

PEDAGOGICAL INTEGRATION OF ICT IN SELECTED KENYAN SECONDARY SCHOOLS: APPLICATION OF BENNETT'S HIERARCHY.

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Abstract

This article presents findings on the extent to which selected secondary schools in Kenya use ICTs to deliver curriculum content. Qualitative and quantitative methods were used to collect the data. Five secondary schools in urban and rural areas were targeted for study. Using Bennett's Hierarchy of Evidence Model, the data indicates that all the five secondary schools are at different levels in their use of ICT in curriculum delivery. While some are at the level of acquiring the physical and human resources, others are at the learning stage. The results also show that the integration of ICT in curriculum delivery is influenced by the ownership of the school, its ICT policy and the school manager's level of ICT skills. While private schools seem to have a clear policy on ICT integration, public schools have none. This implies that the Kenya Government should develop and implement an ICT policy on education. Secondly, head teachers should have ICT skills because they can act as change agents by encouraging and driving the adoption of ICT in teaching and learning processes in their schools.

KEYWORDS: ICT integration in education; Bennett's Hierarchy of evidence; adoption of ICT; teaching and learning; ICT policy; curriculum delivery

Introduction

Education is a prerequisite for achieving developmental goals globally. This is supported by evidence from developmental research, which has shown that education is positively associated with human welfare issues. One such study was by Lockhead et al. (1980), which found that in a modernizing environment, four years of education improved agricultural productivity by 10 %. A World Bank report (World Bank, 1995, p.1) indicates that education is crucial to effective poverty reduction strategies. Tilack (2002, p.198) concluded that there is sufficient research to support the hypothesis that education and poverty are inversely related. A study by the Global Campaign for Education (2004) suggested that if Universal Primary Education (UPE) is realized then an estimated 700,000 young people could be prevented from contracting HIV/AIDS. Wims and Lawler (2007, p.2) also suggest that educating females has enormous potential to create a virtuous circle, as children of educated mothers are more likely to receive an education. Glewwe (1999) in his study on health in Morocco found that mothers with numeracy and literacy skills attained through school possessed greater health knowledge and consequently had healthier children.

It is, therefore, generally agreed that access to knowledge provides individuals with a competitive advantage in whichever environmental situation they may find themselves. ICT promises to be one way of accessing information and hence empowering people to compete effectively in society. Unfortunately, most developing countries find themselves in a situation of ICT deprivation. This leads to low access to information and invariably low competitiveness. Prahalad and Hart (2002, p.9) regard information poverty as probably the single biggest roadblock to sustainable development.

Technology enhanced learning in secondary schools is a rare experience in educational systems in most of African schools. The Southern African Department of Education uses “Technology Enhanced Learning” as a phrase to describe the use of technologies in teaching and learning environments for any education-related purpose (SAIDE Report, 2001). This is the perception this study will adopt to describe the use of ICT in teaching.

In developing countries, particularly Sub-Saharan Africa, the quality of education has been negatively affected by factors such as low economic growth rates, political and ethnic conflicts, HIV/AIDS to mention a few. The high levels of debt in these countries have also aggravated the low level of development, particularly in education. The basic instructional tool in most schools, at primary and secondary level is the blackboard and chalk (Alade, 2005, p.135).

Studies on integration of ICT in teaching and learning at secondary school level in Africa are scanty. A cursory glance, however, appears to show that although some secondary schools in Kenya have ICT facilities supplied by either the donor community, for example, School-Net, Computers for Schools Kenya (CFSK), parents and other well-wishers, it is not yet scientifically established how the ICT facilities are used for effective instructional purposes. There is a difference between the physical and the pedagogical integration of ICT in teaching. The computers are in schools, but of what instructional value are they for the implementation of the curriculum? This is a question that educationists need to address.

The purpose of this paper is to highlight how teachers in selected secondary schools in Kenya are using ICTs to deliver secondary school curriculum. Answers were sought to the following questions: what type of software is used in secondary schools for teaching and learning? What are the main challenges hindering the integration of ICT in delivery of curriculum and what factors differentiate schools that integrate ICT from those that do not? Three objectives guided the study. These were:

- a) To evaluate the extent to which secondary schools use ICTs to deliver curriculum content
- b) To establish the specific computer software used.
- c) To investigate the main challenges faced in integrating ICT in the delivery of curriculum content.
- d) To identify the factors that differentiate the schools that integrate ICT from those that do not integrate.

