monthly basis. In the NEPAD schools, results indicated that 30% (of 53% recorded users) used the internet daily, 63% used it weekly, and seven percent used it on a monthly basis. Further analysis of students' responses showed that, significantly more students from NEPAD schools used internet services than in the non-NEPAD schools ($\chi^2 = 311.369$, $df = 4$, $p < 0.05$). This was not surprising given that all the NEPAD schools had free internet services and connectivity while only one of the non-NEPAD schools had the same facility and even then, the students had to pay for the service by buying a mobile phone card for access.

The ICT HODs were also asked to indicate the frequency of the internet usage by their students in education research. Due to the nature of the responses, chi-square was used to test significance levels in the use of this service. The results showed that there was a significant difference ($\chi^2 = 12$, $df = 3$, $p = 0.05$) in the usage of internet services for education research in the NEPAD and non-NEPAD schools. This was confirmation of the students' view, which had indicated a significant difference ($\chi^2 = 311.4$, $df = 4$, $p < 0.05$) in the use of internet in the NEPAD and non-NEPAD schools.

In conclusion, it could be stated that, availability of internet services in the NEPAD schools, gave their students undue advantage over their non-NEPAD school counterparts in as far as the use of ICT in educational research was concerned. This was because the internet seemingly held the major key to educational research and by extension, e-learning. Infact, it is an open secret that it was the key component of the NEPAD projects. At the same time it was the major component of integration. This could explain the existence of a significant difference in ICT integration in curriculum subjects in the two categories of schools.

Electronic libraries

Education research becomes quite simple if electronic content (e-content) is available (Allen, 2003). It was therefore, necessary to investigate the availability of electronic materials (e-materials) through the presence of the e-libraries in the study schools. This was necessary because the presence of e-learning would enable teachers in the schools to train their learners in personal study through research. In this way the schools would be having teachers and learners who are in a position to use electronic materials in research, which was one of the objectives in this study. To investigate availability and use of the e-libraries, the checklist was used to identify them in each school. The information from the checklist results showed that the NEPAD schools had a total of 40 e-libraries spread amongst them. This gave them an

average ratio of at least six 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, Wikipeddia, and Health matters which students used for personal information search as they studied. In the non-NEPAD schools on the other hand, there were only three e-libraries.

The checklist indicated further 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 Boards of Governors (BOG) or Parents/Teachers Association (PTA). Therefore, it was possible to conclude that e-libraries were expensive as such, out of reach to schools whose only funding of the ICT project was BOG/PTA. This came out clearly because the schools' PTA/BOG could afford to invest in computers (averagely 24 per non-NEPAD and 46 per NEPAD School) but were not able to invest in even a single e-library.

This fact was true for both categories of schools except in one school that had more e-materials than what NEPAD had pro-vided, meaning the BOG/PTA sourced for or bought the rest. This suggested that, besides prohibitive costs, the other possible explanation for BOG/PTA's lack of investment in e-libraries was lack of information on the same. This was because the only school that had extra e-libraries than what NEPAD had provided had a very aggressive ICT HOD who took personal initiative to provide information needed for further ICT use in the school. This came out when the checklist indicated that, it was the only school that had networked its ICT operations such that the principal could follow all school operating activities from his office. The same school offered peer training to other teachers in the whole province on ICT integration while the students were able to give clear presentations on any subjects of their choice. It meant that, this particular school had attained a level of implementation of ICT education that the other NEPAD schools had not yet embarked on. This brought out the fact that ICT integration requires personal initiative and interest amongst the teachers to drive its cause.

Further investigations from the observation checklist showed that students in NEPAD schools indicated that, half of them (25% of total students) accessed online educational materials many times in their schools, while the other half (25%) accessed it some times. It further showed that, only 16% of the students from the non-NEPAD schools indicated that, having accessed these materials sometimes (8%) or a few times (8%).

Student responses also revealed that 58% of all of students used ICT in education research through the e-libraries. As a result, further analysis revealed that students from NEPAD schools significantly used this

service more as compared to non-NEPAD school students ($\chi^2 = 9.00$, $df = 3$, $p < 0.05$). This was expected since all NEPAD schools had at least five e-libraries each while, all non-NEPAD schools had none except one school. The other explanation was obviously due to the equipment and materials the consortia partners fitted in the project schools.

Contribution of information search to academic performance

The students were asked to indicate which ICT services contributed to an improvement in their academic performance. Results showed that 61% of all the students indicated that information search contributed positively to their academic improvement. Amongst all the ICT services students listed as contributing towards the improvement of their academic work, information search and ICT integration had the highest percentage (61%). The other areas contributing to academic improvement noted by the students included use of interactive computer games (21%), use of simulated experiments (11%), and interaction with students from other schools (6%).

It was also noted that of the 61% who identified information search and ICT integration, 90% were NEPAD school students. This was because it was mainly the NEPAD students that had e-libraries in their computer laboratories and were connected to the internet as a result to accessed online educational materials.

Therefore, they were right to indicate that information search contributes positively to their academic performance.

Comparing learner achievement in NEPAD and non-NEPAD schools

The other 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.

