INTEGRATING ICT IN TEACHING AND LEARNING IN WEST AND CENTRAL AFRICAN SCHOOLS

A CASE STUDY OF PIONEER SCHOOLS IN GHANA

AUTHOR
ABSTRACT

This study is a transnational multiple case study of primary and secondary schools in Benin, Cameroon, Ghana, Mali and Senegal. Within the African context, it seeks to identify the conditions likely to favour the successful integration of ICTs in schools in order to contribute in a significant way to the development and quality of education through the identification of best practices in ICT integration in the schools identified as pioneer schools in the area.

Specifically, the study seeks to:

1. Determine the process and conditions for access to ICTs by school children.
2. Identify appropriate pedagogical approaches for the use of ICTs in African schools.
3. Evaluate the effects of ICT integration on the quality of education.
4. Identify the factors that contribute significantly to the sustainability of ICTs in schools.

All five participating countries selected eight schools for each case study making a total of forty (40) schools. The schools in Ghana were selected using a purposive and stratified random sampling method. Stakeholders in the school, namely parents, teachers, students, headmasters and other school authorities were interviewed and video taped to generate both qualitative and quantitative data. The research instruments were developed at a workshop with researchers from all the participating countries. In all, five thousand and forty eight (5 048) students, two hundred and twenty one (221) teachers, parents, administrators in the eight (8) schools in Ghana responded to items on the questionnaire for the quantitative analyses.

From the study, it was found that although school children had access to the computers in the schools the facilities were woefully inadequate based on the number of computers to the number of students. However, most of the teachers and the students did not see this as a setback to fully using the available resources for problem solving, teaching and learning.
Some of the identified teaching methods included the use of pre-identified websites for teaching and learning, the use of interactive CD ROMs, as well as teaching children to make presentations or conduct research with the help of a computer.

Some of the identified negative effects of ICT integration in teaching and learning on the students included:

- Overzealousness to use ICTs leading to a gradual disregard for subjects that did not have ICT integration in the teaching and learning process.
- Poor and inappropriate apportioning of study time.

However, the positive effects far outweighed the negative ones. Some of the positive effects of ICT integration included increased teacher-student interaction, student-centred learning, and increased capability on the part of students to learn independently and to put into practice hitherto theoretical and abstract concepts on the part of both students and teachers.

Issues on regarding the sustainability of computers i.e. higher utility bills, frequent power cuts and poor telecommunication networks were some of the challenges that were common to all the schools visited. Again, the absence of a clear cut policy on the integration of ICTs in schools was one of the major threats to their continued and successful use schools.

It was recommended that access to working computers be improved, teachers be trained in the requisite technical and pedagogical skills necessary for ICT use in teaching and learning. More importantly, there should be a total revamp of the educational system to move it from the conventional theoretical approach to a problem solving approach. This would facilitate the use of ICTs as a pragmatic teaching and learning tool for solving the problems faced by Africa in its quest for educational and social development.


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1. ICTs AT NATIONAL LEVEL

1.1 Brief country overview

The Republic of Ghana is centrally located in West Africa and has a total surface area of 238,537 square kilometres\(^1\). It is bordered on the east by the Republic of Togo, on the North and North West by Burkina Faso and on the West by Cote d’Ivoire - all French speaking countries. The Gulf of Guinea lies to the South and stretches across the 560 kilometres of the country’s coastline. Ghana is generally a lowland country except for a range of hills that lie on the eastern border and stretching up to join Mount Afadjato, the highest mountain in Ghana with the highest point of about 884 meters above sea level.

The country’s population according to the March 2000 population census was 18.9 million with a sex ratio of 97.9 males to 100 females\(^2\).

The country is divided into ten political regions (see map below). The locations of the selected project schools are shown on the map.

Fig. 1. Map of Ghana showing regions and selected pioneer school locations

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\(^1\) Ghana Statistical Services (GSS) and Macro International Inc. (MI) 2004. Ghana Demographic and Health Survey, 2003. p.1

\(^2\) Ibid, P. 1
1.2 Information and communication technology (ICT) in Ghana

The Government of Ghana acknowledged that the young population with close to 60% under the age of 25 can be transformed into an asset by adding value to human resources and providing the environment for utilising these resources for the socio-economic development of the individual and the nation. The crucial role ICT can play in moving this vision forward is fully recognized by the Government. Therefore Ghana formulated a National ICT Policy in 2003 to guide the facilitation of wealth creation and rapid economic growth as well as improving the global competitiveness of nations.

The Ghana ICT for Accelerated Development Policy (dubbed ICT4AD), charts a roadmap for the emerging information society and knowledge-based economy, it is a multi-sectoral approach bringing on board sectors such as agriculture, industry, health, physical infrastructure as well as local and foreign direct investment. The overall objective of the policy is to initiate an ICT led socio-economic development process with the potential to transform Ghana into a middle income information rich, knowledge-based and technologically driven economy. Ghana’s ICT development agenda, nonetheless, is still in its infancy and as are most of the implementation strategies.

Table 1. Implementation phases spread over 20 years

<table>
<thead>
<tr>
<th>Plan</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Rolling ICT4AD Plan</td>
<td>2003 - 2006</td>
</tr>
<tr>
<td>2nd Rolling ICT4AD Plan</td>
<td>2007 – 2010</td>
</tr>
<tr>
<td>3rd Rolling ICT4AD Plan</td>
<td>2011 – 2014</td>
</tr>
<tr>
<td>4th Rolling ICT4AD Plan</td>
<td>2015 – 2018</td>
</tr>
<tr>
<td>5th Rolling ICT4AD Plan</td>
<td>2019 - 2022</td>
</tr>
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</table>

The first three plans included the promotion of ICTs in education. This has been identified as one of the priority policy areas of Government. To this end, the plan is to “transform the educational system to provide the requisite educational and training services, an environment capable of producing the right types of skills and human resources required for developing and driving Ghana’s information and knowledge-based economy and society”3. In this direction, the Kofi Annan ICT Centre (named after the former Secretary General of the

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United Nations) and the National ICT and Science Resource Centre of the Ministry of Education and Sports were built to offer ICT training to different categories of people from the various institutions and organisations of the Ghana Education Service.

1.3 Information and communication technology in the education sector

The main ICT agenda for the education sector in Ghana is to direct efforts at ‘using ICTs to facilitate teaching and learning within the education system and to promote e-learning and e-education, as well as to facilitate the development of the culture of life-long learning within the population at large’\(^4\).

In this way, the education system is to be modernised to improve the quality of education and training at all levels and to expand access to education, training and research resources and facilities. The Ghana Education Service has in consonance with the spirit of the policy directive of the Ministry of Education and Sports (MOES) started integrating ICTs into public schools.