Literature Review

ICT utilization appears to be more widespread in African secondary schools contrary to widespread belief. According to PanAf, (2006, p.13) both teachers and students use it in the learning process. It is observable that certain disciplines have developed ICT-related practices. The report goes further to point out that ICT integration in learning activities in secondary schools is important since it goes beyond interpersonal communication and integrates several dimensions such as interactive learning, collaborative learning (PanAf, 2006, p.13).

The SAIDE Report (2001) identified three types of technology used in schools in developing countries: Technologies to support the provision of course materials to learners made up

predominantly of information and communication technologies (ICT), for example, printed materials, television, radio, multimedia computers and the Internet. Technologies to support other teaching and learning processes such as white boards, overhead projectors, woodwork equipment, language laboratories, pen, paper, and computerized simulations and technologies to support management and administration such as telephones, filing cabinets and so on (pp1-2).

The SAIDE Report goes further to provide some principles for integrating technologies into teaching and learning environments. Making learning needs and desired outcomes from which learning objectives are derived the starting point for decisions about what to teach and how; planning for the appropriate use of technology in the learning systems as a whole and placing people, learners and educators at the center of the learning process would ensure that the chosen technology serves their teaching and learning goals. The report also cautions institutions to resist the tendency to see technology as a solution to education and training needs because the value of technology in enhancing learning depends on how people integrate it into the learning process.

Where technology is introduced, the users should be trained on how to use the resource appropriately. Planning for the development of appropriate infrastructure networks, providing learners with choice about learning routes, helping teachers and educators develop their own ability to learn, integrating evaluative and impact assessment into the learning systems from the start, adopting a learning orientation to the use of technology in education and training and providing affordable and cost-effective technological resources are some of the tenets that would ensure successful implementation of ICTs in teaching and learning. It is in light of these principles that an effective use of ICTs by teachers in secondary schools in Kenya should be evaluated.

According to Baylor and Ritchie (2002), regardless of the amount of technology and its sophistication, technology will not be used unless Faculty members have skills, knowledge and attitudes necessary to infuse it into the curriculum. This is consistent with the findings of Gakuu (2006). He found no significant difference in University lecturers' attitude towards the adoption of ICT between the various university disciplines and that the adoption rate would be enhanced if the lecturers' issues of concern were addressed. Karsenti and Larose (2001) stated that a major obstacle to adequate use of technology across all grade levels and the curriculum is the lack of a critical mass of teachers who feel comfortable in using the technology and who can provide support and exemplary instances of good practice to those who are still not well versed with technology.

A research study by Wims and Lawler (2007) that used both quantitative and qualitative survey, in three secondary schools in the expansive Rift Valley Province in Kenya revealed that there was an absence of educational software, lack of Internet access and use of e-mail in the schools. Some 35-40% of secondary school teachers had never used a computer. The study revealed that exposure to computers in schools influenced the career choices of former students. The main issues of concern that came out of the study included staff training, mainstreaming of ICT across the curriculum and provision of adequate ICT equipment.

In another study by Bakar and Mohamed (2008) on assessment of trainee teachers' confidence to integrate ICT in teaching found out that trainee teachers in general were quite confident with their

ability to integrate ICT training. However, male trainee teachers were more confident compared to their female counterparts. Trainee teachers who had taught previously in schools and vocational trainee teachers also felt more confident with their ability to integrate ICT in teaching. They found no significant correlation between academic performance and levels of confidence in the integration of ICT in teaching.

Several researchers, academicians and policy makers have suggested several ways in which ICT can contribute to solving educational problems in developing countries (Whims and Lawler, 2007, p.3). The shortage of qualified teachers in Sub-Saharan Africa estimated at 25% by GeSCI (2004) can be addressed by the use of ICTs to accelerate teacher training. The Imfundo Report (Unwin, 2004) concluded that ICT in education has most potential in pre- and in-service teacher training. ICTs can also be used to enhance learning. They can minimize some of the negative factors endemic in many schools in developing countries such as high pupil: teacher ratios, shortage of basic instructional materials and poor physical infrastructure.

High dropout rates are a common feature in schools in developing countries. ICTs can be used to make the school curriculum more interesting. Studies by Hepp et al., (2004): Osin, (2003) found out that children enjoy learning using technology. Gomez and Martinez (2001) descriptively shows how using Internet in education programmes for street children in Columbia enticed a higher than usual number of the children back to school. ICTs can also play a significant role in providing teachers and students with access to educational content and updated resources (Wims and Lawler, 2007 p.3). Open and distance learning methods, which have traditionally been used to reach learners in remote geographical areas can be improved through ICTs. This would be appropriate for learners in the conflict zones of Africa such as Somalia, South Sudan, Chad and Sierra Leone.