Schools' KCSE mean grades

In a bid to conclusively answer the research question: Was there a significant difference in the contribution of e-learning in academic performance of learners in NEPAD and non-NEPAD schools? The checklist results indicated that the NEPAD school students posted a better performance in the KCSE examinations (mean score of $6.65 \pm 0.361 - 5.70 \pm 0.297$) for the two categories of schools.

The fact that, there was a better performance in KCSE mean grade in NEPAD than the non-NEPAD schools does not mean that it was specifically due to e-learning, because it could also have been due to any other factor not being investigated. To rule out action by other extraneous factors, further investigation was needed. Since the e-learning project was launched in 2005, it was necessary to investigate the schools' KCSE performance specifically in the years 2005 - 2006. The results showed that, there was no significant difference (ANOVA, $F = 1.047$, $df = 1$, $p < 0.05$) in the schools' mean scores in NEPAD and non-NEPAD schools in the years 2005 and 2006. This meant that, there may have been other extraneous factors not determined in this particular study that were responsible for the better performance noted in the NEPAD schools when compared to the non-NEPAD schools other than the e-learning project. Or alternatively, e-learning could be indirectly involved in the better performance without being the key factor.

KCSE mean grade in computer studies

The last objective of this study was to identify significant differences in academic performance of NEPAD and non-NEPAD schools attributed to e-learning. Besides the overall KCSE examination results, the researcher used the checklist to collect information on KCSE examination results for the study schools in computer studies. This was because it was the main subject directly influenced by the ICT facilities. Therefore, the KCSE mean grades in computer studies in NEPAD and non-NEPAD schools were compared as a means of comparing performance in the schools. In comparing the two categories of schools, it was interesting to note that the lowest performance posted by a NEPAD school would have been amongst the best in the non-NEPAD school category. This was because the other NEPAD schools posted even better performance (Average mean grade ranging from 7.00 - 10.20), while the non-NEPAD schools had mean grades varying from 6.51 - 7.66, and in the same years. This indicated that, the performance of learners in the NEPAD schools (Average mean = 8.27) was much better in the KCSE computer studies examination than the performance of the non-NEPAD schools (average mean = 6.69) in the same subject.

Further statistical analysis carried out to compare the effects of the e-learning programme on the mean grades in computer studies in the two categories of schools in the years 2005/2006 showed that, there was no significant difference in the schools' performances in the KCSE computer studies examination even though the NEPAD schools posted a better performance when the average mean grades were considered.

The findings of this research were in line with the results reported from Batchelor et al. (2003, 126) of schools where e-learning had been practiced: "There

has been a revolution: we have better facilities to engage in dialogue and to solve problems that emerge in the classroom, and also to create projects and to address our local needs” a Student stated; “The classes were tedious, full of books and notebooks, working individually without integration of materials. Now we work in groups, everyone values the work of all members of the class, there is communication with companions in other schools, and the teachers are more dynamic. Now the learning activities challenge your own creativity and it is more fun to work in the classroom”. Another study reported by Abdulsamad (2006) gave a discourse of the successful implantation of e-learning by NEPAD in a primary school in Coast province, Kenya. This was the very first primary school in the whole of Africa to join the NEPAD programme. The admission of the primary school and the success stories behind its e-learning implementation gave hope for the eventual ICT implementation in all the sectors of education in Kenya as was confirmed for secondary schools in this study.

Conclusions and Recommendations

The findings brought out the fact that e-learning produces significantly better results in the teaching/learning outcomes in a secondary schools. Specifically, the results from this study indicated 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 non-NEPAD schools. This was because of availability of the internet and other ICT equipment and materials like LCD projectors, smart boards and e-libraries.

As a result, ICT integration in NEPAD schools was significantly different as compared to the non-NEPAD schools; all students (100%) from NEPAD schools had access to electronic materials for educational research while only 17% from the non-NEPAD schools had access to the same; only 53% of all students in the study schools used internet services. However, 90% of these students were from NEPAD schools. As a result, there was a significant difference in the way the NEPAD and non-NEPAD school students used the internet services and e-libraries in education research ($\chi^2 = 311.369$, $df = 4$, $p < 0.05$). This was because all the NEPAD schools (100%) had access to the internet and averagely had at least 6 e-libraries each school as compared to only 3 in one non-NEPAD schools; NEPAD schools performed better than the non-NEPAD schools in the KCSE examinations with an average mean score of $6.65 \pm 0.361 - 5.70 \pm 0.297$ for the two categories of schools, respectively, but this could not be attributed directly to e-learning; The NEPAD schools performed better in KCSE computer studies examination than the non-NEPAD schools with an

average mean score of $8.27 - 6.69$ for the two categories of schools, respectively. This was despite the fact that, computer HODs from the non-NEPAD schools (89% either graduates or diploma) were more qualified in computer studies than their counterparts from the NEPAD schools (67% either graduates or diploma). The difference in performance was however not significant.

The study recommends that every school that has an ICT programme should seek to be connected to the internet and to be in possession of e-content relevant to the curriculum taught. This was seen to be possible through formation of public and private partnerships with ICT providers. As a result this would facilitate teachers' roles that are required in student centred learning e.g. use e-learning in content delivery is done more easily while learners would have more sources from which to carry out education research. Another recommendation is that, the government should find a way of exposing more schools to e-learning facilities probably by setting up centralized e-learning centres within specified education localities.

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