UNIVERSITY OF CAPE COAST

THE EFFECT OF ICT FACILITIES ON TEACHING AND LEARNING IN SENIOR HIGH SCHOOLS IN THE CAPE COAST METROPOLIS

NELLY ABAIDOO

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BY

NELLY ABAIDOO

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DECLARATION

Candidate's Declaration

I hereby declare that this dissertation is the result of my own original research and that no part of it has been presented for another degree in this university or elsewhere.

Candidate's Signature: ……. …… Date: ……..

Name: Nelly Abaidoo

Supervisor's Declaration

I hereby declare that the preparation and presentation of the dissertation were supervised in accordance with the guidelines on supervision of Dissertation laid down by the University of Cape Coast.

Supervisor's Signature: …….. Date: ……

Name: Mr. Paul Dela Ahiatrogah

ABSTRACT

Despite the increase in ICT tools in Ghanaian Senior High Schools, most of the schools are teaching ICT as an isolated subject. Instead of completely integrating the ICT tools into the educational curriculum to enhance the teaching and learning of ICT. The objective of this study was, to investigate the effects of ICT facilities on teaching and learning in Senior High Schools in Cape Coast Metropolis.

A total sample of 200 respondents took part in the survey. This sample was picked from five Senior High Schools, comprising both males and females. Convenience random sampling was used to select the students. The instrument used for the study was a questionnaire. Data were analyzed using SPSS software to produce frequencies and percentages.

The main findings of the study were that most of the students had access to ICT in their schools but the real integration of ICT into their curriculum which could aid in effective teaching and learning was lacking. Student's skills of ICT were not restricted to application software. ICT is being used as a pedagogical tool. Students had very positive perception of the usefulness and ease of use of ICT in schools.

Based on the findings, it was recommended that policy-makers, the Ghana Education Service, and Curriculum Developers should help provide enough computers and internet accessibility as well as the provision and maintenance of ICT infrastructure in Senior High Schools.

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DEDICATION

To my parents, Dr. and Mrs. Mensah, my siblings and my husband.

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CHAPTER ONE

INTRODUCTION

Background to the Study

The Japanese International Cooperation Agency (JICA) has since 1998 implemented a project the goals of which are to update the textbooks, re-train the IT teachers, update IT equipment, provide e-mail access facilities and establish a school support center.

This project provides secondhand computers using open source software (Linux-based operating system), the Star Office package and access to an e-mail system to some schools. The connection to the Internet was made available through ErdemNet. Within the framework of the project, manuals were developed using Linux Operating System and the Star Office package and training was provided for teachers and students to use. Within the framework of this project, 388 computers along with networking equipments were supplied to some schools (average 7.6 computers per school). All schools involved in the project use the internal e-mail on their Local Area Network and amongst them 16 schools use the internet e-mail (Ide, 2003).

The existence of ICT does not transform teacher practices in and out of itself. However, ICT can enable teachers to transform their teaching practices, given a set of enabling conditions. Teachers' pedagogical practices and reasoning influence their uses of ICT and the nature of teacher's use in ICT affects student achievement. Teacher lesson planning is vital when using ICT.

Where little planning has occurred, research shows that student work is often unfocused and can result in lower attainment.

The use of ICT as presentation tools through overhead and liquid crystal display projectors (LCD), television, electronic whiteboards, guided "web-tours", where students simultaneously view the same resources on computer screens, is seen to be of mixed effectiveness. While it may promote class understanding of and discussion about difficult concepts, especially through the display of simulations, such uses of ICT can re-enforce traditional pedagogical practices and divert focus from the content of what is being discussed or displayed by the tool being utilized.

Teachers most often use ICT for 'routine tasks' such as record keeping, lesson plan development, information presentation, basic information searches on the Internet. Effective ICT use in education increases teachers' training and professional development needs. However, ICT can be an important tool to help meet such increased needs by helping to provide access to more and better educational content, aid in routine administrative tasks, provide models and simulations of effective teaching practices, enable learner support networks, both in face to face and distance learning environments, and in real time or asynchronously.

The rapid development in Information Communication and Technology (ICT) has made tremendous changes in the twenty-first century, as well as affected the demands of modern societies. Recognizing the impact of new technologies on the workplace and everyday life, contemporary educational institutions try to restructure their educational programs and classroom facilities, in order to minimize the teaching and learning technology

gap between developed and the developing countries. This restructuring process requires effective diffusion of technologies into existing context in order to provide learners with knowledge of specific subject areas, to promote meaningful learning and to enhance professional productivity (Tomei, 2005).

The use of Information Communication Technology (ICT) in Ghanaian schools and other African countries is generally increasing and dramatically growing. However, while there is a great deal of knowledge about how ICTs are being diffused and used in high schools in developed countries, there is not much information on how ICTs are being diffused and used by teachers in Ghanaian schools. There is also an assumption that there are wide gaps in the use of ICTs between rural and urban schools (Aduwa-Ogiegbaen & Iyamu, 2005).

Statement of the Problem

Information and communication technology (ICT) has become an indispensable tool in today's information age, making a dramatic impact on the lives of people globally. This effect is most significant in education. The computer has become a motivating tool for teaching and learning in schools (Mossom 1986; World Bank 1999). The Internet allows cost-effective information delivery services, collaborative and distance education more than has ever been imagined (Clyde 1995; Mbeki 1996; Todd 1997).

At the inception of the millennium, Ghana's education authorities embarked on a number of projects to introduce ICT into the Ghanaian education set up; especially at the basic and secondary school levels. For instance, in the middle of the 1990s, educational providers realized that Ghanaian professionals could not compete on the global market for jobs, since

they were limited in skill, especially in the area of Information Technology. Subsequently, the authorities incorporated the study of ICT as part of the study of science. The government of Ghana with the Ohio University in collaboration with Non-Governmental Organizations (NGO), philanthropists and Parent-Teacher Associations (PTAs) built about 110 science resource centres to help the teaching of science and ICT. However, initiators found that the various programs were disintegrated, unstructured and did not cover all the schools (Nyarko, 2007).

In the later part of 1990s, Ghana was host to a number of ICT initiatives supported by the government and NGOs. The Ministry of Education in conjunction with the Ghana Education Service (GES) and its allied partners undertook a critical situational analysis and review of the utilization of ICT in education under the auspices of the United Nations Global E-Schools and Community Initiatives (GESCI). Many lapses were identified for which the stakeholders agreed to work together to make education complete with ICT as a facilitator. The study, therefore, intends to examine the effect of availability and utilization of ICT facilities on teaching and learning in Senior High Schools in Cape Coast, Ghana.

Purpose of the Study

The study was carried out against the backdrop of the assumption that utilization of modern ICT in education potentially enhances the effectiveness and efficiency of teaching and learning and therefore, provides a country with a pool of well-trained and skilled labour to meet the demands of both the public and the private sectors. In addition, it is assumed that ICT creates the opportunity for governments to provide distance-learning programs, which

makes it possible for many more people, located far from the centers of learning programs to educate themselves. The study is, therefore, being carried out to justify the assumptions of the potential of ICT in teaching and learning in Ghanaian schools.

Research Questions

The following research questions were proposed to guide the study:

1. To what extent do ICT facilities have positive effects on ICT usage?
2. What purposes do students Use ICT for?
3. How accessible are ICT facilities to students?
4. How important do students consider ICT to teaching and learning process?
5. What is the effect of Availability of ICT on teaching and learning?
6. What is the effect of the utilization of ICT facilities on teaching and learning?

Significance of the Study

The results of this study are significant since they bring to the notice of stake holders (government, managers of education, headmasters, teachers and students) how ICT is being integrated in teaching and learning processes. Also, it would enable school heads to know whether students benefits from ICT usage in terms of resources, equipment, and electricity and can use it effectively in their daily learning processes. Additionally, it would provide the Cape Coast Metropolitan Director of education the necessary opportunity to facilitate the provision of adequate infrastructure such as ICT resource centres and computers in the various schools where necessary.

Delimitation of the Study

The scope of this study was limited to two hundred (200) second year students, selected from five (5) public Senior High Schools out of thirteen (13) Senior High Schools in Cape Coast Metropolitan Area.

The study was focused on the effect of ICT facilities on teaching and learning and did not cover other sections of the Ghanaian educational systems, such as Junior High School and Colleges of Education were. Findings conclusions and recommendations were not extended beyond the population.

Limitation of the Study

Ideally the study should have covered all Senior High Schools in Cape Coast metropolis. But this was not so, due to time and resource constraints. The study was pointed to only five senior high schools in Cape Coast metropolis and no generalization was attempted beyond this.

Organization of the rest of the Study

This dissertation is organised into five chapters. Chapter one gives overview of the study. It presents the background to the study, statement of the problem and purpose of the study. It also includes questions the study answers, significance of the study, limitation of the study, delimitation of the study and organization of the study

Literature related to the study was reviewed in chapter two. The review involved the conceptual framework and empirical review.

The third chapter covered the methodology, the research design, the study population, sample, sampling technique, research instruments, data collection procedure and data analysis. Chapter four presents results and

discussion. Finally, chapter five gives the summary of the study, conclusions and recommendations suggested for future research efforts.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

Overview

The literature review has been structured to ascertain the state of ICT integration in schools and other relevant studies. The reviewed literature looked at factors that hinder ICT integration in schools, teachers' attitudes and beliefs in ICT use, teachers' ICT knowledge and skills, ICT facilities and access to students and teachers as well as ICT infrastructure utilization.

Factors that hinder Diffusion of ICT in Schools

There are many factors identified as hindrances to the diffusion of ICT in high schools. Pelgrum (2001) presented a list of ten of such factors that impede ICT integration in schools. Out of the ten identified, four major ones, namely; personal ideas about the contribution that technology can make to the processes of teaching and learning and classroom management; Teachers' lack of knowledge and skills; insufficient number of computers and ICT infrastructure; and difficulty in integrating ICT instruction in classrooms. In a related study, Ely (1993) similarly distinguished three major conditions, relevant to ICT integration in classrooms. These are: dissatisfaction with the status quo, existence of knowledge and skills, and availability of resources.

The two categories identify, more or less, the same issues: Ely's existence of knowledge and skills relates to Pelgrum's factor relating to teachers lack of knowledge and skills. Also Ely's availability of resources is similar to Pelgrum's insufficient number of computers and ICT infrastructure.