The Ministry of Education introduced various interventions into the education system as a prelude to introducing ICTs. These included the establishment of the National ICT and Science Resource Centre. This Centre was established in February 2001 and was commissioned in 2004 to train science teachers, technicians, non-teaching personnel in the Ghana Education Service, and students in the teaching and learning of science and ICTs. Others were the GLOBE Programme (Global Learning and Observations for the Benefit of the Environment), aimed at enhancing the Science and Mathematics Education Enterprise, as well as research among school-going youth, and Imfundu, a support programme by DfID to help train pre-service teachers in using ICTs for education.

The World Links Development Programme connected secondary school teachers and students in 15 Countries, including Ghana, to the Internet with the aim of integrating ICTs into teaching and learning in the classroom.

Furthermore, with assistance from the Mackenzie Consult Group, working on behalf of the United Nations ICT Task Force, the Ghana Education Service (GES) has been able to develop

\(^4\) Posit P.32
a comprehensive high level business plan for the complete roll out of ICTs in education in schools under the Ghana e-schools initiatives.

Presently, about 139 out of 476 (2004/2005 MoES data) public secondary schools in the country have computer laboratories. To sustain the programme in the public schools, the GES had given directives to the public schools to levy parents £30,000 (equivalent to $3.33) per child per term.

Private schools have not been left out. In the Greater Accra Region for example, 18 out of 3,611 (2004/2005 MoES data) basic private schools in the country have ICT facilities for teaching and learning.

Above all, a School Networking Programme is being planned to coordinate the entire implementation of the integration of ICTs in education.

1.4 Problem statement

Since independence, several African countries have made considerable efforts to improve the quality of education by way of introducing reform programmes into the inherited colonial education systems. Despite these efforts, there are many villages without schools, many schools without teachers and the attainment of a universal basic education by 2015 which all the countries have ascribed to remains a dream.

Above all, educational provision in most African countries appeared to be making very little use or taking any real advantage of the technological age. Thus, instead of providing students with the skills they will need when they leave school, the education delivery systems were still preparing students for the twentieth century.

Arising from the Jomtien Conference on Education for All held in 1990, was the Dakar Plan of Action on Education for All adopted in 2000. This Plan and that of the Conference of Education Ministers of the African Union, held in 2005 ‘realized the importance of ICTs to be extensively exploited to support the objectives of quality education for all at a lesser cost. According to the Plan of Action ICT offers considerable possibilities for disseminating
knowledge, improving the learning process, as well as, for developing more effective and efficient educational services.\textsuperscript{6}

Numerous research findings on the many benefits that can be derived from integrating ICTs into teaching and learning have led governments in Africa to introduce ICTs into their education system. However, the question remains to be answered whether the introduction of ICTs has been carried out in a sustainable way i.e. has there been a full integration of ICTs or just an introduction to computer literacy? Indeed, has the introduction of ICTs contributed to the development of education?

1.5 General objective
This transnational multiple case study of primary and secondary schools seeks to better understand (within the African context) the conditions likely to favour the successful integration of ICTs into schools in order to contribute in a significant way to the quality improvement and development of education.

1.6 Specific Objectives
Its specific objectives are to:

1. Determine the process and conditions for access to ICTs by students and teachers.
2. Identify appropriate pedagogical approaches for the use of ICTs in African schools.
3. Evaluate the effects of ICT integration.
4. Identify the factors that contribute to the sustainability of ICT innovations in schools.

In this vein, the case study in Ghana and indeed in the other participating countries, seeks to partly fill the information gap on ICT integration in education delivery and to identify and document (within the confines of the set objectives of the study) the pioneer schools in this field. Secondly, to understand the conditions that favours successful integration of ICTs in the educational systems of schools.

\textsuperscript{6} ERNWACA Proposal on ICT Integration in Teaching and Learning in West and Central African Schools, 2003, P.6
2. LITERATURE REVIEW

Several Studies have shown that pupils learn more with ICTs than without it. (Shutte. 1999); (Haugher and Anderson. 1997) and (Jonassen. 1999). They have demonstrated that the new technology represents a unique and fascinating option in the teaching and learning process. ‘The advantages are many in terms of flexibility, accessibility, increasing communication and interactions, as well as, a variety in the modes of teaching and learning. ICT integration results in more effective learning, improved teaching more suited to the daily realities for the pupils, better leadership of administrators…and members of the Community in the School life.’\(^7\)

Some African countries have started introducing ICTs in their education system. For example, in Botswana, the Ministry of Education is implementing an ambitious project to install twenty (20) computers in each of 205 Community Junior Secondary Schools under the Boipelego Programme. An important part of this programme is to provide training and support for Botswana Teachers in the use of ICTs and their integration into the existing national curriculum\(^8\)

A similar project is going on in Namibia, where ICTs have been introduced in Schools by Schoolnet, Namibia.

Mozambique started ICT integration in secondary schools in 1998 and in December 2000 the Government approved the ICT Policy, which was reinforced by an implementation strategy. This strategy outlined the roles of the Government and the private sector in promoting the use of ICTs in education and human resources development as their priority areas.

In Ghana, the initial move in the direction of ICT integration in the education system was the establishment of a number of Science Resource Centres in the country with the parent facility being the National ICT and Science Resource Centre. The Centre was equipped with 60 computers to train science teachers, technicians, non-teaching personnel in the Ghana Education Service and students in the teaching and learning of science and ICT.

\(^7\) Posit P.12
\(^8\) Johannes, Cronjé & Generosa G. Cossa, Computers for Africa ‘Lessons learnt from introducing computers into Schools in Mozambique, 2002, P.3
Other interventions include the introduction of the World Links for Development Programme, which had provided connectivity to forty Secondary Schools, on pilot basis, with the aim of integrating ICT in teaching and learning. To ensure sustainability in all public secondary schools with computer laboratories, the GES has given directives to these schools to levy parents €30,000 per student per term.

Again the GLOBE (Global Learning and Observations for the Benefit of the Environment) was introduced in 2000 in 36 Secondary Schools in the Country (on a pilot basis), to enhance the teaching and learning of science and mathematics, as well as research using ICT.

Some non-governmental organisations, such as the GLOBAL Teenager Project, have also introduced ICTs in extracurricular activities of both private and public first and second cycle schools.

These activities include helping pupils to build websites for their schools which are then entered in a competition with other participating schools. The pupils can also try their hand at building websites for their own families.

Microsoft has contracted the University of Education, Winneba, in collaboration with MoES to train secondary school classroom teachers and supervisors from GES, in the integration of ICTs in teaching and learning. Currently, the teachers trained can now use ICTs in teaching and learning. For example, a science teacher could use PowerPoint to present his/her lessons, while an accounting teacher could use Excel and the English, history and social studies teachers may use word processing programmes in their lessons.
3. METHODOLOGY

3.1 Research type and justification

The research used the case study approach because it offered a real phenomenon (i.e. the integration of ICT) that was studied in the natural milieu of the schools and classrooms. Besides, the case study used a number of information sources to enable the researchers to better understand the exemplary use of ICT in each of the selected schools.

The second reason for using the case study approach was to enable the findings of the individual countries to inform and direct national dialogue and policy formulation.

