UNIVERSITY OF CAPE COAST

TRAINING AND DEVELOPMENT NEEDS OF INFORMATION AND COMMUNICATION TECHNOLOGY TEACHERS IN JUNIOR HIGH SCHOOLS IN MFANTSEMAN MUNICIPALITY OF GHANA

BY

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Thesis submitted to the Department of Arts and Social Science Education of the Faculty of Education, University of Cape Coast, in partial fulfilment of the requirements for the award of Master of Philosophy Degree in Curriculum Studies

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DECLARATION

Candidate's Declaration

I hereby declare that this thesis 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: Robert Brigars Awoonor-Williams

Supervisors' Declaration

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

Principal Supervisor's Signature…… Date: …….

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ABSTRACT

The introduction of ICT as a subject into the JHS curriculum was a good and bold innovation but it was accompanied with numerous challenges including lack of proper training for the ICT teachers and inadequate ICT infrastructure which has led to non-performance of JHS students at the BECE. The study therefore investigated the training and development needs of the ICT teachers in the Mfantseman Municipality of Ghana.

Descriptive survey was employed considering my desire to obtain first hand data from the ICT teachers. The data were collected by means of questionnaire and classroom observation instrument with the assistance of 5 field workers, using a census method of 120 ICT teachers from 120 JHS in the municipality over a period of 13 weeks .The mass survey data was collected and classified. The criteria '50% or above' was adopted to make a value judgment to determine the training needs of the teachers. The results were presented in graphs and tables of frequencies and percentages to display the data.

The findings revealed that 112 (93%) of teachers perceived the introduction of the ICT curriculum as 'good' based on its usefulness. ICT infrastructure was also relatively available and accessible except for internet connectivity. Also, 110 (91.7%), teachers need improvement in Hardware, 107 (89%) in Newer application, and 89 (74%) Spreadsheet. They also need improvement in pedagogy. Based on these findings some recommendations were proffered including conduction of In-service training relevant and responsive to the training needs uncovered.

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DEDICATION

To the memory of my late Father Emmanuel Brigars Awoonor-Williams, a Teacher, Headmaster, Lawyer, and an Ambassador.

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CHAPTER ONE

INTRODUCTION

Background to the Study

The 21st century presents the world with new alternatives, prospects and challenges due to the ubiquitous presence of technology in all spheres of life, such as business, administration, government, and education. The widespread use of Information and Communication Technology (ICT) in all areas demonstrates the fact that ICT is universally acknowledged as an important catalyst for social transformation and national progress. Many policy reports have argued that societies are changing from industrial societies into 'information societies', in which the creation and dissemination of knowledge is of paramount importance (European Round Table of Industrialists [ERTI], 1997). In fact, ICT has the potential to change the way we live, learn and work. It is therefore fast becoming a necessary condition for successful participation in society. Accompanying this argument is the belief that it can play an important role in reshaping education to respond to the needs of contemporary society

Again, with the challenges faced by the international community in meeting the Millennium Development Goals (MDGs) (United Nations, 2005) and the Education for All (EFA) targets, it seems unrealistic to assume that conventional delivery mechanisms will ensure achievement of targets set.

Most governments are now promoting ICT in their various countries (African Development Forum, 1999). It stands to reason that the Government of Ghana (GoG) places a strong emphasis on the role of ICT in contributing to the country's progress which is laid down in Ghana's ICT for Accelerated Development (ICT4AD) policy (GoG, 2003), a policy statement for the realization of the vision to transform Ghana into an information-rich knowledge based society and economy through the development, deployment and exploitation of ICTs within the economy and society, which is currently at various stages of implementation. This policy represents the vision of Ghana in the information age and addresses 14 priority focus areas. Similarly, the country's medium-term development plan captured in the Ghana Poverty Reduction Strategy (GoG, 2006) Paper and the Education Strategic Plan (ESP) 2010-2020 all suggest the use of ICT as a means of reaching out to the poor in Ghana (Mangesi, 2007). Schools have been found to be the third most important change agent and the channel for accelerating ICT enhanced learning and training in Africa countries (Isaacs & Hollow, 2012).