Finally Ely's dissatisfaction with the status quo is directly related to what Zhao and Cziko (2001) term as discrepancies that activate the individual. The problem of teachers' confidence in their ICT competence as a major factor for integrating technology in teaching is reported in other studies as well. Mooij and Smeets (2001) explain that if teachers are not confident in their ability or competence to handle computers it may hinder their willingness to introduce technology in their classrooms. In their study (Smeets, E., Mooig, T., Bamps, H., Bartolome, A, Lowyck, J., Redmond, D., 1999, cited in Mooij & Smeets, 2001), it is reported that the most important reason teachers give for not using ICT is that they are not familiar with ICT or they are not sure of their knowledge. This ICT competence factor is the same that Zhao and Cziko (2001) refer to as Control Principle. Some other important factors are also recorded as significantly influencing ICT use in schools. Teachers claiming to follow more innovative educational practices such as use of inquiry, project-oriented work and hands-on activities, are more likely to use new technologies than those who stick to the more traditional instructional approaches (Honey & Moeller, 1990, cited in Myhre, 1998). According to Mooij and Smeets (2001) school manager's policy and budgetary decisions and in general the attitude of the school manager (their commitment and decisions) are expected to be relevant to the ICT innovation process.

Teacher's Attitudes and Beliefs in ICT Use

International experience has shown that teachers play an important role in diffusing and utilizing ICT in classrooms. Teachers' attitudes and beliefs affect the way technological innovation is applied in education. They tend to use technology in ways shaped by their own personal perspectives on the

curriculum and on their pedagogical practices (Cohen, 1987; Cuban, 1986; Czerniak & Lumpe, 1996; Lai, Pratt & Trewern 2001). Bullock (2004) found that teachers' attitudes are a major enabling or disabling factor in the adoption of technology. Similarly, Kersaint, Horton, Stohl, & Garofalo (2003) found that teachers who have positive attitudes toward technology feel more comfortable using it and usually incorporate it into their teaching. Woodrow (1992) asserted that any successful transformation in educational practice requires the development of positive user attitudes toward the new technology. The development of teachers' positive attitudes toward ICT is a key factor not only for enhancing computer integration but also for avoiding teachers' resistance to computer use (Watson, 1998). Dupagne & Krendl (1992) indicated that in-service training is a key factor in cultivating positive attitudes to the computer.

The teachers' attitudes and beliefs also influence what they themselves learn from education and training programmes and what didactic practices they make use of in their classrooms (Clark & Peterson, 1986; Fang, 1996; Pajares, 1992; Zeichner, Tabachnick, & Densmore 1987). Research has shown that many educational reform initiatives have failed precisely because they did not influence the beliefs or the practices of the teachers (Cohen & Ball, 1990; Elmore, 1987).

However, significant positive correlations exist between teachers' attitudes towards ICT and four independent variables namely cultural perceptions, computer competence, computer access and computer training (Albirini & Abdulkafi, 2004). However, what the reviewed literature failed to explore is the teachers' perceptions pertaining to computer and technology

facilities provided to them.

Huffman, Goldberg & Michlin (2000) recognized that using ICT can involve a different teaching and learning style from that of the traditional, didactic approach. It requires that a constructivist approach be adopted that allows students to start from their own point of understanding as they work individually or in small groups. Thus, the teacher must be familiar with that style of teaching as well as the ICT in use. Their study showed that not only did the ICT improve students' science understanding but that it could be even further enhanced when the teachers were experienced in Constructing Physics understanding ICT and constructivist approach.

Teachers' ICT Knowledge and Skills

The effective use of computers by teachers depends not only on their attitudes, but also on the training they have received (Ashton & Webb, 1986; Madsen & Sebastiani 1987). Teachers' competence in ICT presupposes: positive attitudes to ICT, understanding of the educational potential of ICT, ability to use ICT effectively in the curriculum, ability to manage ICT use in the classroom, ability to evaluate ICT use, ability to ensure differentiation, progression and technical capability (Albirini & Abdulkafi 2004; Beck, 1997).

It is also worth noting that inadequate pre-service and in-service training is another obstacle for many teachers to integrate technology in their classroom teaching (Yaghi, 1997; Yildirim, 2000). There is a large body of research in the literature that supports the same position that teachers should receive effective, timely and continuous training to promote technology in their teaching. (Wilson, Notar, & Yunker, 2003; Yildirim, 2000; Yildirim & Kiraz, 1999; Lemke, 1999; Northrup & Little, 1997).

How teachers construct and reconstruct their knowledge is a critical issue as teachers' thought processes determine largely what happens in the classroom. Teachers' pedagogical decisions and actions are closely tied up with their professional growth. Their professional knowledge might be changed by means of experience, curriculum directives and in-service training. In-service training of good quality could support the process of changing teachers' thinking and practice, recognizing that teaching is a difficult, complex and multifaceted process (Wood & Bennett, 2000). In a related study Lai et al., (2001) revealed that school-based professional development is better organized and facilitated by the ICT coordinators, who usually have adequate training and a deeper understanding of integrating computer technologies into the school curriculum and can provide role models for teachers.

However, research into in-service training has shown that what the training programme has to offer all too often fails to meet the teachers' real needs (Tella &Adeyinka, 2007; Crook, 1994). A decisive factor in the effective integration of computer use in the school curriculum is the provision of appropriate in-service training to the teachers, training which will show them how to use the new tools in their everyday teaching practice.

The IEA study in 1989 showed that a fair number of teachers had some experience of in-service training in computer use, but the majority of programmes at that time emphasized the technical rather than the pedagogical and didactic aspects of computer use. In-service training needs to focus not on the technical, but on the pedagogical and didactic aspects of ICT use in the classroom (Lai et al, 2001; Pelgrum & Plomp, 1996).

Many recent research studies on the state of ICT’s diffusion in schools

also show that many institutions are failing to integrate technology into existing context. Bauer and Kenton (2005) stated in their study that although teachers were having sufficient skills, were innovative and easily overcame obstacles, they did not integrate technology consistently both as a teaching and learning tool. Reynolds, Treharne and Tripp (2003) also underlined continuing problems in the adoption of ICTs by teachers and stated the need for further research on how ICT can improve education.

It is worth noting that what the reviewed literature failed to explore is how the ICT policy framework supports ICT's integration in schools in the various countries. Without any clear cut policy, ICTs integration would be implemented based on the whims and caprices of the teachers. Riel (1998) argued that the use of ICT impacts on both declarative and procedural knowledge to such an extent that clearly the current curriculum and models of teaching and learning were not designed to accommodate the increasingly rapidly expanding quantity of knowledge. It is worth noting that the focus of ICT integration is changing teaching and learning, the process in Ghanaian schools is varied.

Another major problem associated with ICT integration is high student/computer ratios, computer breakdowns, and slow or inconsistent Internet connectivity. The ICT backbone project was part of the broadband infrastructure expected to be used to undertake and implement Information Communication Technology (ICT) programs in governance, health, education, commerce and agriculture. In addition, it is expected that the completion of the first phase of the project would pave the way for ICT programmes to be undertaken nationwide and thereby bridge the digital divide between the rural

and urban schools**.**

ICT Facilities and Access to Students and Teachers as well as ICT Infrastructure Utilization

Another important variable of ICT integration in schools is availability of ICT infrastructure. In his doctoral dissertation, Ottesen (2006) reveals that one fundamental problem facing ICT integration in schools is the lack of computer infrastructure. In a related study Norris, C., Sullivan, T., Poirot & Soloway (2003) reveal that appropriate access to technology infrastructure is another key factor in the effective technology integration process. The study reveals substantive correlation between technology access and use. In another study, Yildrim (2007) reveals that teachers agreed that access to ICT infrastructure is one of the effective means to integrate ICT in classrooms.

Together, education and employment are key building blocks of strategies to eradicate poverty. ICT is increasingly being used to improve access to education and employment opportunities. ICT has the potential to improve young peoples' access to educational opportunities as well as to enhance the quality of that education through the new modes of learning they enable. Through ICT, curricula can be more easily updated, adapted, enriched and personalized to satisfy a broad range of learning needs. Using ICTs access to a curriculum can be made available more efficiently over a wider area. Even within more traditional learning environments, ICT is changing the way classrooms operate; the integration of multimedia subject presentations, online research, changing teacher-student dynamics, and innovative project approaches are making the learning process more interactive and participatory (UN Youth Report, 2005).

Waite (2004) indicates that even though teachers show great interest and motivation to learn about the potential of ICTs, in practice, the use of ICT is relatively low and it is focused on a narrow range of applications, with word processing being the predominant use. The research reveals that the use of other ICT tools such as video conferencing, emailing and the internet are rarely used. The study further reveals the lack of ICTs infrastructure as one of the factors for non-usage of those tools. Another research study suggests that ICT as a tool to promote learning is not generally well embedded in teachers' practice (Cox M., Preston C. & Cox K. (1999); Pedretti E., Mayer-Smith J. & Woodrow J. 1999; Zhao & Cziko, 2001) and that "information technology in the classroom is used in an ineffective way and it has proven difficult to integrate within traditional curriculum settings" (Van Belle & Soetaert 2001, p. 38).

More substantial gains in pupil attainment are achievable where the use of ICT is planned, structured and integrated effectively. This question about evidence of the impact of ICT on learning has been the focus of a number of studies in recent years. Reviews of research, and meta-analyses synthesising research in various learning areas have yielded some evidence about positive impact on students' learning.

A professional user review of UK research was undertaken for the British Educational Research Association (BERA) in 2003. A range of sources was included in the review, which found that ICT can help students to learn and teachers to teach more effectively, although the review noted that there is not a simple message in such evidence that ICT will make a difference simply by being used. (Higgins, 2003)

More substantial gains in pupil attainment are achievable where the use of ICT is planned, structured and integrated effectively. Computers should be used to enhance aspects of teaching through the presentation of information in different ways and in different forms. Effective use of ICT can support the development of understanding across the curriculum (Higgins, 2003).

In 2003 Higgins suggested the need for flexibility in curriculum and assessment to accommodate technological change, although by 2008 it seemed clear that ICTs have brought about changes in the curriculum as the developing technologies provide new avenues for accessing knowledge.