3.2 Process of Selecting Cases

a) Sources of information on schools

Prior to the selection, background information on schools (primary, secondary, public, private, single sex and mixed sex, rural and urban) was gathered from the following sources:

i) The Basic Education Division of GES (BED)
ii) The Secondary Education Division of GES (SED)
iii) The Private Schools Unit of the Basic Division of GES
iv) The National ICT and Science Resource Centre of the MOES
v) The Office of the World Links Development Programme

Information from SED revealed that 139 out of 476 public secondary schools had computer laboratories. The Office of the World Links Programme had provided computer labs for 40 of these schools and had connected them to the Internet in 4 regions of the country (i.e. Greater Accra, Eastern, Ashanti and Central Regions). Around ten out of 3 611 private schools also have computer laboratories.

b) Selection process

A multistage selection process was adopted for the selection of schools. Because various categories of schools were participating in the study, the schools were classified as follows:
i) Basic and secondary schools  
ii) Public and private schools  
iii) Mixed and single sex schools  
iv) Schools with/without educational CD ROMs

In selecting the schools, a stratified list of the categories of schools was prepared. The name of each school in a category was written on a piece of paper, folded and placed in a container and shaken to mix them thoroughly. This was done to ensure that all schools had equal chances of being selected.

In each category, the schools were picked at random from the container by three (3) researchers. Depending on the number of schools in each category, proportionate numbers of each category were picked randomly until a pre-determined total number of schools (22) were selected for screening.

**b) Screening**

The pre-selected schools spread over four regions of the country; Greater Accra, Ashanti, Central and Eastern were visited for an on-the-spot assessment to see if they met the selection criteria identified at a workshop held in Bamako, Mali in 2003. The heads of schools as well as the ICT instructors were interviewed. A standard ‘Interview Guide’ designed for the purpose by the trans-national team in Bamako, Mali was used. The Guide had sixteen (16) items, which were assessed on a six point rating scale. These items were chosen to depict a ‘Pioneer School’, which must have a computer lab, Internet connectivity or educational CD ROM, and used ICTs in their teaching and learning.

A cut-off point of 62.5% of total score was used to select the final schools to participate in the study. That is schools, which had a rating score of 50 and above out of 80 (i.e. \( \frac{50}{80} \times \frac{100}{1} = 62.5\% \)) were finally selected to participate.

In all, out of the twenty-two (22) schools, the following schools qualified to be included in the study after the screening.
### Table 2. Selected schools and their characteristics

<table>
<thead>
<tr>
<th>School</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morning Star</td>
<td>Private, urban, mixed, basic</td>
</tr>
<tr>
<td>Jack and Jill School</td>
<td>Private, urban, mixed, basic</td>
</tr>
<tr>
<td>Soul Clinic International</td>
<td>Private, urban, mixed, basic</td>
</tr>
<tr>
<td>Presbyterian Secondary School</td>
<td>Public, urban, mixed, secondary</td>
</tr>
<tr>
<td>TI Ahmadiyya Secondary School</td>
<td>Public, urban, mixed, secondary</td>
</tr>
<tr>
<td>Armed Forces Secondary</td>
<td>Public, urban, mixed, secondary</td>
</tr>
<tr>
<td>St. Mary’s Girls</td>
<td>Public, urban, girls, secondary</td>
</tr>
<tr>
<td>Accra Academy Public,</td>
<td>Public, urban, boys, secondary</td>
</tr>
</tbody>
</table>

NB. The rural schools visited such as Zoe International School did not satisfy the selection criteria for choice. Standby schools were Aggrey Memorial Secondary School and Akro Sec./Tech.

### 3.3 Data collection methods

Methods employed in collecting the data included individual and group interviews (semi-directed), focus group discussions, questionnaire administration, structured observations of the school environment, computer labs and teaching and learning, documents and statistical analyses and visual documentaries (photographs or videos of school and classroom interactions). Data was collected from teachers (including ICT teachers), students, heads of schools, managing directors and parents.

### 3.4 Methods of data analyses

Both qualitative and quantitative methods were employed to analyse the data. Qualitative methods included analysis of documents, data generated through observations, interviews and evaluation workshops. Since the study is a case study, analyses were based on the cases i.e. school by school.

Data was electronically recorded and field notes of observations and transcripts of interviews developed. Each transcribed interview of a category of respondents and of group discussions in a school were put into a synthesis report to make easy reading.
The Statistical Package for Social Sciences (SPSS version 12) as well as linear regression was used to analyse the quantitative data and these findings were presented on school by school basis.
4. OVERVIEW OF PIONEER SCHOOLS

4.1 Overview of pioneer schools

a) Morning Star School
Morning Star School is a private mixed sex, basic level, (primary and junior Secondary) school. It is located in an urban setting in the country’s capital in Cantomens, a suburb of Accra. All the members of the staff (both academic and administrative) are answerable to two Directors both of whom are female. One is responsible for academic issues and the other for administration. Both Directors are also answerable to the Managing Director. The School has a well-established PTA and two computer labs and there are plans to replace all the computers in the smaller lab with newer ones. The school has been networked and ICT is the backbone of all administrative procedures and output.

The school’s administration has fully involved the pupils (under the guidance of their ICT Teachers) in ICT-based projects and competitions, which are either inter-school or international in nature. For example GLOBAL Teenager, an NGO in Ghana, has involved the school in a website building competition and the school came out second, even though almost all the other competitors were in the secondary school category. The School has been involved in ICT exchange programmes in science with high schools in the United States and has displayed some of its trophies in the school’s notice area.

The pupils do some of their homework on the Internet, communicate with their ICT teacher over the Internet regarding their homework, and search for information on websites. They are also able to do PowerPoint presentations. During lunch break, the pupils rush to the lab to chat with friends on the Internet, send e-mails or while away time playing games.

The teachers have access to two computers in the staff room and the librarian also has one not only for cataloguing but for research. The music teacher has used the computer extensively in teaching and has composed the school’s marching song for the school band enabling them to practise their various musical instruments.

b) Soul Clinic International School
Soul Clinic International School is also an urban, private, mixed sex, basic level (primary and junior secondary) school located in Cantonment, a suburb of Accra. The owner is the Managing Director (female), and two of her adult children (one male, one female) perform administrative tasks. All members of the academic staff, including the headmaster are answerable to the Managing Director. The school has one computer lab but no PTA. The school is yet to be networked, except for one computer used by the administration.
With no Internet connectivity, the ICT teachers rely on educational CD ROMs for teaching and learning. From all indications, the absence of a PTA, whose role is to have a voice in the affairs of the school’s administration, especially, in the provision of technical and financial support, might be responsible for the fact that there is little or no ICT integration in the school’s education. As a result of this, the only major project the pupil engaged in was designing the 2000 World Cup.