Kozma (2008) noted that there is growing awareness among educators that the educational system designed to prepare learners for an agrarian or industrial economy will not provide students with the knowledge and skills they will need to thrive in the 21st century's knowledge-based economy and society. In fact, the young generation is entering a world that is changing in all spheres: political, economic, social, cultural, scientific and technological. This is because the emergence of the knowledge-based society is changing the global status of

education. Increasing the quality of teaching and learning has therefore been a seemingly important concern for education. Traditional teaching and learning paradigms have been shaken by the impact of ICT on educational practices. Teachers are therefore confronted by challenges which range from the acquisition of skill and literacy in the usage of ICT to the delivery of the necessary tools which will lead students to become knowledge creators and users.

Modern technologies can improve the teaching and learning process by reforming conventional delivery systems, enhancing the quality of learning achievements, facilitating state of-the-art skills formation, sustaining lifelong learning and improving institutional management. This was confirmed by Lefebvre, Deaudelin and Loiselle (2006) who posited that modern technology offers many means of improving teaching and learning in the classroom. In fact, it is believed that the inclusion of ICT as a study subject and the use of ICTs can increase access to learning opportunities, enhance the quality of education with advanced teaching methods, improve learning outcomes, better attitudes towards schools, better understanding of abstract concepts and enable reform or better management of education systems.

Mangesi (2007) contends that since the introduction of ICT and its inclusion in the educational curriculum with the associated financial investments, many countries around the world have found the need to monitor these developments, using reliable and valid indicators. Some of theses' indicators point to the fact that significant progress has been made in increasing access to and

usage of ICTs in the education sector (Hennessy, Harrison & Wamakote, 2010). Overall there is much optimism for huge advances in ICT in education.

Ghana, like many other countries around the world, has over the years sought to improve its education system by introducing reforms and making plans based on the educational needs of the country. It was therefore welcome news when in January, 2002 a committee was set up to review the entire education system of the country with the view to arriving at decisions that would make the system responsive to the challenge of education in the 21st century.The Anamuah-Mensah Education Review Reform Report recommended among other innovations that ICT be made core subject at the basic level of the school education system (Ministry of Education, Youth and Sports [MoEYS], 2004).

This is timely since the tertiary sector started few years back and it is therefore the most advanced in ICT deployment, followed by the secondary sector which has attained an appreciable level because the ministry of education approved Parent Teacher Associations (PTAs) to collect some limited amount of money to provide infrastructure (computers, computer laboratories, internet connectivity, etc.) for ICT in education but a great deal needs to be accomplished at the basic level especially when it is the foundation upon which the secondary and the tertiary levels of education build on.

In order for the ICT objectives set out in the ICT for Accelerated Development [ICT4AD] (GoG, 2003) Policy document and the ICT curriculum to be achieved, teaching and learning of the subject must be done right. This focuses attention on the teacher, a sine qua non to the success of teaching and learning.

Trucano (2005) postulated that a shift in the role of a teacher utilizing ICTs to that of a facilitator does not obviate the need for teachers to serve as leaders in the classroom; traditional teacher leadership skills and practices are still important. Bielenberg (2009) as cited in Rodden (2010, p. 31) further noted that ‘‘throwing laptops in schools will have little positive effect without proper broadband connections and training of teachers to use computers effectively’’ to apply appropriate teaching approaches.

Providing some insight into the issue of teacher preparedness to use ICTs for learning and teaching, Granger, Morbey, Owston and Wideman (2002, p. 487), explain that the ‘‘relationship between teachers’ ICT skills and successful implementation is complex”, and that there are contributing issues including teachers’ “attitudes, philosophies, communication, and access to skills training” in addition to having the necessary equipment, support, and education (p. 487).This elevates the suggestion that teachers who are well trained are key players in relation to this infusion of ICT in the education process (Jegede, 2008). Unfortunately, a large amount of training is organized when there is an innovation or a reform (technology), but these training programmes are mostly done as an ‘afterthought’. As a result, most of these trainings are fast track courses which also lack focus and depth. On top of it all they are organized within a short span of time. These inadequacies often make the training ineffective. The need for teachers to be well trained in ICT and pedagogy has therefore become imperative to the implementation of ICT in schools because it is a key to transforming education processes and improve educational outcomes. As Haddad (2007, p. 60)

puts it, 'appropriate and effective use of technologies involves competent, committed people. The required competence and commitment cannot be inserted into a project as an afterthought, but must be built into conception and designed with the participation of those concerned.' Capacity-building for teachers is especially crucial and will be discussed in the next chapter.