A series of systematic reviews of research studies on the impact and effectiveness of ICTs in teaching and learning have been conducted through the EPPI-Centre at the Institute of Education, University of London. Systematic reviews seek out as much research as possible on specific research questions, and use a rigorous methodology to screen the studies to determine what can reliably be said about their findings. The research findings are then synthesized into a form accessible to policy makers and practitioners.

The EPPI-Centre has undertaken several systematic reviews of the effectiveness of ICTs in different aspects of literacy learning in English. The first of these (Andrews, Burn, Leach, Locke, Low, & Torgerson, 2002). identified the interest in the impact of information and communication technologies (especially computers, networked computers, mobile phones) on young people's learning, and investigated the impact of networked technologies – the internet and email – on literacy learning. The results of the review were suggestive rather than conclusive, but in general, the studies assumed that networked ICT had a positive impact, and explored how that

impact was made. Increased motivation for literacy, empowerment and ownership were considered to be important factors. Most studies used a pre-digital conception of literacy (Andrews et al., 2002). The report of this review drew out the implications of the findings for teaching, and suggested that, in practice, more attention needs to be given to how ICT is used both within the classroom and at home to see it as one tool of many which can support literacy learning.

The review recommended that further in-depth work be done on areas such as email, conferencing and the internet; writing and composing multimedia; on-screen reading and hybridity of the verbal and visual in multimedia, and noted that a range of research methods and types of study were needed, including teachers' action research projects.

More recently, a systematic review addressed the question, what is the evidence for the effectiveness of different ICTs in the teaching and learning of English (written composition), (Andrews et al., 2006) Interestingly, the findings of the review were reported as follows:

… It was not possible to arrive at a clear answer to our in-depth research question. Rather, we wish to report that the field is in a pre-paradigmatic state where definitions of English, literacy and ICT are still relatively unclear and where the causal and/or symbiotic relationship between them has yet to be fully theorised. The most authoritative study in terms of the present review … showed that ICT made little difference to an experimental group of 'learning disabled' students in terms of writing quality, but that, for lower-order writing skills, improvements happened at a faster rate for such students as well as there being an increase in self-esteem for these students.

The report provided some advice to teachers, suggesting that ICT is best seen as another tool in the repertoire available to learners and teachers for expression and communication. Custom-made word processing and other software programs should be considered by teachers, as some of these prove to be more attuned to the writing process than others. Teachers also need to be aware that there are times when the use of ICT is appropriate for a particular writing task (or part of that task), and other times when different media are more appropriate. (Andrews et al., 2006).

A systematic review of research in science learning posed the question: What is the effect of ICT teaching activities in science lessons on students' understanding of science ideas*?* (Hogarth, Bennett, Lubben, Campbell & Robinson, 2006)

The in-depth review of research from 2000-2005 identified evaluation studies from 10 countries on the use of simulation to teach the understanding of science ideas. These studies included a control and pre- and post- testing of achievement of students aged 11-16. The findings of the systematic review suggested that simulation has potential value in classrooms:

1. Simulations fell into two main categories – simulation of specific experiments and simulations of wider scientific situations.... Both types of simulation can improve students' understanding compared to non-ICT/traditional teaching and learning activities.
2. Students' use of ICT simulations helped them to improve their understanding of science ideas more effectively compared to the use on non-ICT teaching activities.

3. Students' use of ICT simulations was more effective than using non-ICT teaching activities for improving basic science ideas including science understanding and the scientific approach.
4. However, the improvement in higher levels of understanding (for example, the transfer of scientific knowledge from one situation to another and experimental design) can equally well be achieved when students use traditional (non-ICT) teaching approaches.
5. The gains in students' learning when using ICT simulations were further enhanced when teachers actively scaffolded or guided students through the ICT simulations. (Hogarth et al., 2006)

A systematic review of ICTs in mathematics found evidence to answer the research question: How have different information and communication technologies (ICTs) contributed to the development of understanding of algebra for pupils up to the age of 16? Major findings were that:

i. pupils achieve general gains of understanding when using one type of ICT
ii. students successfully use visualization with graphing software to fit graphs to datasets, to solve equations and to transform functions.
iii. pupils working in a computer environment reach higher levels of thinking and are able to explain their thinking better than pupils working in a paper and pencil medium.
iv. lower attaining students prefer to work arithmetically with tables of values and only later move to integrate the tables of values with computer-generated graphs.
v. pupils have difficulty moving between symbolic, tabular and graphical forms when solving equations.

vi. students do not always know how to use the technology, interpret ambiguities in the output or exercise critical judgment when using some of the advanced calculators. (Goulding & Kyriacou, 2008)

The report of this systematic review drew on the findings to provide practical advice for teachers. This example relates to the management of individual, small group work and whole class work.

A comparatively recent development in research has explored possible links between the use of ICT in schools and the standards achieved by students in national tests and examinations. Recent studies by the British Educational Communications and Technology Agency (Becta, 2001a, 2001b) have sought to compare the performance of students in schools well-resourced for ICT with those less well-resourced. The studies indicated that students at schools with 'good' ICT resources achieved significantly better results in national tests in English, Mathematics and Science at ages 11 and 14, and in national examinations at 16 than students at schools with 'poor' ICT resources. Achievement was higher in schools where ICT was used routinely in mathematics and science lessons, and the best results were seen in schools where ICT was used across the whole curriculum.

Teachers need to negotiate a balance between the individual constructions which may develop when pupils work alone or in small groups with the technology, and common knowledge developed within the whole class. Although this is a consideration in any teaching situation, technology may be particularly fruitful in encouraging individual experimentation. This is desirable but needs to be tempered by teachers encouraging sharing within the whole class. The last point is also relevant when considering the use of

electronic whiteboards and computers connected to data projectors. If this is completely within the control of the teacher, then pupils may not have the opportunity to experiment with the technology themselves. (Goulding & Kyriacou, 2008). Other large-scale reviews of studies of ICT impact on schools provide further perspectives. A review from European Schoolnet of the impact on schools in Europe identified the following findings from a review of 17 recent impact studies and surveys at the national European and international levels. The authors summarized the findings of ICT impact in eight statements:

1. ICT impacts positively on educational performance in primary schools, particular in English and less so on science and not in mathematics.
2. Use of ICT improves attainment levels of school children in English- as a home language- (above all), in Science and in Design and technology between ages 7 and 16, particularly in primary schools.
3. Schools with higher levels of e-maturity demonstrate a more rapid increase in performance scores than those with lower levels.
4. Schools with good ICT resources achieve better results than those that are poorly equipped.
5. ICT investment impacts on educational standards most when there is fertile ground in schools for making efficient use of it.
6. Broadband access in classrooms results in significant improvements in pupils' performance in national tests taken at age 16.
7. Introducing interactive whiteboards results in pupils' performance in national tests in English (particularly for low-achieving pupils and for writing), mathematics and science, improving more than that of pupils in

schools without interactive whiteboards. (Balanskat, Blamire, & Kefala, 2006)

The body of research on the impact of technological innovations continues to expand as the take-up of ICT in schools increases. The possibilities of integrating technological communication and information resources into effective classroom practices are widely acknowledged, and there is a growing body of evidence indicating the positive impact of such practices. Evidence about the nature of students' levels of ICT literacy and about the diverse ways in which ICT is used in contemporary classrooms has many implications for future directions in education.

There is clear recognition of the need to expand the range and scope of research methodologies in the area, and the need for teachers to be more involved in the design of ICT artefacts, and … to be more involved in research on how students use these artefacts. (Freebody, Reimann & Tiu, 2008a)

White (2008b) draws attention to the sheer richness of media that is available and the diversity of processes that can be applied to those media mean that we need research into their effects on learning. We also need to look at the capacity for education to explore these aspects of the use of ICT in education if we're to enable progress that is more than haphazard.

This research digest has drawn on rigorous large scale studies to help in providing a map of the challenging territory of ICT in education, as well as on more focused studies of classroom practices. The need to continue and broaden research into the impact of ICTs is emphasized in the following recommendation about the uses of ICT in schools:

Learning objects and ICT more generally, need to be seen as both curricular and technical interventions into classrooms. In that regard their use poses challenges to teachers and students that are cognitive, attitudinal, technical and practical. Studying their adoption, adaptation and sustained use therefore means building up detailed knowledge from a variety of case sites, targeting practices and outcomes in close-up designed-based interventions in which every day practices – initiations, modifications, challenges, responses and outcomes – are documented and disseminated. (Freebody, Reimann & Tiu, 2008a).

A number of key messages emerge from the body of research evidence about the uses of ICT in schools in the digital age:

1. teachers' confidence about using ICT in the classroom is variable;
2. ICT learning objects are used mostly in mathematics, English and science;
3. the use of computers is common at home and at school;
4. students use ICT in limited ways. Information access and searching are common, but creating, analyzing and transforming information are less common.

ICT improves student engagement, supports learning in a variety of ways, and is both a tool and process for new ways of thinking and learning. For example, simulations are powerful learning tools. ICT can assist general gains in mathematics and has a positive impact in primary schools especially, in English. Student performance improves with time when using ICT, but low access to ICT and low confidence in using ICT corresponds to low performance. Innovative uses of ICT continue to evolve: for example, teachers can provide new learning opportunities for students by using interactive

whiteboards, or electronic discussion board systems. Overall, the effective use of ICT in schools is planned, structured and integrated.

There is evidence from research that ICT can help pupils to learn and teachers to teach more effectively. However there is not a simple message in such evidence that ICT will make a difference simply by being used. Findings suggest that although ICT technology is going to make a difference. Some caution is therefore called for at this broad level of where and how ICT might have an impact. There are two main issues. First is the modest effect of ICT compared with other researched interventions, second is the almost negligible effect of the provision and use of ICT at a general level.

There has been extensive research into computer-assisted instruction (CAI) and computer-based learning (CBL). Some major reviews of this extensive work have been undertaken. One study (Fletcher-Flynn and Gravatt, 1995) into the effectiveness of CAI limited the studies it examined to those that took place between 1987-1992 and identified almost 400 reports of research that met these criteria. The impact of the use of computers was then combined statistically to identify the overall impact. In this meta-analysis the mean effect size was relatively small (.24) for the five years in question but increased for more recent studies analysed (.33). This kind of improvement would move an 'average' class pupils form 50th to about 40th in list of 100 classes ranked in order of attainment. This suggests two things: first, it is possible that the impact of computers may be increasing; second, ICT only produces relatively small improvement. Other forms of educational interventions, such as peer tutoring, reciprocal teaching and homework, for example, all produce greater average impact (Hattie, 1987; Hattie, 1992). In a

study of the effect of different types of study skills interventions the average effect size was .57 (Hattie, Biggs & Purdie, 1996); this would move a class from 50th to the top 30. A study of the effect of thinking skills or metacognitive approaches (Marzano, 1998) indicates the average impact would move a class from 50th into the top 20 (an effect size of .72).