The Head of School views the PTA as interference and a drag on the progress of the School. The existence of a PTA, therefore, became short lived. Nevertheless, some of the teachers use the computers to tally the end of term marks, especially, of their pupils and the pupils use them at home to chat, send e-mails and to play games. In general, ICT integration in teaching and learning of the various subjects is minimal. According to the Head of the school, the programme is sustained with ‘seed money’ set aside from donations from well-wishers.

c) St. Mary’s Girls Secondary School
St. Mary’s Girls Secondary School is a public, urban secondary school for girls and is located a few meters from Ghana’s premier teaching hospital in Korle Bu in Accra. All members of staff, both academic and administrative, are answerable to the Headmistress. The school has one computer laboratory supported by a very well established PTA. Although many of the computers have broken down, there were a few connected to the Internet which students and teachers use for research and for producing their school magazine.

The ICT Teacher has also gone a step further by developing an ICT integrated curriculum for the school based on the past questions of the West African Examinations Council. The successful use and integration of this curriculum in the teaching and learning of the various subjects has been hampered by the fact that only a few of the teachers are computer literate.

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The ICT teacher has also gone a step further by developing an ICT-integrated Curriculum, for the School; and it is based on the past questions of the West African Examinations Council. The successful use and integration of this curriculum in the teaching and learning of the various subjects has, however, been hampered by the fact that only a few of the teachers are computer literate.

d) Accra Academy
Accra Academy is a public, urban secondary school for boys located in Bubiashi, a suburb of Accra. The school has a Headmistress and two male deputy headmasters, one for academic affairs and the other for administrative affairs. The school has two computer laboratories and a third, far larger one, was near completion at the time of our visit. It has a well established PTA and ICT Committee, which support the running of the computer labs which are online.

e) Armed Forces Secondary/Technical School
The Armed Forces Secondary Technical School is a public, urban mixed secondary school located in the heart of Kumasi, one of the regional capitals and the second largest city of Ghana. The school is run by a retired army major assisted by a headmistress. The school recently gave a facelift to its computer lab and introduced ICTs into the teaching and learning process. It also has a well-established PTA, which provides technical and financial support to the computer lab. The lab is networked and has internet connectivity.

f) Jack and Jill School
Jack and Jill School is a private, mixed basic level (primary and junior secondary) school. The management of the school consists of a Managing Director, who is assists his mother, the owner of the school. The two are assisted by a deputy. There is also a headmaster who takes
care of the administration of the school. ICT was integrated in teaching and learning two years ago and despite its lack of Internet connectivity prolific use is made of interactive CD ROMs. The lab is networked.

g) T.I. Ahmadiya Secondary School
T.I. stands for Talim-Ul-Islam, meaning Teachings of Islam. The school is a public, mixed secondary school situated in Kumasi. It has a headmaster and two assistants. It has two computer labs, one for teachers and one for students. The school is networked and uses ICTs in administrative, academic and financial matters. The school has a powerful database system complete with students’ pictures and financial and academic records.

h) Presbyterian Secondary School
Presbyterian Secondary School is a second cycle school located in Osu, a suburb of Accra. It is a mixed school, which was established by the Presbyterian Church. A headmistress and two assistants manage the school. The school has a well-equipped computer lab that is well patronised by both staff and students. Students sometimes have their classes and assignments online and the teachers are remarkably knowledgeable in the use of ICTs in their teaching and learning processes.

4.2 Brief summary of school visits
The dates and the purposes of the visits to all the selected schools are presented in the table overleaf.
Table 3. Visits made to selected schools by purpose and date

<table>
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<tr>
<th>S/N</th>
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<th>1&lt;sup&gt;st&lt;/sup&gt; visit</th>
<th>2&lt;sup&gt;nd&lt;/sup&gt; visit</th>
<th>3&lt;sup&gt;rd&lt;/sup&gt; visit</th>
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<td>23/02/04</td>
<td>2/04/04</td>
<td>22/04/04</td>
<td>3-4 June 2004</td>
<td></td>
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<td>4</td>
<td>Accra Academy</td>
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<td>26-27 June 2004</td>
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<td>5</td>
<td>St. Mary’s Secondary School</td>
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<td>16-17 June 2004</td>
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<td>6</td>
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<td>2/04/04</td>
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<td>9-10 June 2004</td>
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<td>7</td>
<td>T.I. Ahmadiyya Secondary School</td>
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<td>2/04/04</td>
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The first visit was for screening the schools based on pre-determined selection criteria sent by the Regional Project Coordinating Committee based in Bamako, Mali. The screening process sought to find the schools that best met the criteria.

The second visit was to distribute letters of notice of selection to the first eight schools which came out with the highest score rating of 62.5% and above. These were the selected schools used for the research.

The third visit to the schools was with the Project Managers, one from the ERNWACA Regional Office in Bamako, Mali and the other from the University of Montreal, Canada. The purpose of the visit was to enable the team confirm that the schools selected by the team fit the study.

On the fourth visit, the first stage of data collection was carried out through interviews and observations. Collection of data was in the form of tape recordings of interviews, photography and videos. The interviews were then transcribed and synthesis reports written.
Before the fifth visit to the schools, a one-day workshop was held in Accra for all the heads of the participating schools and their ICT teachers to acquaint them with all that had gone on as far as the project was concerned and to keep them abreast of the stage the study had reached. Members of the Ghana’s National Scientific Coordinating Committee participated in the workshop.

The fifth and last visit was to undertake the second set of data collection through the administration of questionnaires.

During each of the visits, the research team was accorded maximum cooperation by the heads of the schools.
5. RESULTS/FINDINGS AND DISCUSSION

5.1 ICTs in the School

5.1.1 Time Span
The integration of ICTs in the schools was between 18 months and seven years.

5.1.2 Responsibility of initiation
The initiators of the ICT projects in the schools were mainly the headmasters and headmistresses in the case of the public schools and the proprietors in the case of private schools. Although there was some assistance from NGOs and the private sector, for the public schools, a lot depended on the will and drive of the heads to get the programmes going. It was found that this was a key factor to the success or otherwise in integrating ICTs in the school. In some cases, such as St. Mary’s Girls Secondary School, and Morning Star School, pressure from the PTA as a stakeholder in education delivery was a motivating factor for the heads to push for the integration of ICTs.

5.1.3 Reasons for integrating ICTs
Several factors accounted for the integration of ICTs in the school. Some of these were:

- The need to be abreast with current trends in teaching methodology (the case in the private schools)
- Other schools had integrated and had found the use of the computer to facilitate teaching
- Short courses had been organized by some NGOs for teachers in some of the schools and this had “jump started” the use of the computers
- The PTA had insisted on the introduction of ICTs into the school curriculum.

5.1.4 Initial steps
The process of integration in each school visited was an uphill task. Each of the schools had its own story to tell on the processes of integration. In all cases, though, the financial drain on resources was paramount and this problem prevented a smooth take off of ICT integration.