It is, therefore, apparent that ICTs have enormous opportunities in enabling access to learning. ICTs can be used to solve many of the educational challenges faced by education systems in most of developing countries. In particular, teachers can use ICT to improve their instructional delivery and hence make learning more effective. However, for this to happen, teachers must be ready to learn to use the technology. More so, educational policy makers need to appreciate the need to motivate teachers to use ICTs in the learning process. ICTs have penetrated all facets of people's lives and educational curriculum content delivery in Africa and particularly in secondary schools in Kenya cannot be left behind.

Methodology

The research design for this study was the case study. Data collection methods were triangulated. The mixed method approach where both qualitative and quantitative methods were used to collect data was chosen for this study. The selection of subjects was based on a multi-case approach as opposed to a single case study. Five secondary schools in urban and rural areas were targeted for study. Selection was not based on a statistical model, but on the significance of the case for the objectives of the study, which in this case was the presence of computers in the institution. Diversity factors taken into consideration for the selection of schools included gender, type of institution, geographical location and ownership.

The indicators of ICT integration in curriculum delivery were: the frequency of ICT uses by the teachers for academic purposes; types of ICT use by teachers; types of software and number of courses taught using ICT. For every indicator, triangulation was employed by seeking views from the school managers, educators and learners on the same indicator. The following qualitative and quantitative data collection instruments were used:

- semi directed interviews with school directors, administrators, pedagogical advisors, and parents;
- focus group discussions with pupils and teachers;
- audiotapes of discussions, videotaped classroom observations and photographs of school environments;
- review of school documents on ICT and teacher and student productions;
- questionnaires for quantitative data from pupils and teachers on access, usage and training.

By applying similar procedures for data collection, comparison between subjects was possible.

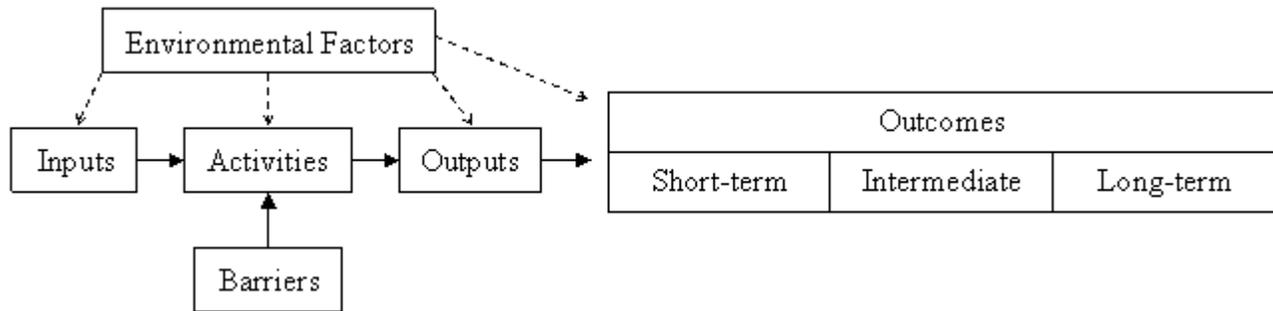
Data collection procedures involved four visits to each institution. The first visit was made to ascertain if the school had computers. The second visit involved completing survey questionnaires, whose purpose was to collect quantitative data from the school manager and educators on connectivity, access, training and gender. The third visit was made by all researchers and the aim was to conduct focus group discussions with teachers and learners. These sessions were tape recorded and videotaped and later transcribed. Finally, the data collected was The data collected was edited and uploaded onto the Pan African Research Agenda on the Pedagogical Integration of ICT in Education (PanAf) Observatory. Data analysis was done qualitatively using narratives guided by the research objectives and quantitative data was analyzed descriptively and presented in bar graphs.