A study by the British Educational Technology Association (BECTA, 2000) found no link between levels of resources for ICT and either reading or mathematics grades at Key Stage 1 in 1999. At Key Stage 2 there was a significant, by very weak association between ICT resources and pupils attainment. This indicated that ICT curriculum resourcing was at least 99.5% independent of pupil performance at Key Stage 2 (no correlation coefficient exceeded 0.07). In the USA, information about computer use from a longitudinal study was analysed (Weaver, 2000).

A weaker link between high computer use and pupil attainment was reported in a preliminary survey for a Teacher Training Agency study in England (Moseley, D., Higgins, S., Bramald, R. Hardman, F., Miller, J., Mroz, M., Tse, H., Newton, D., Thompson, I., Williamson, J., Halligan, J., Bramald, S., Newton, L., Tymms, P. Henderson, B. and Stout, J. (1999*)*, p 82), the authors did not interpret this as a causal link, but rather that more effective teachers (and more effective schools) tended to use more innovative approaches, or tended to use the resources that they had more effectively. If this interpretation is accepted it suggests that it is more important to think about how computers are used in schools.

This same study also reported dramatic impact on pupil attainment in its 16 development projects in primary schools. The average gain on

standardized test was 2.8 months progress per months of the project in mathematics and 5.1 months progress per month in literacy. The report states, however, that these gains do not prove that ICT will raise attainment, but rather that "teachers can raise levels of pupils attainment when they use ICT to support their teaching in literacy and numeracy" (p 6). In these projects the use of ICT was planned to have an impact on particular areas of pupils' learning using research evidence from literacy and mathematics as well as the effective use of ICT.

The development work involved working closely with the class teachers over an intensive period using a range of different equipment and software. These projects did not use control groups, but the consistent and significant increase in the attainment of pupils in mathematics and England suggests that where ICT is targeted at specific areas of learning, with a clear rational for its use from a broad research base (about ICT, about pedagogy and about professional development) it can have positive effect.

1. Research indicates that ICT can make a difference to pupils' learning.
2. In large studies there is a positive link between the provision or use of ICT resources and pupil attainment, but this link is weak.
3. Analysis of targeted interventions using ICT shows a more positive picture, but not as effective as other educational innovations.
4. More substantial gains in pupil attainment are achievable where the use of ICT is planned, structured and integrated effectively.
5. The way that this equipment and these resources are then used by pupils and by teachers is what makes the difference.
6. Other options to improve pupils' attainment should also be considered.

7. Providing ICT equipment to schools or teachers will not necessarily make a difference.

The central focus of the new education reform was to use Information Communication Technology (ICT) to transform the economy into a knowledge-based system, Deputy Minister for Health, Odoom (March 2008) was speaking at the 17th anniversary and prize giving-day of Jukwa Senior High School at Jukwa in the Central Region. He said the government had come to the realisation that ICT could serve as a tool to promote the various sectors for developments, including the educational system (ghanaZone.com). The Deputy Minister said this was because technology had the potential for knowledge dissemination, knowledge acquisition, effective learning and development. He advised the students to use the knowledge of ICT positively to drive socio-economic development of the nation instead of using it in negative acts such as fraud.

Odoom (March 2008) said the Twifo-Heman-Lower Denkyira District Assembly was first to set up an internet café and noted that the facility had opened up the district to the benefit of all, especially oil palm producers. He said the success of any venture hinged on discipline and asked the students to be obedient to teachers, parents and elders in the society.

In her annual report, the Headmistress, Regina Ammam, said the school's academic performance had improved since 1998. She said of 184 candidates presented for the West African School Certificate Examination, only one could not make it, adding that 98 of the students passed in at least six subjects, representing 95percent.

Ammam (31st March 2008, 5:14pm) said the school's plan to re-introduce Home Economics as part of its curriculum was being hampered by lack of classrooms and a science laboratory, ICT laboratory and appealed to the Government and philanthropists to come to their aid.

She commended past members of the Parent-Teacher Association for providing an assembly hall and other facilities for the school. Mr. Samuel Agyeibie-Kessie, the District Chief Executive, said the District Assembly in collaboration with World Vision, Ghana and the Twifo Praso Area Development Council had constructed a hostel for the school at the cost of GH¢207,000. He said the GETFund was also constructing a boys' dormitory estimated at GH¢320,000 for the school.

In 2006, the Assembly, in partnership with the Central Region Community Water and Sanitation Agency constructed a six-seater KVIP for the school, he said.

Education policymakers in Ghana have hailed the introduction of Information and Communication Technology (ICT) in Ghanaian secondary schools as a remarkable step that will contribute to knowledge production, communication and information sharing among students and teachers in the school system. This perception stems from assertions in the literature about the benefits that come with ICT literacy in schools (Mucherah, 2003; ETS, 2001; Hakkarainen et al, 2000). Hakkarainen et al (2000) points out that ICT is a transformative tool and its full integration into the school systems is necessary to prepare students for the information society they will inherit. Contrary to the promising notion of ICT as a means of knowledge production, numerous scholars have highlighted the need to address the numerous problems that the

introduction of ICT will bring. These issues include: a lack of adequate planning for implementation of ICT (Mooij & Smeets, 2001); inadequate teacher training (Webb, 2002); inequalities in ICT distribution (Nachmias, Mioduser, & Shemla, 2001; Sutherland-Smith, Snyder & Angus, 2003); lack of information regarding the distribution of ICT; low levels of literacy in general, and lack of relevant content and technology applications to meet the needs of diverse societies (ETS, 2001; Hakkarainen et al, 2000). The literature identifies the tendency for ICT to lead to a digital divide between urban and rural schools (Hartviksen & Akselsen, 2002).

A review of the available literature reveals significant inequity in the implementation of ICT in Ghanaian secondary schools. The literature (Dankwa, 1997; Parthemore, 2003) reveals that ICT provision to secondary schools is skewed in favor of schools categorized as premier schools and schools in urban areas. Unfortunately, this is not a new trend.

Since the introduction of formal schooling in Ghana, educational resources have been unequally distributed in the school system (Folson, 1995; Foster, 1965; Graham, 1971; McWilliam & Kwamena-Poh 1975). At this juncture, it is critical that policy makers ensure that ICT does not become another tool for perpetuating educational inequalities in Ghana's school system.

The term ICT is used in Ghana to describe both the study of and the use of computers and other technologies that are used for Communication and Information Systems (See National ICT policy and plan development committee). In this article, I will utilize the following definition of ICT: "digital technology, communications tools, and/or networks that help to access, manage, integrate, evaluate, and create information in order to function

in a knowledge society" (ETS, 2001, p. 1). I will utilize Farrell's (1999) "educational equality" model, particularly the concepts of "equality of access" and "equality of output," to explore ICT provision and implementation in Ghanaian secondary schools. The article employs these concepts and the history of Ghanaian educational development to examine how ICT is likely to perpetuate the existing inequalities in Ghana's educational system. "Digital divide" is defined as the absence of equity in ICT implementation (ETS, 2001, p.1) and is likely to widen the knowledge gap that exists between the urban (core) and rural (periphery) communities highlighted in the development literature (Farrell, 1999; Samoff, 1999).

The discussions in this article are based on review of literature on ICT, review of NGO documents involved in implementing ICT in Ghana, my experience as a teacher and administrator in a Ghanaian secondary school, and informal conversations with educators including, headmasters and teachers in the Upper East, Eastern, Greater Accra and Central regions of Ghana. Accessing detailed information from the Ghana Education Service and the Ministry of Education was a methodological dilemma in the study due to lack of transparency. This paper presents a contextualized review of the phenomenon and considers the critical need for a policy framework to serve as the basis for equitable implementation of ICT throughout high schools in Ghana.

Farrell (1999) points out that schooling is a long-term process in which children may be sorted at many different points and in several different ways. Thus schooling operates as a selective social screening mechanism. It enhances the status of some children, providing them with an opportunity for

upward social or economic mobility. It also ratifies the status of others, reinforcing the propensity for children born poor to remain poor as adults, and for children born into well-off families to become well-off adults. Studies on postcolonial education in sub-Saharan Africa reveal that schooling has been a mechanism for perpetuating these/such social inequalities (Farrell, 1999; Mfum-Mensah, 2003; Samoff, 1999).

According to Farrell the term "equality" refers to equitable service provision as well as the actual patterns in which something (e.g. income or year of schooling) is distributed among members of a particular group. When the concept is applied to public policy, "equality" has to do more specifically with non-discrimination (Samoff, 1999). Farrell conceptualizes "educational equality" as encompassing four dimensions including equalities of access, survival, output and outcome. He defines equality of access as the probabilities of children from different social groups getting into particular levels or portions of the school system. He applies this concept to the inequalities in the distribution of educational resources. He posits that most children residing in remote rural areas, those in urban slums, and those belonging to groups outside of mainstream society are disadvantaged when it comes to the distribution and access to educational resources.

Farrell defines equality of survival as the probabilities of children from various social groupings staying in the school system to some defined level, usually the end of a complete cycle. He explains that in any given level poor children are generally less likely to survive educationally than are well-do-to children. Similarly, children born in rural areas are less likely to survive educationally than urban children. Equality of output refers to the probability

that children from various social groupings will learn the same things to the same levels at a defined point in the schooling system. The concept is expressed through differences in the level of achievement in nation's school system which Farrell points out as systematically associated with differing social origins. He points out that among those who have reached a given level of nation's school system, children who are poor, rural, female, or from any other socially marginalized groups learn less. Equality of outcome refers to the probability that children from various social groupings will live relatively similar lives subsequent to and as a result of schooling.

Here too, Farrell posits that in societies where the economy is expanding, and where there is no dominant group in the society, formal education becomes a predominant influence on the level of employment acquired. The "equality model" presented above by Farrell shows how formal schooling can be a powerful selective tool for ratifying or building a new social order. The model can also serve as a useful lens for analyzing the educational inequalities that have characterized the Ghanaian educational system and can be extended to analyze ICT implementation.