In the case of some public schools, the World Links Programme provided ten computers each of its project schools, with the aim of assisting them to integrate ICT in teaching and learning; and that was how those schools had come up with seed computers. In others, some parents had donated the
computers. The occurrence of having broken down computers was very high even in the inception process. Financial constraints were mainly responsible for this.

For the private schools however, none of them had any assistance from the public sector or government. Initiation also came from private funding and assistance from friends and relations in some instances. Though integration of ICT in the private schools originated without first seeking the consent of parents, they were generally made to make financial contributions in the form of levies for the use of the labs.

5.2 Knowledge of ICT policy

Although most of the heads admitted that they were not aware of the ICT policy of the country, they had ‘in-house’ guides to use computers in the school. None of the schools visited was willing to give out this policy mainly because it was inculcated in their main school curriculum and in the case of the private schools, was a strategic document, which was not for general consumption.

5.3 The vision of school heads on ICTs in their schools

The heads and school authorities of the public and private schools were relatively harmonious in their visions for ICT in their various schools. However, the slight difference between the two was that while the public schools focused on visions that would benefit the students, teachers and the administration for schoolwork to be smooth and progressive, the private schools went a step further with their visions. The vision in the private schools was to actually inculcate in the individual certain skills that would enable them to be independent in learning and in application outside the school walls.

“Our vision is that every single kid leaves this school with a life skill and the life skill I’m referring to is typing. Every kid should be proficient in typing so that if they choose not to continue their education, they can get a job as a secretary or whatever”. Jack and Jill School

“Our vision is to open up ICT more to make it available to students and teachers to get maximum use of what those machines can do for us. In fact, it will make work very easy and copying of notes and all paper work will be cut out to a large extent. Cost wise the initial input will be a little expensive but thereafter, I think the benefits are greater than you can imagine. In fact it is my vision that normal classroom work and teaching should one day be through that line”. Armed Forces School

“For administration, it is hoped that increasingly, our paper work would be minimised and most of
"With the pupils, it would be nice to see that they increasingly improve their reading to get more information from internet facilities, being able to use word and other soft-ware programs, to complete assignments or to learn more for themselves. So it is hoped that generally, staff, and administrators will all have the operations of their day to day work here enhanced with the use of ICT as time goes on". Morning Star

"I would really like to have a complete computer lab. In every sense 'complete'. When you move into the cafes, what you see there regarding computers, that's what I'm aiming at, especially the software. Yeah, you know, so that's what I want to do, when you walk in, you have a lab. English or French language lab. That's what I want to do with the computer". Soul Clinic

"My vision is to ensure that every teacher and every student gets to know about the computer and use it as a tool to learn. Also in the area of research the computer will be of immense help where we can research into areas". TI Ahmadiya

5.4 Overhead Costs, Maintenance and Methods of Replacement

All the schools admitted that the costs of running the computer lab were quite high. Some of the costs associated with ICT were the high utility bills, especially with labs that had air conditioning and the use of the telephone and the monthly Internet bills. To offset these costs, which many schools considered an investment in the future of their children, some of the schools had provided for these in their budget.

The Ghana Education Service had approved a levy of 30,000 Cedi (approximately $3.33) per term on each school-going child for ICT use in the public senior secondary schools with computer labs. However, the private schools made the ICT levies part of the school fees the pupils paid. These enabled the schools to defray the cost of maintenance. The schools invite companies from outside to see to the technical and hardware problems of their computers. The minor problems of installations and general software problems were dealt with by the ICT teachers and other teachers who were familiar with such software problems.

Several methods were employed in replacing the obsolete computers. The public schools usually relied on the PTA and NGOs to donate computers while the private schools usually had a quota system where a percentage of the school fees charged to the children was used to
purchase a given number of computers every year.

5.5 **Access to ICTs**
Collaboration on the issue of access and use of ICT came in two forms. In the first case, some of the schools were linked with other schools and institutions outside the country for assistance in obtaining computers and other ICT equipment. In the second instance, the schools were linked with other schools locally and internationally to undertake projects in various disciplines of learning. Though it was a very interesting undertaking in which prizes and certificates of participation were awarded, it was only the schools with full Internet connectivity that benefited from this venture.

It was found out that the public schools rather than the private schools had a high level of collaboration with external institutions in the area of projects and cross linked associations. In most cases, the collaboration was high when subjects that were studied by other schools outside the country were the same as those studied here in Ghana.

5.6 **ICT and the school curriculum**
Some of the schools visited such as the Armed Forces Secondary Technical School, were using the WAEC ICT Syllabus. However, some public schools like T.I. Ahmadiya, St. Mary’s Girls Secondary and the Presbyterian Secondary Schools and some private schools like the Morning Star School had designed their own ICT curriculum for use. Some of the schools, such as Morning Star, Soul Clinic International and St. Mary’s Girls Secondary schools have made ICT part of the students’ examinable subjects. In other words, the ICT skills of students as a subject was measured during their examinations.

5.7.1 **Administrators’ use of the computer**
There was no difference in the use of the computer between the public and private schools. In fact some of the public schools such as the Accra Academy and T.I. Ahmaddiya had actually networked their computers to the accounts office, the exams department and other places of administration just as the private schools such as Morning Star School have done. The computer was used to type and review examination questions, as well as tally exam marks, record financial and personal information on students. It was also used for clerical duties such
as letter writing and general correspondence. It was observed that in one or two of the private schools, such as Soul Clinic International and Jack and Jill Schools, the computer in the administration was limited to only typing letters and circulars while in one public mixed school TI Ahmadiya, the computer was used in administration as an advanced archival and information retrieval centre. In the latter school, the student’s pictures, and other identification information and even their financial status were recorded.

5.7.2 Students' use of the computer

Students used the computer in a variety of ways. This included its use for researching, typing assignments, communicating and designing the cover of school’s newsletters, school logos and birthday cards. At the lower primary, pupils used the computer to design their book covers and to learn the French language. In some schools, class work in certain subject areas was completely carried out on the computer under the teacher’s supervision. The teacher used the main computer to mark students’ work. In all cases, the students agreed that the computer helped them to learn faster and better. With those schools that did not have Internet connectivity, interactive CD ROMs were used and the students attested that it made learning more fun and almost effortless. Specific statements made by students to this effect included the following:

"Actually, I like to work with the computer; it’s fun to work with it. It also helps me to get more information. Again, if I have any problems I go to the Internet, ask questions and I get answers to the questions". Presbyterian Secondary School

"There is always something changing in science so you can’t keep learning the old things. If you don’t go onto the net and see what’s going on, you wouldn’t know and besides, it removes the stress of going to the library". St. Mary’s

Again, all the students admitted that the computer motivates them to come to school more, although this assertion was more pronounced in the public schools than in the private. Here are some examples of statements made to that effect:

"The presence of computer here has aided my trend of learning. Before we started using computers, I used to come to school late and if I have any job to do, I do it, then wait till it’s time for the morning assembly and I go and start with the day’s school subject. But now, with computers, we come to school early, work a little on our project, see what we can do to change or modify it, so that we do whatever more work needs to be done". Morning Star

"I am not from the Greater Accra region. Where I come from they are not very much acquainted
with the computer so you get up from home, go to school, and there is nothing new you are going to learn so that strong urge is not there to be in school. But when I came down here, you know there are specific times that you have to sit by the computers and do so many things like my brother said so it gives me the love to come to school because if after all I come and I am going to have something new to learn, that increases the urge that I have". Accra Academy

5.7.3 Regularity of use by students
On average, the students in the various schools had an access time of between 40 minutes and 90 minutes for the computers per week. They all desired longer time periods or unlimited access.