Statement of the Problem

The overall ICT in education policy goal is to enable graduates from Ghanaian educational institutions to confidently and creatively use ICT tools and resources to develop requisite skills and knowledge needed to be active participants in the global knowledge economy by 2015 (MoESS, 2006). Is this objective being achieved, especially at the basic level?

The introduction of ICT as a taught subject into the curriculum of the Ghanaian school system (especially the JHS) in 2007 was a good and bold innovation but it was accompanied with numerous challenges for both teachers and individual schools. The most frequently referred to in literature is lack of effective training of teachers (Sicilia, 2005; Toprackci, 2006; Ozden, 2007). This was confirmed by a JHS ICT teacher on TV3 on October 23th, 2011, on a programme 'Mission Ghana', a programme that sought to reveal the challenges that ICT teachers in Junior High Schools encounter in their bid to implementing the ICT curriculum. It should be noted however that some forms of in-service training of teachers in the field and other stakeholders at various levels of education were undertaken before the implementation of the ICT curriculum in Ghana. For instance, 100 ICT tutors in 38 Colleges of Education were trained on

how to integrate ICTs in the teaching/learning process under the Microsoft's Partners in Learning (PIL) Programme. Another fifty (50) Primary and JHS teachers were also trained in the use of ICT in teaching and learning under the UNESCO - Associated Schools Project (ASP) Network Programme, and 200 teachers selected from all regions (pre-tertiary levels) underwent 'training the trainer' workshop as part of a special Ministry of Education (MoE) /Microsoft/University of Education Winneba (UEW)collaboration among others. That notwithstanding, not all ICT teachers are trained. Also, these capacity building is 'one to fit all situations', 'one-off-training' and usually for a short period without any needs assessment to guide the training. It is not surprising therefore that the training did not adequately prepare the ICT teachers to teach ICT.

Again, ICT is a practical subject so availability and accessibility to ICTs (functioning computers and accessories) to the teaching and learning of the subject is paramount (Trucano, 2005). There is therefore the need to look into ICT infrastructure which literature (Pelgrum, 2001; Sicilia, 2005) indicates is basically not available or accessible to the teachers and students.

Then there is also the challenge of shortage of appropriately qualified teachers. This refers to the number of teachers as well as their area of specialization. For instance, the percent of professionally trained teachers in public schools dropped (76.7%) in the 2008/09 academic year to 72.8% in 2009/10 and that of private schools was 22% in 2008/09 but reduced to 20.5% in2009/10 school year (MoE, 2011). Meanwhile, students' population has

increasing from 984111 in 2003/04 to 1301940 in 2009/10 and projections indicate continuous increase. Bullock (2004) clearly writes that despite the huge investment of financial and human resources, pre-service teacher education does not currently provide the required number of teachers as well as teachers with the necessary skills, competencies, and experiences requisite for the teaching of ICT. This situation promotes the tasking of untrained teachers as well as teachers not trained in ICT to teach ICT.

Some of these inadequacies were confirmed in the Mfantseman Education Directorate midyear Review (GES, 2010a) and Annual (GES, 2010b) Reports. There ports indicate that ICT teachers are experiencing various challenges in their bid to implement the ICT curriculum. While some attribute it to inadequate infrastructure, others ascribed the problem to inadequate teachers with requisite qualifications, training, knowledge and skill needed to teach the subject. Consequently, other subject teachers (especially science teachers) were asked to teach ICT without any form of ICT training or haphazardly trained for a short period. As a result, the BECE candidates in Mfantseman Municipality are not performing well in the subject. For instance, in 2011, 57.4% passed in ICT. The situation worsened in 2012 (37.6%) and 2013 (34.5%) (GES, 2011, 2012 & 2013). The downwards spiral needs to be dealt with.