Since the time formal schooling was introduced in Ghana to date, educational provision has been skewed in favor of those in the urban communities and there has been inequitable distribution of educational resources and services (Asiedu-Akrofi, 1982; Graham, 1971). Postcolonial educational reforms, policies and practices have done little in terms of bridging the gap that has been created between schools in the urban communities and their counterparts in the rural and isolated communities.

Most schools in the urban areas have been in existence since the colonial or early postcolonial era.

Premier schools such as Achimota, Prempeh College, and Wesley Girls, were fashioned along the lines of elite British schools and are well known beyond the borders of Ghana.

Most of the rural schools that were established from the 1970s onwards, especially those that proliferated in the 1990s after the implementation of the Senior Secondary School (SSS) concept, are based on the egalitarian ideology of mass secondary schooling (Ministry of Education, 1974 & 1999b).

Since their establishment, most of these rural Senior Secondary Schools have faced problems of poor infrastructure, lack of logistical support, inadequate material input, and lack of qualified teachers. In light of such general inequalities in Ghana's school system, a current challenge is the equitable implementation of ICT policy for secondary schools. This issue becomes intricate when factors such as accessibility of electricity and telephone grids, the current state of school infrastructure, and availability of technical support are considered.

Educational policy makers, non-governmental organizations (NGO), bilateral and multilateral donor organizations, and school administrators are making the collective efforts to promote ICT in Ghanaian secondary schools. Because of the efforts of NGOs and donor organizations in particular, ICT facilities have extended to some schools, mostly in urban communities (Dankwa, 1997; Parthemore, 2003). Parthemore (2003) points out that many secondary schools in Ghana can now boast of computer labs through which

students are gaining basic computer literacy. A number of these schools have Internet capabilities, enabling students to deepen their connection to the outside world. Although this is encouraging information, extensive review of documents of

NGOs that are spearheading ICT implementation in Ghanaian schools reveals that most secondary schools now benefiting from ICT are either located in urban areas or are classified as premier secondary schools (Dankwa, 1997; Hawkins, 2002; Parthemore, 2003).

According to Parthemore (2003), computer literacy education in Ghana has been concentrated in major urban areas. A few better schools in outlying areas have attempted to "catch up" with their urban counterparts by contracting with private companies to provide computer education. The costs for private computer training are prohibitive and it is rarely if ever the case that all students have access. Other schools have taken part in the Ghana Education Service sponsored scheme where for every hundred textbooks they purchase from a private firm, they receive one computer system.

Recently SchoolNet, a foundation based in Switzerland, chose fourteen schools in Ghana in which to implement ICT programmes. Of these schools, five are located in Accra, three in Kumasi, four in Cape Coast, one in Tema, and one in Aburi. Of these fourteen schools, eleven belong to those schools categorized as premier schools. Apart from Aburi, the rest of the locations are all cities. Aburi is located about twenty minutes drive from Accra. Now that the distribution of ICT in schools is also progressively skewing in favor of the urban schools, policy makers face the challenge of promoting equitable ICT implementation. The equitable implementation of ICT in the secondary school

system is a complex issue. However, recent educational policies may offer some perspectives on this issue.

In 1987, the Government of Ghana expanded the secondary school system by establishing rural Senior Secondary School (SSS) to accommodate the growing numbers of Junior Secondary School (JSS) students in rural communities. The government made promises to ensure the standardization of all SSS in terms of resources and quality of output (Ministry of Education, 1999a, 1999b). Over the years, the government did not embark on its promises, hence the persistent wide urban and rural gap in the standards of secondary school system. To date secondary schools that has been established in rural communities in Ghana are faced with the problems of poor infrastructure, lack of material input, inadequate logistics, and lack of qualified teaching personnel. The environment in which the majority of these schools operate does not promote any serious learning and academic advantage.

Recently, the government reiterated its commitment to extend computers to all schools in the country in the news media. The government also emphasized its commitment to promote equitable ICT in the school system so that all students will equally benefit from ICT regardless of their geographical location. The successful implementation of such a policy would be a great achievement in the educational system. However, existing inequality, poor infrastructure and the nation's present economic situation (as a highly indebted country) is likely to pose a challenge to implementing equitable ICT in the school system.

Accessibility of ICT in secondary schools also interconnects with other development issues, such as accessibility and connectivity to electricity and telephone grids. The themes that emerged from the policy arena challenges to ICT in rural schools are lack of telecommunication and resources (finance, infrastructure, personnel and their training, software, and textbooks). The telecommunication and expenses will be considered in this section while the issue of resources will be considered in the next section. Since 1998, the government of Ghana has extended electricity to many rural communities in the country. However, many rural communities are yet to be connected to the electricity grid. Most rural communities that have secondary schools do not currently have access to electricity and telephone services. In such localities, the idea of promoting computers in classrooms will require more financial backing, and a considerable amount of time, considering the pace of development in Ghana.

In a recent Ghanaian case study (Ismail, 2002), it became apparent that the high costs for providing electricity (where there is none) and connectivity to telephone services are major setbacks to providing ICT in rural areas in Ghana. Students enrolled in premier schools like the Achimota School, Wesley Girls School, and Prempeh College and those in urban areas who have easy access to computers and Internet cafés have already made a considerable increase in the use of computers and the Internet do not face such challenges.

On the contrary, most students enrolled in rural secondary schools have never set eyes on a computer. While students in urban areas can now boast of their proficiency in the use Internet and basic computer programmes,

the silent majority of their colleagues in the rural secondary schools do not have a clue as to how to click a mouse.

Availability of an appropriate environment for ICT facilities is another issue that will determine accessibility of ICT for rural schools. Some schools have successfully implemented ICT projects because they possess the infrastructure to accommodate ICT equipment donated by benevolent organizations. Inadequate infrastructure is a problem facing many rural secondary schools. The infrastructure of most rural schools lacks the appropriate environment and the needed security for storing ICT equipment, even if they become available. Such concerns are also setbacks to ICT implementation in rural schools.

The use of ICT in secondary schools will soon be a policy mandate in the Ghanaian educational system. The government has made the promise to extend computers and Internet services to every secondary school in the nation. The Ministry of Education has developed a curriculum for ICT training. The Ministry has also indicated its plan to include ICT in the Senior Secondary School Certificate Examination. These developments at the policy levels show that ICT will soon become a tool for assessing students' ability and determining their fitness for transition to post-secondary education and employment. This is where the equality of output concept comes into play.

Farrell (1999) posits that among those who have reached a given level of the school system, children who are rural or those from marginalized groups learn less. Will the school system be able to ensure that students who are at the same level of the secondary system are provided with the same ICT knowledge and skills?

The history of Ghana's educational development and recent case studies all point to the fact that the distribution of educational resources especially, material inputs, teaching personnel, and well-equipped facilities, have always been skewed in favor of some section of the society. (Folson, 1995; Glewwe & Jacoby, 1994; Graham, 1971; McWilliam & Kwamena-Poh, 1975; Mfum-Mensah, 2003). These educational resources pointed out above have direct effect on students' acquisition of knowledge and learning, and hinder equal implementation of ICT policies.

Many urban secondary schools in the nation have now implemented ICT as part of their schools curriculum. However, most secondary schools in rural areas do not yet have access to ICT. Students in schools that have ICT facilities are using this tool for projects and are able to connect with schools around the world. Through ICT students and teachers in these schools are contributing to the knowledge production and information sharing with other students and teachers around the world. Analysis of the NGO documents and other emerging case studies in Ghana reveal some interesting themes, which we need to consider in the light of equality of output. First, the implementation of ICT has resulted in positive impacts in secondary schools that have ICT programs.

Second, the dimension of impact extends to include students and teachers. Third, the provision of technical support for ICT has been a challenge for its effective implementation (Ismail, 2002). The World Bank impact assessments reveal that through ICT, students in Ghanaian schools have gained knowledge and skills. The case study also points out that through ICT, students have gained positive attitudes toward school, and collaborative

learning projects have been implemented in schools. Similarly, the tool has contributed to teacher's professional satisfaction. These revelations show how some schools and students have taken the lead in the acquisition of ICT skills and knowledge even before its inclusion in the school curriculum.

The literature and other emerging Ghanaian case studies on ICT implementation reveal that technical support is a challenge to ICT implementation (Amenyo, 2003; Ismail, 2002; Ministry of Education, 2002). This body of literature points out that the major challenge for schools that have ICT is lack of resources and proper implementation by trained personnel. As can be seen through previous policy implementation processes and case studies, due to the scarcity of educational resources in rural areas, there is the probability that the distribution of educational resources will skew in favor of those in urban schools (Folson, 1995; Glewwe & Jacoby, 1994; Mfum Mensah, 2003). It is most likely that a situation will be created where schools that have the technical support will get comparative learning advantages over those without, therefore creating a digital divide in the school system.

Milli, Fayad, Brugali, Hamu, and Dori (2002). define a framework as a set of interacting objectives that together realize a set of functions. A framework for educational policy and practice is therefore a working objective that highlights the participants, the relationship between the participants, and the set of interaction scenarios between the participants. An educational policy framework can help to define the roles and responsibilities of educational actors, which include policy makers, administrators, teachers, students, funding agencies, development organizations, and civil society. As a blueprint,

an educational policy framework can be a process through which various actors and policy makers translate educational policy into practice.

In spite of the benefits of a policy framework highlighted above, to date, Ghana's

Ministry of Education has not established a clear framework for the implementation of ICT. Almost six years after some premier and urban schools ushered into their first experience with ICT, the Ministry of Education has now submitted a draft ICT policy to the Cabinet for approval. Because of the lack of a policy framework, ICT implementation in the school system is currently uncontrollable and irrespective of government initiatives. The literature on Ghana's ICT policy (Republic of Ghana, 2003; Ismail, 2003) reveals that there is currently no coordination on the proposed national ICT policy.

Second, the other ministries are not actively involved in the policy formulation process. Third, there is lack of human resource capacity to devise and implement an appropriate ICT policy for Ghana. These policy level issues make the implementation of ICT in the educational sector more challenging. This problem does not pertain only to the Ghanaian education system but also most educational systems in the developing world.