B. FINDINGS FROM QUANTITATIVE ANALYSES
Several findings emerged from the quantitative analysis.

5.7.4 Relationship between age and computer use
There was a significant relationship between the ages of the students and the frequency of use of computers in the school.

Table 4. Correlation between computer use frequency in school and age of student

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* Correlation is significant at the 0.01 level (2-tailed).

It was seen that the percentage of frequency of computer use was relatively higher among pupils between the ages of 8 and 12, than those between ages 13 and 17 and 18 years and above. However, the frequency of use of the computer between these age groups who occasionally used it was almost the same. The percentage of students who ‘rarely’ used it was high among students who were eighteen years and above and low among pupils aged between 8 and 12 years. From the ages of 18 onwards, the frequency of always using the computer fell.

Fig. 2. The use of computers by age of student
Two main reasons could be attributed to this, one being that students between the ages of 8 and 12 were introduced to the computer earlier than the other groups. This is because ICT integration is a recent phenomenon and secondly because the interest of those over 18 had waned because they were concentrating on preparing for their final exams and so had little time for computer use. Though the latter reason could not be substantiated, information from the qualitative analyses revealed that the teachers and parents feel that the enthusiasm of their wards in regard to learning and using the computer was high.

On a critical note though, the age band which recorded the lowest percentage in frequency of computer use (18 years) was expected to have recorded the highest. The age of 18 years and above would have been an ideal age to harness all the potential of integrating ICTs in education.

In most developed countries, children in that age band are skilled in computer use and its use in learning. Indeed, studies have proved that by the time they are 18 and above, they have mastered basic operations and use. Likewise, from the age of 18 and above, computer use should have been high on the agenda because at that age, the necessity of information
retrieval and use, as well as, information application would have been heightened. Students at that age would either be in high school preparing for their examinations, or about to enter university or other tertiary institutions where research would be a priority.

5.8 Perception of importance of computer
Despite this picture of somewhat misplaced priorities, a good majority of all the age groups attested to the fact that the computer and/or the Internet, to a very large extent, actually helped in academic work. See graph below.

**Fig. 3. The importance of ICT in academic work by students**

The large majority of students (81.4%) who maintained that the computer was very important in academic work prompted an investigation into why the computer was considered important and what was considered to be the use of the computer in the various subjects. See Fig. 4 & Fig 5 below.

**Fig. 4. Importance of the computer use by students**
As can be seen in Fig. 4 one out of every three students questioned was of the view that computers could greatly enhance their general knowledge in academic work. Another one out of every five students focused on the use of computers as a good research tool, while the rest perceived the computer to be very useful in communication; reducing manual and strenuous work and helping them to secure good jobs in the future.

**Fig. 5. Computer use for the various subjects**

As can be seen from Fig. 5 English, social studies and mathematics were the subjects for which the students frequently used the computer. This could be generally attributed to the universality of the subjects in question. English and mathematics are known to have universal codes and applications and would be more suited to the local needs of almost every student.
social studies with its combination of subjects, especially the history elements, would also be more likely to receive patronage from the Internet or use of the interactive CD ROMs which were found in a number of the schools visited. The low mean in geography could be due to the culture specific requirements of some of the vegetative platforms and differences in geographical regions.

5.9 Computer use and gender

Another area of interest in studying ICT integration in the educational system was the extent to which boys and girls showed interest in their use of the computer at school and at home. Pearson’s bivariate correlational analysis was used to test whether there were any significant differences between boys and girls on the various uses of the computer in the school at the significance levels of 0.05; 0.01, p < 0.05. The results are tabulated below in Table 5.

**Table 5. Correlation of gender of respondents and computer use in school**

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In the first place, it was found that a higher percentage of boys (66%) rarely did their homework on the school computer as compared to (61%) of the girls who also rarely did. For those who either always or occasionally stayed in school to do their homework, it was found
that more females than males stayed in to do their homework on the schools’ computers. Boys were generally found to have more interest (always and occasionally) in downloading music than girls (40%; 38% and 18%; 15% respectively). Girls were generally disinterested in downloading music from the Internet, 43% and 39% respectively. This was expected as boys generally explored music sites more than girls did.

This trend was further confirmed with the observation in the table that there was a strong relationship between gender and the student’s perception of the importance of the use of the computer. The bar graph below further illustrates this relation between gender and the perception of importance of ICT including computer use.

**Fig. 6. Relationship between gender and perception of importance of ICTs**

As can be seen from the graph above the perceived importance of the use of the computer for general knowledge, research and the acquisition of jobs was almost the same between boys and girls. The main differences were found in the academic and communication purposes for which girls readily valued and preferred the use of the computer more than their male counterparts.

It was also observed that the extent to which the computer helped in academic work was correlated with how often homework was done on the schools’ computers \((r = 0.49)\). It was found that there was a direct relationship between the frequent use of the computer in school
and the way students felt about the computer helping in academic work. (See Table 6 below)

Table 6. Perception of usefulness and frequency of computer use

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The results of the use of the computer at home were not too different from that of the school. In all cases where there were significant differences, the explanations were the same as in the school. It was seen that there was no major difference between the behavioural use of the computer in the home and the school between the boys and the girls.

5.10 Access and teachers’ computer use

5.1.1 Competence of the teachers

Several of the teachers in the schools said they were relatively comfortable with the computer and that the phobia that used to surround computing and computers was gradually fading away. All the same, there were those who still had a phobia of computers and those who were overly confident that they could use the computer to teach their students.

"I am not too comfortable because I've not had any training yet so I just try on my own but as to whether I can use it in teaching my girls or not, I am not too comfortable with it". St. Mary's
"I am not frightened but I wish I know more about it, I wish I could go further than I can do now. And at times I am a bit uncomfortable because if something goes off I'm hard up. I don't know how to bring it back to the screen so it makes me not very comfortable". Armed Forces

"I'm also at ease with computers. I have one in my office given by the headmaster and have one in the house so most of the time I'm in front of the computer whether in school or in the house". Armed Forces

Fig. 7. Accessibility of the computer by location

A majority of the teachers accessed the computers in the school and sometimes from the Internet cafe because very few of them had computers at home.

Teachers used the computer for various reasons. The graph in Fig. 8 shows the extent of use of the computer for school related work, e-mail, chatting and surfing.