Theoretical Framework

In order to establish the effectiveness of the integration of ICT in curriculum delivery, the evaluation approach developed by Bennett (1975) was applied. Bennett's Hierarchy encourages evaluators to look at how well goals have been achieved. This approach measures the impact of a programme using a system of criteria usually referred to as Bennett's Hierarchy of Evidence Model. This model has been used from the 1970s to evaluate extension programmes, and it has continued to be updated and used for planning and evaluation of broad-based development programmes and therefore ideal for evaluating educational programmes. Bennett's Hierarchy is a list of the types of evidence that may be examined by an evaluator to determine the overall impact of a programme. Information from lower levels helps to explain the results from the higher levels which are more long term. As an evaluator moves up the ladder the evidence becomes more difficult and expensive to obtain. For example evidence of actions such as behavioural changes in the target audience may require focus groups and interviews while evidence of resource use may simply require an observation of existing infrastructure. Evidence from higher up the ladder provides a stronger indication of whether the programme has achieved its larger goals. The Bennett's Hierarchy of Evidence Model is based on a logical progression of evidence required to conduct an evaluation. The model has seven stages explained in Table 1 below. According to Bennett's thesis, collecting data at several stages of the hierarchy usually strengthens evaluations.

To enhance understanding of the effectiveness of ICT integration in secondary schools, Bennett's Hierarchy was paired with the generic logic model used in project planning. A logic model explains the elements and causal linkages that exist within a programme. Although logic models may vary in design, they typically include six major elements. These are shown in Figure 1 below.

Figure 1: General Logic Model



Environmental factors and barriers are the external factors that act on a programme. Inputs include the resources that are used for the project, such as ICT equipment, human and financial resources and physical buildings. The activities are the actions taken by School managers to achieve the goals of the project for example purchase of computer software, professional training of teachers in ICT and providing learners with computer literacy. Outputs are the immediate results of the initiative, such as the number of teachers who are able to integrate ICT in their subjects. Outputs provide evidence that an activity has occurred, though not necessarily that a program has achieved its purpose. Outcomes are the desired accomplishments or changes that show movement toward the program's ultimate objectives. Outcomes typically are divided into short-term, intermediate and long-term subsets. In the case of ICT integration in education, short-term outcome might be teacher's heightened awareness of importance of ICT; an intermediate outcome might be development of study material to deliver through ICT and a long-term outcome, often the ultimate goal of the initiative, might be improved academic performance by learners and consequently better educational outcomes.

Logic models also include information on the program's environment and barriers. Environmental factors describe the context in which the program operates. In an educational logic model, one environmental factor would be that rewards to teachers do not take into account the extra workload resulting from preparation of ICT teaching materials. Barriers are a subset of environmental factors; they are hindrances to the achievement of the ICT integration goals of a school. Identifying barriers in the logic model allows school managers to identify the necessary steps that must be taken to achieve successful results. A barrier might be resistance to change of teaching method by teachers or inadequate ICT skills among teachers.

Table 1 below illustrates the link between the logic model and Bennett's Hierarchy.

Table 1: Bennett's Hierarchy		
Logic Model	Bennett's Hierarchy	Effective Delivery of Curriculum Content Using ICT
Outcomes (Long-term)	7. Impact	Represents end results, impact or benefit of a programme e.g. Improvements in quality of teaching and learning, better academic performance, positive impact on national development, achievement of national educational goals.
Outcomes (Intermediate)	6. Actions	If the target audience is students, evidence of their ability to search and use ICT information or teachers actually integrating ICT in teaching using various software.
Outcomes (Short-term)	5. Learning	Change in knowledge, attitudes and skills acquired, aspirations, ambitions and hopes in relation to students' and teachers' understanding of the importance of ICT integration in teaching and learning.
Outputs	4. Reactions	Reaction of teachers in terms of degree of interest, as well as positive or negative feelings toward ICT integration in teaching and learning.
	3. Participation	Number of teachers and students reached within a school, characteristics of teachers and students; extent and intensity of exposure to programme etc.
Activities	2. Activities	Development of performance measures; formulation of ICT policy, maintenance, acquisition of ICT skills and competencies, subject matter taught and methods used.
Inputs	1. Resources	Human resources e.g. ICT advisors, computer laboratories, funds and related infrastructure.

Findings and Discussion

Five secondary schools were surveyed in the study: St. Joseph's High School, Githunguri is a rural based government assisted public boy's school with 14 computers and 800 learners. The school has 32 teachers of whom 25 are female and 7 are male. While all the 32 teachers have access to the computers, only two use them for academic purposes. It was also apparent that only the subject of Computer Studies is taught using computers. This confirms an earlier observation by Wims and Lawler (2007) that the computer is the object of study rather than a tool for teaching and learning in most schools in Africa. Except for preparing lesson plans, there is no integration of ICT in the teaching and learning of other subjects.