Hawkins (2002) posits that while many educational ministries around the world have made the commitment to computerize schools, few have developed coherent strategies to integrate its use fully as pedagogical tools in the classrooms. Despite the above challenges, education policy makers are quite enthusiastic about the introduction of ICT in Ghanaian secondary schools (Ministry of Education, 2002).

The introduction of ICT in school systems in Ghana and other sub-Saharan African nations is a major step to promoting innovation. However, like Ghana, many of these educational systems currently do not have any coherent ICT policy framework in place.

The current lack of policy frameworks for ICT implementation in these educational systems shows that they are not equipped to keep up with the ICT revolution that is taking place. However, education policy makers in this region still have the chance to take advantage of the technology that is becoming more widely available. Amenyo (2003) cautions that any attempt to implement a well-meaning ICT project in a haphazard and context-independent manner would not help in sustaining it.

Summary

This review of literature has extensively been discussed. The purpose of the study is to explore the effect of ICT facilities on teaching and learning in senior high schools. In order to help students learn more about and use technology effectively, sub-topics such as factors that hinder ICT integration in schools, teachers' attitudes and beliefs in ICT use, teachers' ICT knowledge and skills and ICT facilities and access to students and teachers as well as ICT infrastructure utilization. These sub-topics have thoroughly been reviewed with supporting literatures developed by researchers from different educational background and authorities.

CHAPTER THREE

METHODOLOGY

In this chapter the procedure for the study is discussed. These include the research design, population, sample and sampling technique, research instrument, data collection procedure, and data analysis.

Research Design

The study was intended to find out the effects of ICT on teaching and learning. Against this background the descriptive survey employing quantitative methods was used.

According to Cohen and Manion (1991) in descriptive survey, data is gathered at a particular point in time with the intention of describing the nature of existing conditions. It is also used in identifying a standard against which existing conditions can be compared. It seeks to determine the relationship that exists between specific events using structured or semi-structured interviews, self-completion or postal questionnaire, and by telephone.

The descriptive survey was used because it has the advantage of producing good responses from wide range of people. It will explain people's opinion and behavior on the basis of data at a particular time. It can be used with greater confidence with regard to particular time or questions of special interest or value to the research. Also, in-depth follow up questions can be asked and items that are unclear can be explained using the descriptive design (Fraenkel & Wallen, 2000).

On the other hand, descriptive survey also has some weaknesses such as low response rates and nonresponsive bias. Responses to questions can also be difficult to analyze or summarize. Also the quality of a descriptive survey depends on the accuracy and truthfulness of the participants. It is certainly possible that at least some participants will distort or conceal information, or simply have no knowledge about the topic when they answer certain questions (Frederick & Lori-Ann, 2006).

Population

The Form Two Students from five (5) out of thirteen (13) Senior High Schools in Cape Coast were considered to be the study population. These five schools had these students' numbers: Wesley Girls (350), Mfantsipim (720), Adisadel College (600), University Practice (430) and Academy for Christ the King (240) Senior High Schools. The researcher considered these five (5) schools for the study because they represented perfect variables of interest to the study. In effect, the target population was approximately two thousand three hundred and forty (2340) (Schools Register, 2009).

Students from various disciplines of the selected schools were used due to the fact that they were closer to the researcher and due to time and financial constraints. However for a fair result to be captured in the study three single sex schools and two mixed schools endowed with ICT facilities were considered. The Form Two Senior High School students were selected to respond to the questionnaire based on the fact that they have done ICT in the first year and therefore were able to determine its effects on teaching and learning. Unlike the form three students who were preparing seriously for their

final examination, the form two students were readily available to respond to the questionnaire.

Sample and Sampling Technique

Wiersma (2000) defined sample as a subset of the population to which the researcher intends to generalize the results. Sampling refers to the systematic selection of a limited number of elements (persons, objects or events) out of a theoretically specified population of elements, from which information was collected (http://www.socialresearchmethods.net/). Out of the target population of Two thousand three hundred and forty (2340) respondents from the five (5) schools, a sample size of Two hundred and fifty (250) was used. Convenience sampling techniques was used in selecting the respondents from schools.

Sample size is determined by the level of confidence required from the results. The larger the sample, the smaller the confidence interval and therefore the smaller the risk that the reported result would not be representative of the population as a whole (The Research Advisors, 2006)

Research Instrument

The instrument used for the study was a formally organised set of written items presented in a uniform manner (questionnaire). A questionnaire consists of questions or statements related to the aims of the study. The questionnaire raises research questions that are verified and answered by respondent, by writing. (Fraenkel & Wallen, 2000). The reason for choosing questionnaire was because it provides a quick way of collecting data. It is also known to be quite valid and reliable if well constructed. It also saves time and

money. (Frederick & Lori-Ann, 2006). Respondents were to provide responses on a specific subject matter.

The researcher designed one main set of questionnaire for the students. The items in the questionnaire arrived out of the literature review, previous studies and researcher's own personal experience. The questionnaire was made up of four major sections; Sections A, B, C, and D. Section (A) deals with the demographic data of students. Section (B) is designed to measure respondents' view of the effects of ICT facilities on teaching and learning in their schools. Whiles Section (C) consists of items designed to measure respondents' views on effects of ICT on teaching and learning. Finally, Section (D) of the instrument measures respondent's view of the use of ICT in teaching and learning. All the items were close-ended and structured on a four likert-scale type. This type of questionnaire has been found to be the most suitable type of instrument for the measurement of attitudes and perceptions. This is because it enables respondents to indicate the degree of their belief in a given statement (Best & Khan, 1996).

Data Collection Procedure

Quantitative studies involved the extensive use of statistical data and tools which provides precision when interpreting collected data. Questionnaire, perceived to be the most appropriate tool by the researcher was used in the study to collect data from the students. This is because it was an effective small-scale research tool and because "the knowledge needed was controlled by the questions; therefore it afforded a good deal of precision and clarity" (McDonough & McDonough, 1997). Since all the respondents were literates the instrument was presumed to be an effective one. It was made up

of close ended items to solicit responses from the respondents. Using the structured list, respondents voted on the alternatives in a quantitative way. This was done to get some of the advantages in descriptive design.

The researcher personally collected the administered data for the study. The questionnaires were administered to the respondents through the help of the ICT tutor in the five (5) selected Senior High Schools. Upon entering the schools, permission was sought from the various Assistant Heads in their respective offices, with an introduction letter from the Director of Centre for Continuing Education, University of Cape Coast (CCE), to administer the questionnaire to the second year students in their schools. This enabled the researcher to get most of the students present at that moment. During their break time, all the second year students in the various selected schools were asked to stay behind. The researcher was formally introduced to the respective schools on her academic mission for completion of the questionnaire. This offered the students the free space to respond to the questionnaire without any reservations. Confidentiality was assured and respondents were encouraged to return the completed questionnaires to the researcher immediately. But in some other schools, the researcher was to return the next day for the complete questionnaires.

In spite of these measures, few problems were encountered during the collection of the data. The day schools were involved in inter-schools athletics competitions outside their schools premises; this made it very difficult to retrieve all the questionnaires administered in those schools. In all, out of the two hundred and fifty (250) questionnaires administered, two hundred (200) questionnaires were retrieved.

Data Analysis

The researcher used Statistical Product Service Solutions (SPSS) to analyse the data. Descriptive Statistics was used to give an overall picture of the distribution of the data. The descriptive statistical tools used included frequency distribution and percentages.

The data collected were the views of second year students from five selected Senior High Schools in the Cape Coast Metropolitan Area. Descriptive statistics (frequencies and percentages) were used to analyse the data from the field. Tables were also presented. The analysis was done by scoring the items fashioned on the 4 Point Likert scale using the main sections of the questionnaires in relation to the research questions raised. The items were weighted as follow; 1-Strongly Disagree, 2-Disagree, 3-Agree, 4-Strongly Agree. This presented a clear picture from the respondents.

CHAPTER FOUR

RESULTS AND DISCUSSION

This chapter presents the data and analysis based on the objectives set for the study and the research questions. The responses from the students at the various senior high schools are analysed and findings presented in tables, figures and description of data.

Demographic Characteristics of Respondents

This section highlights the demographic characteristics of respondents from all the selected Senior High Schools. The breakdown of the number of students' respondents in each institution is illustrated in Table 1

Table 1: Schools that Participated in the Study

Schools	Frequency	Percent
Academy	40	20.0
Adisadel College	42	21.0
Mfantsipim School	41	20.5
UPSS	41	20.5
Wesley Girls High School	36	18.0
Total	**200**	**100**

Source: Field data, February 2010

A total of 200 students took part in the study. For Academy Senior High School, being a day school and consisting of both males and females, 40 students participated which resulted in 20%. Adisadel College being a

boarding school with only males had a total of 42 with its corresponding 21%. Mfantsipim School is a boarding school with only male students; they had a total of 41 and 20.5%. UPSS consisting of males and females had 41 students that took part in the exercise and constitutes 20.5%.

Wesley Girls High School is a boarding school with only females and 36 took part in the study corresponding to18%.

Initially, equal numbers of questionnaires were administered to each selected school, but at the end of the exercise some could not return theirs due to some circumstance beyond them. Students were asked to indicate their programme of study. The responses are shown in Table 2.

Table 2: Programmes Pursued by Respondents

Name of School		General		Home		
	Business	Arts	History	Econs	Science	Total
Academy	23	0	0	17	0	40
Adisadel College	0	42	0	0	0	42
Mfantsipim School	0	40	1	0	0	41
UPSS	0	41	0	0	0	41
Wesley Girls High School	0	15	0	0	21	36
Total	**23**	**138**	**1**	**17**	**21**	**200**

Source: Field data, February 2010

In Academy School, 23 Business students responded to the instrument and 17 Home Economics students also took part. Only 42 students from Adisadel College pursuing General Arts took part in the exercise. For Mfantsipim School, 40 General Art's students took part and only 1 History

student participated. UPSS had 41 from General Art's class participating in the exercise. For Wesley Girls High School, 15 students from General Arts took part and 21 science students also took part in the study.

Analysis of Main Data

Research Question 1: To what extent do ICT facilities have positive effects on ICT usage?

Items 1 to 4 at Section B of the questionnaire was used to answer research question one. This sought to find out the positive effect of ICT facilities on ICT usage by the students of the selected institutions. The result is presented in Table 3.