Fig. 8. Use of computers in the school
The graph shows that using the computer for actual school-related work was third on the priority list for the use of the computer. The other uses included typing questions, learning to type and learning other software and hardware components of the computer.

There were several reasons for the computer being used for school-related work coming third and not the first. Some of the reasons were:

Although the use of the computer would benefit the students more in terms of its suitability as a teaching aid, the computer labs were too small to take all the students in the class at once.

Teachers were hard-pressed to finish their syllabus on time, and the temptation was to use more conventional teaching methods.

Some of the students could not follow the simple instructions when they were behind the computers and lagged behind.

There was the temptation for students to do something else on the screen and not pay attention to what was supposed to be done in class.
This result led the researchers to find out how often the computer was used to prepare lessons and how often the computers were used in class. The results are presented in the graphs below.

**Fig. 9. Frequency of use to prepare lessons**

**Fig. 10. Frequency of use in class**

**5.11 Importance of the computer to teachers**
Based on some of the findings above, teachers in the schools were asked how important computers were to them. See responses below.
“Personally I am one person with a very horrible handwriting. I find it very difficult, very tiring when I have to be writing so the facility helps me sit down and type and the thing looks neater”. Armed Forces

“As I said apart from playing games and checking mails, I think it gives information on diseases, their causes etc. I teach food and nutrition and sometimes we talk about foods to give to people who are suffering from certain disease and when I use the net, it gives me information on them”. St Mary’s

“In most cases I happen to serve in a committee where we deal a lot with assessment and those things so I mostly use that in computing results and positioning and all that. So I think that is the areas I use the computer and also when I want to print more information”. TI Ahmadiya

“I print out pieces for them; like you are seeing here. So during classes they read to the music and they hear it on the computer as well. Yes, so I use it during class hours. I meet the marching band and let them hear the music before they start practising”. Morning Star

It was found that although the use of the computer was limited, teachers were willing to use it on a greater scale if the conditions were in place. Asked what priorities and advantages they would give and have if the holistic approach was used in solving the problems confronting the full integration, the teachers listed the priorities in the diagram below.

**Fig. 11. Percentage of uses of the computer by teachers in order of priority**

![Pie chart showing priorities of uses of the computer by teachers]

From the Fig. 11 it can be seen that four out of every five teachers said they would prioritise the use of the computer for seeking information and for teaching and learning processes. Only one percent said they would use the computer mainly as an entertainment tool. To some
extent then, it could be said that the teachers’ need for the computers was to assist them in their pedagogic delivery.
C. EFFECTS OF INTEGRATION

5.3 Positive Effects

5.3.1 Behaviour/ performance of students

Although no empirical evidence in all the eight schools showed that there had been an improvement in the learning styles and examination performance of the students since the introduction of ICTs, the teachers could attest to the fact that there had been a significant improvement in their academic work. In one school, for instance, this is what the teacher had to say:

| Teacher: Project? They rather use it (the computer) for academic purposes and last year, I had a 100% pass rate in my crop science external examinations. | Interviewer: Wow! Owing to? |
| Teacher: Owing to the use of the computer. |

Regarding the processes of learning, most of the teachers admitted that apart from the fact that the students had become more adventurous, it had encouraged the teachers also to be up-to-date in their subject areas as well as teaching methods. It was noticed that in most cases, students were on time for classes, were more research-oriented, learnt faster in their subjects and had more interest in their lessons than in classes, where the teachers used conventional teaching methods.

Another positive thing was the fact that students were now collaborating with each other on a greater scale, sharing sites with information on their various subjects and in some cases on school projects with little or no supervision. Some of the teachers have confirmed this.

“I gave them alphabets: I gave them A-Z to give me animal names starting with A to Z. And then they brought a name up and I wasn’t sure and I said they were lying. So they said it was on the net; so I went to my room and they followed me and then it was there. So they were screaming—Auntie Maggie doesn’t know...” Morning Star School

“Because they themselves, after teaching, notice that they can access, they ask for the website where they get the information themselves, and they get so excited about going to see the information themselves”. Morning Star
“Before the computers came to the school, the students were using their hands to design their boards for the practical work but now they use the PC to design nicely and to be frank what they do I can’t so I think they are learning something”. St Mary’s

“It is one area where if there is time for a class it wouldn’t be the headache of the teacher to go round looking for them, they will be right there so it is an area where the students are so much interested. So I think it is an area that has chalked positive results since its inception”. TI Ahmadiya

There was also evidence to show that the students had become closer to the teachers especially when it comes to problem solving issues. In one school, where IT was used in teaching vocational students how to type, the science and general arts students would come begging the teacher to let them also sit in the class to participate since the use of ICT made the class generally more interesting. One teacher in Kumasi also reported that the students had started greeting him all over the place because he would take his students to the lab to watch animations in some of the theoretical concepts they had learnt in physics. Below are what some of the teachers had to say:

“Sometime ago you would ask a student about a teacher, and they wouldn’t know the teacher; possibly the teacher is not teaching him or her. Now but with the integration of ICT, you work with students from different course backgrounds so you get closer to them. For example I don’t teach geography in science 1 and science 2 but I am working with students from science 1 and science 2. Aha, so I have that friendly relationship with them. But there are also instances at times they can go very far because you have become very close to them, they think you are colleagues and you have to at least distance yourself. – Accra Academy

Tr: I will also want to say that under no circumstance will a student have a teacher’s e-mail address and write to the teacher but through the learning circle, they’ve been sending me mails.

Interviewer: What kinds of mails do they send? Are they love letters (General laugh)

Tr: No. No (laughs) not love letters, there was a time a boy sent me a mail that when I came to class, some of the boys were reporting that I stood at one place and teach. I don’t move round, so it was an eye-opener to me. Yes, he couldn’t come to me face to face, but through that, he was able to tell me. Yes. Accra Academy

5.3.2. The provision of teaching/learning aids

Teachers found lesson note preparations and class handling, as well as, concentration on the lessons by students to be a lot easier with the integration of ICTs. A number of teachers used the Internet to gather the necessary teaching and learning materials and in some cases, had them printed and/or laminated for the students to use. Teachers maintained that the use of ICTs brought a whole new era of multimedia learning to the classroom and that abstract
phenomenon was now a reality and more easily understood (Morning Star School, Presbyterian Secondary School & Accra Academy).

From the students’ perspective, teachers who usually used information gathered from the Internet had more interesting classes and they acknowledged that their quality of teaching and their ability to understand the concepts being taught had been greatly enhanced (Accra Academy).

5.4 Negative effects/disadvantages

No major negative effects of integration had been recorded in any of the schools visited. However, teachers mentioned certain traits in the students that had to be dealt with. They mentioned that the students tended to concentrate more on classes that integrated ICTs than classes that did not. There was also the tendency on the part of the students to think that the classes that did not integrate ICT were of little importance to them and this affected their concentration.

Another finding that came up was that students would lie about having classes at the lab, when in actual fact they should have been in other classes. A copy of the school timetable, therefore, had to be pasted in a number of the laboratories visited to know when a particular class was being held.