Musa Gitau Secondary School is also a rural based, mixed government assisted public school, with

21 teachers, 11 female and 10 male. The school has 20 computers and none of them is dedicated to the teachers. All 426 students have access to the computers. The school has allocated 15 hours per week for computer studies where the computer is the object of study. Only one female teacher had completed 1-50 hours of professional development, which included ICT training. Out of the eight subjects offered in the school, none of them is taught using any form of ICT. Although the teachers are free to use the 20 computers, none uses them for teaching purposes. This could also be due to competing with the learners for same computers as none are dedicated for teachers.

The scenario changes at Uthiru Girls Secondary School, Aga Khan High School and Enna School where ICT integration in teaching and learning is evident. At Uthiru Girls, five subjects have been integrated with ICT. Uthiru Girls is a semi-urban school with 18 functional computers, 2 of which are exclusively for teachers. The school has 500 learners and 35 teachers: 25 female and 10 male. Fourteen teachers had more than 50 hours of professional development that included ICT training. The Principal, The Deputy Principal and Heads of Departments have had some ICT training. Unlike in most schools, the school principal is competent in ICT and holds a Higher National Diploma in Information Technology. The school also has a fully qualified computer teacher. The teachers use computers to prepare lesson plans, teaching notes and to evaluate students' academic performance in class. The School is connected to the Internet and this enables the teachers to access teaching materials, hence enriching their teaching. The students are encouraged to use the local network to share questions and answers with the teachers. Power point presentations are used and according to The Principal, this has made teaching and learning more exciting and easy. The school downloads the most current teaching materials from the Internet hence saving on the cost of purchasing textbooks. The main computer software used include MS-word, MS- Excel, MS-power point, MS-Quick Books and Encarta Encyclopedia.

Aga Khan High School is a private secondary school with 350 learners and 23 teachers: 11 male and 12 females, all of whom have completed at least 1-50 hours of professional development, which included ICT training. The school has 31 computers that are all accessible to the teachers and students. To teach in this school, a teacher is required to be computer literate. It is apparent that teachers use computers to prepare lesson plans, lesson notes, evaluate students academic performance and for general database. The Cyber School software is used to teach science subjects and mathematics

The Enna School is a private girl's secondary school in a semi –urban location. The school has 100 female students with 30 computers, 25 of which are accessible to the teachers. The school has 10 teachers, six males and 4 females and all have completed 1-50 hours of professional development, which included ICT training. Two male teachers have completed over 50 hours of professional ICT-related training. The school teaches 12 subjects one of them being Computer Studies. The teachers use the computers to prepare lesson plans, prepare lesson notes, and evaluate students' academic performance and to search information from the Internet. To perform these tasks, the school has installed MS-word, MS- Excel, Encarta and MS power point software. The teachers indicated that power point presentations have made teaching and learning easy and enjoyable. For a teacher to be hired to teach in the school, he or she must be computer literate.

Discussions

From these findings, the five schools that participated in this study are at different stages in the integration of ICT in teaching and learning. There is an apparent difference between private and public schools. Aga Khan High School and The Enna School have deliberate policy for integration of ICT in teaching. Teachers are only hired on the basis of computer literacy skills. In both schools it is evident that ICT is used in a more versatile manner and even the software used are more compared to the public schools with the exception of Uthiru Girls High School where the Principal offers clear leadership in use and investment in ICT skills and infrastructure. It is also clear that the Principal supports professional development of teachers in ICT. It is not surprising then that unlike the other public schools, integration of ICT in teaching and learning is higher. These findings concur with those of Tearle (2003, p.576) who observed that strong departments with enthusiastic and capable staff result in positive outcomes that provide a good model for others and create a favourable climate for the implementation of ICT.

The findings from the five schools indicate differences related to ownership of the school, location of the school, professional training of the teachers that included ICT and ICT skills of the school manager. A comparison between the privately owned schools (Aga Khan and Enna) and the publicly owned (St. Joseph's and Musa Gitau) indicates that private schools have deliberate policies to integrate ICT in curriculum development. Aga Khan, for example, hires teachers with ICT skills because they are expected as a matter of policy to integrate ICT in their teaching. Enna on the other hand attracts students by adding value to their teaching hence ICT integration is encouraged as a matter of policy to improve performance and attract students. As in Aga Khan High school, a teacher must be computer literate to teach at Enna School.