Table 3: Students Response on Positive Effect of ICT Facilities on ICT Usage

Item	Strongly Agree(%)	Agree(%)	Disagree(%)	Strongly Disagree(%)
Students benefit from ICT	97(48.5)	84(42)	14(7)	5(2.5)
Students have access to the ICT lab	118(59)	72(36)	8(4)	2(1)
ICT improves critical thinking	42(21)	110(55)	36(18)	12(6)
ICT Improves language acquisition	38(19)	86(43)	55(27.5)	21(10.5)

Source: Field data, February 2010

According to Table 3, 97(48.5%) students strongly agreed to the fact that ICT facilities in schools help them to get exposed to what is happening in the outside world, while 84(42%) students agreed to the same fact. But 14(7%) of the students disagreed to this fact implying that ICT facilities in schools do not help them to get exposed to what is happening in the outside world and

5(2.5%) students also disagreed that ICT facilities in schools help students to get exposed to what is happening in the outside world.

For students having access to the ICT at any time, 118(59%) students strongly agreed, 72(36%) students agreed, 8(4%) students disagreed and only 2(1%) students strongly disagreed. For students who are able to think critically and with precision when using ICT facilities, 42(21%) students strongly agreed, 110(55%) agreed to this fact. While 36(18%) students disagreed, 12(6%) students strongly disagreed. On the issue of ICT improving students' language acquisition, 38(19%) students strongly agreed to it, 86(43%) students agreed to it. However 55(27.5%) of the students disagreed to it and only 21(10.5%) strongly disagreed to this fact.

The result of this study reported in Table 3 shows that 42 strongly agreed and 110 agreed that students are able to think critically and with precision when using ICT facilities. This supports the assertion made by the UN Youth Report, 2005 that within more traditional learning environments, ICT is changing the way classrooms operate; the integration of multimedia subject presentations, online research, changing teacher-student dynamics, and innovative project approaches are making the learning process more interactive and participatory.

ICT is seen to be less effective (or ineffective) when the goals for their use are not clear. While such a statement would appear to be self-evident, the specific goals for ICT use in education are, in practice, often only very broadly or rather loosely defined. In many studies there may be a mismatch between the methods used to measure effects and the nature of the learning promoted by the specific uses of ICT

Research Question 2: What purpose do students use ICT for?

Items I to V under Section C of the questionnaire (Appendix A) sought to answer Research question Two. This research question was meant to find out the purpose for which ICT is used in the selected schools. The analysis in respect of the data collected is shown in Table 4.

Table 4: Students' Response on Effect of ICT on Teaching and Learning

Purpose	Yes	%	No	%
Searching information	165	82.5	35	17.5
For business and special occasion cards	45	22.5	155	77.5
Communication through e-mail	75	37.5	125	62.5
Cyber fraud (SAKAWA)	196	98	4	2
Do not use it at all	24	12	176	88

Source: Field data, February 2010

The students were asked whether they use ICT for searching information, One hundred and sixty five (165) students said, yes which is equivalent to 82.5% of the total number of students who took part in the study. The rest of 35 students indicated, no that is: 17.5% of the total number.

With regard to ICT being used for business and special occasion cards, 45(22.5%) students said, yes and 155(77.5%) students indicated, no. Using ICT to communicate through the e-mail, 75(37.5%) students said yes and 125(62.5%) said no. Interestingly, on using ICT for cyber fraud (SAKAWA) 196(98%) students said, yes and 4 students said, no equivalent to 2% of the students' sample. Only 24 students said they do not use it at all and 176 said they use it.

Regarding the use of ICT by the students, it came out clearly that 196 students constituting 98% of the respondents said that ICT is mainly used for cyber fraud (SAKAWA) which goes to support Van Belle and Soetaert (2001), assertion that information technology in the classroom is used in an ineffective way and it has proven difficult to integrate within traditional curriculum setting.

ICT is concerned with developing the students' ability to understand the modern world and to be able to communicate ideas and handle information effectively. Students learn to use a variety of software packages and should be capable of working independently using a computer to gain access to, manipulate, interrogate information and present their findings in a format suitable for the use of audience.

We show students how computer models can help to predict results and help them to solve problems with unknown variables. Students explore how to set up models and learn how to enter rules and instruction sets. We explore ways in which information can be communicated to others.

Students begin to appreciate how this information can be used to influence others. Students learn how to use Word Processing, Spreadsheet, Database, Presentation, Web Design and Desktop-Publishing packages.

However, some of the students agreed that ICT in their schools is used in the search of information and communicating with friends through the e-mail. This attest to Andrews, et al, (2002) findings from reviews of the effectiveness of ICT in different aspects of literacy learning in English which assumes that networked ICT had a positive impact on children’s learning. The

review also mentioned increased motivation for literacy, empowerment and ownership as very important factors.

Research Question 3: How accessible are ICT facilities to students?

Items 1 to 4 under Students Access to ICT of the questionnaire sought to answer Research question three. This research question seeks information on the accessibility of ICT by the students in the selected schools. The data collected on accessibility is presented in Table 5.

Table 5: Accessibility of ICT to Students

Item	Strongly Agree(%)	Agree(%)	Disagree (%)	Strongly Disagree(%)
ICT teachers in our schools are competent	51(25.5)	97(48.5)	30(15)	22(11)
Tutorials and soft ware's available	34(17)	64(32)	50(25)	52(26)
Periods allocated to ICT are sufficient	11(5.5)	40(20)	77(38.5)	72(36)
Teachers always come to class prepared	51(25.5)	80(40)	42(21)	27(13.5)
Computers are always in go good conditions.	18(9)	41(20.5)	59(29.5)	82(41)

Source: Field data, February 2010

The information in Table 5 indicates that 51(25.5%) students respondent strongly agreed that ICT teachers in their schools are competent while 97(48.5%) agreed to it. On the other hand, 30(15%) disagreed and 22(11%) strongly disagreed. Also, students were asked whether tutorials and other

software are available for students to use in learning. The result of the analysis shows that 34(17%) students strongly agreed, 64(32%) agreed, 50(25%) disagreed and 52(26%) strongly disagreed.

Considering the periods allocated to the students for learning the ICT, 11(5.5%) of the students strongly agreed that the periods allocated is enough, 40(20%) of the students agreed but 77(38.5%) disagreed and 72(36%) strongly disagreed to it. On the issue of teachers fully prepared before coming to class, 51(25.5%) students strongly agreed, 80(40%) students agreed and 42(21%) disagreed whilst 27(13.5%) strongly disagreed. Also 18(9%) students strongly agreed that computers and other accessories are always in good conditions, 41(20.5%) students agreed, 59(29.5%) disagreed and 82(41%) strongly disagreed.

Again, the minority of the students (52) said ICT teachers in their schools are not competent and this is in line with what Mooij and Smeets (2001) said. According to them, “if teachers are not confident in their ability or competence to handle computers, this may hinder their willingness to introduce technology in their classrooms.”(p. 10)

Computers are now widely used in all aspects of government, business, education, leisure and the home. In an increasingly technological age, a study of Advanced Information Technology and particularly how computers are used in the solution of a variety of problems, is valuable to you as a student, and is useful in future employment.

Research Question 4: How important do students consider ICT to teaching and learning process?

Questionnaire items I to III at Section E of the questionnaire answered research question four. This sought to find out the importance students of the selected schools attach to ICT. The responses to the items used in collecting the relevant data is analysed in Table 6.

Table 6: Students Rating of the Importance of ICT

Item	Frequency	Percent
Important	77	38.5
More Important	58	29.0
Most Important	65	32.5
Total	**200**	**100**

Source: Field data, February 2010

From Table 6, it has been established that 77(38.5%) of the total number of respondents rated ICT as important, a frequency of 58(29%) rated ICT to be more important and a frequency of 65(32.5%) rated ICT to be most important.

This shows that the majority of respondents see ICT to be important rather than more important and most important. Waite (2004) claimed that even though teachers show great interest and motivation to learn about the potential of ICT, in practice, the use of ICT is relatively low and it is focused on a narrow range of applications, with word processing being the predominant use.

It is generally believed that ICT can empower teachers and learners, promote change and foster the development of '21st century skills, but data to

support these beliefs are still limited. There is widespread belief that ICT can and will empower teachers and learners, transforming teaching and learning processes from being highly teacher-dominated to student-centered, and that this transformation will result in increased learning gains for students, creating and allowing for opportunities for learners to develop their creativity, problem-solving abilities, informational reasoning skills, communication skills, and other higher-order thinking skills. However, there are currently very limited, unequivocally compelling data to support this belief

Research Question 5: What is the effect of Availability of ICT on Teaching and Learning?

To find the effect of availability of ICT facilities on teaching and learning in selected Senior High Schools in Cape Coast Metropolis, a correlation was computed. Pearson product-moment correlation coefficient was calculated. Preliminary analyses were performed to ensure no violation of the assumptions of normality, linearity and homoscendasticity. The result of the analysis is presented in Table 7

Table 7: Correlation between Availability of Computers and Teaching and Learning

		Availability of ICT facilities	Total usage of ICT facilities for teaching and learning
Availability of ICT facilities	Pearson Correlation	1	.151*
	Sig. (2-tailed)		.039
	N	187	187
Total usage of ICT facilities for teaching and learning	Pearson Correlation	.151*	
	Sig. (2-tailed)	.039	1
	N	187	200

The analysis in Table 7 shows a weak but positive correlation between the two variables $r(187)=.151^*$, $p=.039$. The data means that, though there is very small correlation between availability of ICT facilities on teaching and learning, it is statistically significant, $p=0.039$.

This result collaborates a study by the British Educational Technology Association (BECTA, 2000) which found no link between level of resources for ICT and either reading or mathematics grades at Key Stage 1 in 1999. At Key Stage 2 there was a significant, but very weak, association between ICT resources and pupil attainment. This indicated that ICT curriculum resourcing was at least 99.5% independent of pupil performance at Key Stage 2 (no correlation coefficient exceeded 0.07). In the USA, information about computer use from a longitudinal study was analysed (Weaver, 2000). This study also found a very small link between computer use in the curriculum in school and improvement in pupils' test scores, though again the link was very weak (no correlation coefficient was higher than 0.035 for mathematics, science and reading) which again indicates that at this general level computer use makes very little difference to pupils' achievement. Simply having many computers does not make much difference.