Students who used the Internet and computers for studying had the urge to show off in class. Some of them tended to challenge the teacher in the middle of the class and show the teacher and the entire class that he or she had some additional or new information that the class did not know about and this could sometimes be embarrassing to the teacher and the other students. In the Accra Academy, some teachers said they experienced this situation but that it encouraged them to improve their ICT knowledge, especially the consultation of websites for lesson preparation.

5.5 Human resources training

All in all, it was acknowledged that there was an urgent need to retrain teachers. In all interactions with them, the researchers realised that although these schools had been identified as pioneer schools in integrating ICT, only a small fraction of the teachers actually used ICTs in their pedagogical approaches. Despite this all of the teachers expressed the need to be trained further to move forward the development of education in general and the teaching and learning process in particular.
5.6 Training needs
Teachers identified that they needed training in all aspects of computing to help in their pedagogical delivery. This was the case even though some of them had learnt to use the computer in the course of their educational training. However, after their education, not many of them had had any other training in ICTs and those who had, received the training from friends and other non-formal sources. In actual fact, almost two out of every three teachers had not had any training in the use of computers as a pedagogical tool. See graph below.

Fig. 12. Provision of ICT training to teachers
As asked about their specific training needs the responses provided are presented in the bar graph below.

![Bar graph showing specific training needs of teachers.]

**Fig. 13. Specific training needs of teachers**

5.7 Issues on sustainability

Many factors were identified as inhibiting the successful sustainability of the ICT integration. This was because many schools had started off very well but had had to abandon the whole idea at a point in time. In order to sustain ICT integration, schools should:

**Have hardware maintenance plan:** In most of the schools visited, there was no organised plan for hardware maintenance. It was only when a significant number of computers had broken down that help or technicians were brought in. In most cases, the technicians were not readily available to immediately attend to the needs of the schools. Therefore, the lack of a plan was a stumbling block to the smooth and continuous integration of ICTs in the teaching and learning process. This was because once a computer or air conditioning unit broke down, pressure would be on the computers to meet the high demands. Or the time spent in the laboratories would be reduced considerably because of the intense heat that could emanate from the computers.
Collaborate extensively with the PTA: The PTA (when they existed) in almost all the schools that were a sustaining force for the use of ICTs in the schools. PTAs, which were normally responsible for assisting with the start up capital for the laboratories, were involved in the maintenance of the computers and in some cases replaced broken ones with newer ones. In a particular school where there was no PTA, it was realised that ICT integration into teaching and learning was minimal. Indeed, the computers in that school were not as intensively used as one would have expected. It was merely used for teaching the different parts of the computer, playing games etc. which had very little bearing on the integration of ICTs into the teaching and learning process.

Have an internal committee to oversee the ICT programme: It was noticed that schools that had an internal committee for monitoring the integration and use of ICTs in the school had an aggressive and positive disposition towards the sustainability and growth of ICTs in the school. It was found that these committees helped by ensuring that broken down computers were repaired on time. They sought financial assistance for the procurement of computers from the alumni of the respective institutions, helped in encouraging other subject teachers to inculcate ICT into their teaching and learning. The committees collaborated with the school authorities as to which ‘best practices’ in the integration of ICTs could be applied to the teaching and learning process.

Regularly train and retrain staff on current teaching trends: In the focus group discussions that were held with the teachers, it was evident from the subject teachers who made extensive use of ICTs that they were initially apprehensive about using computers to teach and help students to learn. However, after a while, they became more confident in using them and could not do without them. The lessons learnt here were:

- All teachers could use ICTs to teach their students even though they might be initially apprehensive about using them
- Once the process of integration had started, they could become better teachers and have more confidence in their pedagogy through training and refresher courses.

Provide ICT facilities that work and meet the demands of teachers: From the study, it was clear that many teachers were put off from integrating ICTs in teaching and learning and again from taking the children to the laboratory because of the inadequate number of computers (some of which were broken down). From their viewpoint, the pressure on the equipment was so much that they did not want to add to the already overstretched facilities.
On the side of government:

**A workable and uniform education policy on ICT:** *Charity begins at home* was a popular saying among stakeholders in the schools visited. Without a proper framework, progress could be very slow. Indeed, the need for a workable ICT Education Policy, which could guide the Curriculum Research Development Division (CRDD) of the Ghana Education Service to develop an integrated ICT curriculum for schools is paramount; and the longer the delay in developing and implementing such a policy, the longer Ghana, and for that matter, Africa in general would take in its quest for development. There is a real need for a policy to streamline the activities of schools from basic to tertiary levels. This would identify the Millennium Development Goals and find out exactly how the ICT policy would fit in. It was acknowledged that the provision of computers to the schools was in itself not enough but rather, directions on what to use the computers for and how to have it done for the benefit of the country was the most important factor.

**The restructuring of the educational system to include ICTs:** The integration of ICTs in the school, as identified earlier was a holistic task. It would involve the restructuring of the entire educational system. What was happening on the ground now was that every school integrating ICT was doing that ‘at its own risk’. The risk here being the time and opportunity spent in educating the children to pass their exams and give the school a good name. The children therefore came out of the school system without having the right informational and pragmatic solutions to solve their individual problems and that of society. Teachers admitted that being in the lab with the internet and having a good background in research would greatly aid teaching and learning materials sought for but the question was, with a tight school schedule, an overloaded timetable and an examination culture, was it the right step to take? Most teachers, therefore, preferred conventional teaching methods, without the assistance of ICTs to enable them cover their subject syllabuses.
6. RECOMMENDATIONS

1. It is necessary to introduce computing at an early age to fuel the interests of children in using ICTs to enhance their learning processes. At the latter stages i.e. from 18 years and above young people should be introduced to the intensive use of ICT in their learning processes.

2. The Ministry of Education and Sports should be encouraged to liaise more closely with the software producers who in turn could produce software that conforms to the school curriculum.

3. Schools which do not have Internet connectivity should at least have access to interactive CD ROMs and teachers trained in their use.

4. ‘Basic training in ICT skills should be promoted in all schools and tertiary institutions’. This will go a long way to unearth the hidden talents of pupils and generally make them more creative.

5. The MoES should endeavour to turn the ICT Education Policy into a working document to guide the CRDD of GES to develop a uniform ICT-based curriculum for schools ensuring that proper focus and direction is obtained for the integration process.

6. The MoES in collaboration with the Government of Ghana need to improve institutional information management, intra-institutional communication between regional co-operation institutions and their constituencies to facilitate integration. They also need to play a more critical role in linking national or regional organisations that work on similar objectives to consult, share information and collaborate on joint projects.

7. It is also recommended that the National ICT Policy, which the government has developed in 2003 be enforced as soon as is practical in order to set the priorities of government straight on the provision of ICT infrastructures and the development of appropriate curricula at all levels of education, to tackle the developmental problems being faced in Ghana from both an educational and social perspective.

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