Except for Uthiru Girls, the other two public schools have not integrated ICT in their teaching and learning processes although they have computers. This suggests that there is a lack of clear policy or will to integrate ICT. Other challenges could be lack of training opportunities, lack of encouragement from the school management and technophobia. However, the high level of ICT integration at Uthiru Girls, which is also a public school, seems to be as a result of the School Principal, whose ICT skills are high. It appears, therefore, that when the school manager is conversant with ICT, they encourage its use in many areas including teaching and learning irrespective of whether the government has given a clear policy or not. This underscores the importance of leadership in implementing change.

The Bennett's Hierarchy of Evidence Model (1975) can be applied to evaluate each of the five institutions. It is evident that teachers and learners are at different stages in the use of computers and learning. In most cases the learners are ahead of the teachers!

At Githunguri High School, for example, it is observable that teachers are at the first stage of implementing the use of ICT. Only two teachers out of 32 use the computer for teaching purposes. On the other hand, the learners who take computer studies as a subject appear to be at level six, which is the action stage. The learners use the computers not only for Computer Studies as a subject but to access information for the other subjects and even to prepare Science Congress Projects in

various subjects. It is, however, noticeable that the computer teacher has reached the impact stage, which is the seventh stage. She is involved in training other teachers in the district on how to integrate the computers in teaching during their Strengthening Mathematics and Sciences in Education (SMASE) training seminars. Unfortunately, the teachers in the school do not seem enthusiastic to learn. This can perhaps be explained by the fact that no time has been set aside for them to be trained or to use the computers. They also do not have a computer in the staff room dedicated for their use. They feel that computers are for learners and they have nothing to do with them.

Ironically, the situation changes in Uthiru Girls High School, a public school. Both teachers and the learners are at the action stage that is level six of Bennett's model. Teachers, including the Principal and the Deputy Principal use the computers to prepare lesson plans, source teaching information, and sharing information among the teachers and the students. According to the teachers and learners, this usage of the computers has helped to improve the general performance of the school in academic and other co-curricular activities.

At Musa Gitau Secondary school, the learners appear to have reached the learning stage, which is level 5 in the model. Though the computers have been in the school for barely nine months, their awareness level is high and growing. They can solve problems in various curriculum subjects using the computers. In the interviews, the learners showed evidence of positive attitude and ambition to acquire computer skills. However, with the exception of the Principal who has over 50 hours of professional development which included ICT and the school computer teacher, the other teachers are generally at the resources level, which is the first stage in the Bennett's model. Majority of them shy away from the computer laboratory insisting that there is no time to use them and that there are no computers made available to them exclusively. They appear to be suffering from technophobia.

Aga Khan High School and Enna Girls, which are private schools, can be rated at level six which is the action stage. This is the case for both the teachers and the learners. As mentioned earlier in this paper, a teacher is expected to have ICT skills at entry level. Therefore, naturally, the learners and teachers are expected to use the computers in teaching and learning. The teachers use them to prepare lesson plans, access information for teaching and evaluation of the learners. To achieve their aims, a variety of software is used. The learners use the computers to access information, communicate with teachers and solve some problems like preparing projects for the annual science congress competition.

Implications for policy, practice and future research

The results show that the integration of ICT in curriculum delivery in Kenyan secondary schools is influenced by the ownership of the school, the professional training of teachers in ICT, the location of the school and the school manager's level of ICT skills. While private schools seem to have a clear policy on ICT integration, public ones have none.

The government seems to be lagging behind because, whereas computer studies has been introduced in secondary schools as part of the national curriculum, it has not kept up with the provision of the necessary infrastructure both physical and human resources. Private schools, however, are ahead in ICT use because they have control over their own resources. They also use ICT to maintain a competitive edge in the market because parents tend to associate the use of ICT with good academic performance. This implies that the Kenya Government should develop and implement an ICT policy on education, which so far has not been developed although it is one of the objectives in the Education Strategy on ICT of 2006.

It is obvious, therefore, that the Ministry of Education should urgently develop an ICT in education national policy to streamline this important area of learning. The Ministry needs to provide ICT teachers to schools and reward those who have the skills and are already offering services so as to motivate them. It might also help to include integration of ICT in teaching as part of the teacher's annual performance appraisal to encourage them to acquire the skills. It is also important to equip head teachers of secondary with ICT skills because they can act as change agents by encouraging and driving the adoption of ICT in teaching and learning processes. Future research should focus on the attitudes of learners and parents on the use and impact of ICTs on learning.

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