Research Question 6: What is the effect of the utilization of ICT facilities on teaching and learning?

Data in respect of this research question is analysed in Table 8.

Table 8: Effect of Utilization of ICT Facilities on Teaching and Learning

		Use of ICT facilities	Total usage of ICT facilities for teaching and learning
Frequent use of ICT facilities	Pearson Correlation	1.000	.138*
	Sig. (2-tailed)		.052
	N	200	200
Total usage of ICT facilities for teaching and learning	Pearson Correlation	.138*	1.000
	Sig. (2-tailed)	.052	
	N	200	200

The effect of utilization of ICT facilities (as measured by Use of ICT Facilities) on teaching and learning (as measured by total use of ICT facilities for teaching and learning), was conducted using Spearman's correlation coefficient. Table 8 shows the Spearman's rho statistic r(198)=.138, *p*=.052. With these values, it means that the direction of the correlation is positive and statistically significant. Although the data showed a positive correlation, the effect size is small (0.14).

A similar weak link between high computer use and pupil attainment was reported in a preliminary survey for a Teacher Training Agency study in England (Moseley et al. 1999) though the authors did not interpret this as a causal link, but rather that more effective teachers (and more effective schools) tended to use more innovative approaches, or tended to use the resources that they had more effectively. If this interpretation is accepted it suggests that it is more important to think about how computers are used in schools.

Recent studies by the British Educational Communications and Technology Agency (Becta, 2001a, 2001b) have sought to compare the

performance of students in schools well-resourced for ICT with those less well-resourced. The studies indicated that students at schools with ‘good’ ICT resources achieved significantly better results in national tests in English, Mathematics and Science at ages 11 and 14, and in national examinations at 16+ than students at schools with ‘poor’ ICT resources. Achievement was higher in schools where ICT was used routinely in mathematics and science lessons, and the best results were seen in schools where ICT was used across the whole curriculum.

Again, Huffman et al. (2000) recognized that using ICT can involve a different teaching and learning style from that of the traditional, didactic approach. It requires that a constructivist approach be adopted that allows students to start from their own point of understanding as they work individually or in small groups. Thus, the teacher must be familiar with that style of teaching as well as the ICT in use. Their study showed that not only did the ICT improve students’ science understanding but that it could be even further enhanced when the teachers were experienced in Constructing Physics Understanding ICT and constructivist approach.

Riel, (1998) argues that the use of ICT impacts on both declarative and procedural knowledge to such an extent that clearly the current curriculum and models of teaching and learning were not designed to accommodate the increasingly rapidly expanding quantity of knowledge.

In summary, it could be said that ICT resources at the selected senior high schools are still unsatisfactory to facilitate the teaching and learning activities. In terms of ICT usage, most of the students spent most of their time for ICT on informative, communicative and expressive activities. Level of ICT

proficiencies among the students is just on average. In terms of level of ICT integration process, most of the students are under adaptive category.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter presents a summary of findings and conclusions drawn from the study.

Summary of the Study

The main purpose of the study was to investigate the effect of ICT in teaching and learning in Senior High Schools in Cape Coast Metropolis. The instrument used for the study was mainly a questionnaire. Total samples of two hundred and forty (240) respondents were part of the survey. These samples were picked from five (5) selected Public Senior High Schools. However, out of 240 questionnaires distributed, 200 questionnaires were retrieved. The data was analysed into percentages, frequencies and cross-tabulations using SPSS software.

The main research questions were:

1. To what extent do ICT facilities have positive effects on ICT usage?
2. What purposes do students Use ICT for?
3. How accessible are ICT facilities to students?
4. How important do students consider ICT to teaching and learning process?
5. What is the effect of Availability of ICT on teaching and learning?
6. What is the effect of the utilization of ICT facilities on teaching and learning?

Major Findings

1. The results indicate that most of the students have been influenced positively by ICT facilities and its usage. They are, exposed to what is happening in the outside world and they are able to access more easily through the use of ICT.
2. Students use ICT mainly in searching for information on the internet. The way students use ICT in teaching and learning was seen to be very good. This is because it was revealed by the study that teachers in their schools were competent enough to use ICT in teaching.
3. A surprising phenomenon that also emerged from the study was that about 98% of the respondent use ICT for cyber fraud popularly known as SAKAWA. This goes to confirm the contemporary concerns that Ghanaians have expressed on the rising level of "SAKAWA"
4. The study also revealed that tutorials and other software programmes are not sufficient to support students. Also computers and other accessories in the schools are not enough for teaching and learning. However most of the students who took part in the study saw ICT in teaching and learning to be important.

Conclusions

The integration of ICT in Ghanaian school system is a major step in promoting innovation. However, the educational system currently is bedeviled with a myriad of problems such as: lack of adequate computers and other ICT tools especially in government Senior High Schools, poor internet connectivity, lack of adequate manpower, and lack of coherent ICT policy framework. In conclusion, the introduction of ICT in education in Ghanaian

schools has demonstrated benefits for the future life of students in participating schools, through the acquisition of both technology and academic skills. Other areas, such as collaboration, global awareness and working in projects both with students in their countries and other countries, have also shown marked improvement. For the educational system to leap frog in its quest of ICT integration, there is the need to take a look at the recommendations enumerated below.

Recommendations

1. The Ministry of Education Science and Sports as well as Curriculum Research Development Division of the Ghana Education Service, who provide policy direction to schools, have to address the challenges confronting ICT integration in schools. They should not only introduce computers but also look at the broad range of educational policies, programmes and structures that must also be changed if the introduction of computers is going to contribute to the social and economic development of the nation. The policy direction has to address issues such as provision of computer laboratories, staffing the laboratories with permanent technology coordinators among others.
2. Secondly, one of the corollary changes that would be needed to produce students with skills, attitudes, and propensities needed to address 21st century challenges is a revision of the curriculum. In addition, beyond the memorization of established facts and the reproduction of standard procedures, students will need to be able to apply school subject knowledge to solve complex, real world problems. They will need to be able to work in teams on extended projects that cut across subject matter

lines utilizing technology to search for, organize, evaluate and create knowledge.

3. Furthermore, students should be allowed to set their own technology learning goals, evaluate their progress and the quality of their projects, and continuously revise as well as refine what it is that they know. Educational policy makers, who are desirous about the introduction of new skills into the curriculum, must create assessments that provide students with ongoing opportunities to apply their knowledge in complex, real world settings, to work in teams, and to assess themselves and each other with challenging standards for success.
4. About enhancing human capacity of teachers, there is the need to provide extensive teacher professional development for teachers. Such capacity building programs can be online teacher professional training, face to face training workshops among others. The professional development includes more than training in equipment operation. The new pedagogical models required in the adoption of constructivist and constructionist learning outcomes call for training of teachers in these skills and knowledge base.
5. There is also the need to provide technical support to schools in terms of installation and maintenance of ICT infrastructure. There appears to be an underestimation of the magnitude of effort needed for the large-scale installation and maintenance of hardware, software, and networking equipment for an effective integration of ICT. Computer coordinators alone cannot maintain the system. An extensive network of skilled technicians must be developed to support schools, administrators, teachers, and students.

6. On the use of ICT for cyber fraud, the youths should be educated to desist from this practice. It is therefore incumbent on the stakeholders such as Ghana Education service, the schools as well as the parents to develop a comprehensive campaign to direct the energies of the young people to use ICT positively. Furthermore, a stiffer punishment should be meted out to the young people caught in this phenomenon of cyber fraud. This will serve as a deterrent to others who will like to engage in cyber fraud.

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APPENDICES

APPENDIX A

QUESTIONNAIRE FOR STUDENTS

UNIVERSITY OF CAPE COAST

CENTRE FOR CONTINUING EDUCATION

STUDENTS APPRAISAL OF

THE EFFECT OF ICT FACILITIES ON TEACHING AND LEARNING.

CONFIDENTIALITY STATEMENT: The information you provide on this form will be kept strictly confidential. Do not write your name on the form. By honestly and candidly completing this form, you will be providing your school with valuable feedback information of self-assessment and academic progression.

Instructions for Completing the Questionnaire

Section A: Demographic Data

Please fill in the following:

1. Name of School.....
2. Form.....
3. Programme being pursued.....

Section B: Effects of availability and utilization of ICT facilities

Note the meaning of the following responses:

- **Strongly Disagree:** You strongly disagree with the statement
- **Disagree:** You disagree with the statement
- **Agree:** You agree with the statement.
- **Strongly Agree:** You strongly agree with the statement

Please circle the appropriate response to each statement

	Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**
1. POSITIVE EFFECT OF ICT	**[1]**	**[2]**	**[3]**	**[4]**
1. ICT facilities in schools help students to get exposed to what is happening in the outside world.				
2. ICT facilities make information storing easier.				
3. Students are able to think critically and with precision when using ICT facilities.				
4. ICT improves students language acquisition				

<u>Section C:</u> Effects of ICT on teaching and learning

2. PURPOSE OF ICT USAGE

Please tick the appropriate response

What purpose do students use ICT for in your school?

I. Searching for information on the internet. ( )

II. Designing business and special occasion cards. ( )

III. Communicating with friends and relations through E-mail. ( )

IV. Using ICT for cyber fraud (SAKAWA). ( )

V. Do not use it at all ( )

<u>Section D</u>: The use of ICT in teaching and learning

3. EASY LEARNING TO USE ICT	**Strongly Disagree**	**Disagree**	**Agree**	**Strongly Agree**
	[1]	**[2]**	**[3]**	**[4]**
1. ICT teacher(s) in our school is/are very competent.				
2. Tutorials and other software are available for students to use in learning.				
3. Periods allocated to ICT are sufficient enough for easy learning of.				
4. Teachers for ICT always come to class prepared to teach.				
5. Computers and other accessories are always in good conditions.				

4. STUDENT ACCESS TO ICT	**Strongly Disagree**	**Disagree**	**Agree**	**Strongly Agree**
	[1]	**[2]**	**[3]**	**[4]**
1. Computers at the ICT lab are sufficient to support individual learning at the lab.				
2. Students have access to the ICT lab at any time.				
3. Most of the students have their own computers.				
4. ICT lab in the school is a very good learning environment				

<u>Section E</u>. Importance of ICT to students

5. How would you rate the importance that you attach to ICT in your school?
   i. Important
   ii. More important
   iii. Most important