There is therefore the need for building the capacity of the teacher who is the implementer of the curriculum, a central figure in the entire programme (MoESS, 2006). It is expected that thorough training of ICT teachers in ICT and pedagogy will ameliorate the problem of teacher competency because training

guided by the training and development needs of the teachers is obviously a sine qua non for a successful implementation of the ICT curriculum. It is therefore my desire to conduct an investigation to ascertain the training and development needs of the ICT teacher in the implementation of the ICT curriculum in Junior High Schools in the Mfantseman Municipality.

Purpose of the Study

The primary purpose of this study was to find out the capacity gaps of the ICT teachers in implementing the ICT curriculum of Junior High Schools in the Mfantseman Municipality of Ghana. In delving into these issues, this research sought to explore the competency gaps, that is, the knowledge and skills in ICT as well as pedagogical skills of the ICT teacher vis-à-vis performance discrepancies (the task element to improve). It also aimed at non-competency areas such as ICT teachers' perception about the ICT curriculum in general and availability and accessibility of ICT infrastructure to teachers.

Research Questions

The study aimed at answering a number of questions in an attempt to find solutions to the problems raised. These are:

1. What is the ICT teachers' general perception about the ICT curriculum?
2. What extent is infrastructure for the implementation of ICT curriculum available and accessible?
3. What is the extent of ICT teachers' knowledge and skills in ICT?
4. How well do ICT teachers teach ICT?

Significance of the Study

It is expected that the results of this study will refine and extend the existing body of knowledge. It would also basically facilitate the design of training and development programmes to address the ICT knowledge and skill challenges that teachers face in implementing the ICT curriculum. When disseminated, the results will further inform ICT curriculum development and educational innovation as well as serve as a revelation to policy makers and curriculum experts on the need to prepare teachers adequately to ensure successful implementation of educational reforms now and in the near future. Furthermore, it would induce self-awareness and reflection in practicing ICT teachers concerning their role as implementers of the ICT curriculum. Lastly, it will provide basis or reference source for further studies.

Delimitation of the Study

This study covers all 120Junior High Schools in the Mfantseman Municipality of the Central Region of Ghana. One ICT teacher each was drawn from the 120 Junior High schools to be the participants of this study. This is because I believe they are the best people to provide description of the situation on the ground, being the implementers of the curriculum. They are also the appropriate people to demonstrate their pedagogical as well as ICT knowledge and skills. Students were however not included in this study because they were not the main focus in finding answers to the research questions even though they are the final consumers of the ICT curriculum.

Limitations of the Study

Although the focus of the study is basically on the capacity of ICT teachers in the Junior High Schools, there are other factors that may have affected the teaching and learning of ICT including lack of administrative, parent and community support, unstable internet connectivity (low bandwidth), access of ICT facility by students at home and motivation for the teachers of the subject. Then there are factors affecting students learning. Another limitation has to do with the use of 5 field workers with their various degrees of subjective judgment of quality biases and prejudices, creating inter-rater reliability or agreement problems in the scoring of classroom observation. Additionally, there are problems of class observation which may have affected the final outcome. For instance, the presence of the field workers in the classroom to observe and score may make both teachers and students feel uncomfortable being watched, and thereby perform differently. The teaching being observed may not involve the level of difficulty or volume normally experienced during that time period. Again, sometimes people act temporarily and perform their job correctly when they are being observed and thereby affected teacher performance either positively or otherwise. Finally, the use of twenty (20) sampled schools for pilot testing from the same population also added unto the limitations.

The effects of these limitations were however blunted with measures such as training (in a form of simulation) of the field workers on how to observe lesson and the use of score guide for the classroom observation. Again, the field workers observed each class many times over a period of ten weeks.

Organisation of the Rest of the Study

The study is organized into five chapters. Chapter Two reviews related literature to the study. Chapter Three outlines the methodology and procedure for conducting the study. These include the population, sample and sampling procedure, the research instrument, data administration procedure, data collection procedure and analysis of data. Chapter Four discusses the results. Chapter Five consists of the summary, findings, conclusions and recommendations of the study.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

Overview

This chapter presents and discusses the review of related literature on the topic, both theoretical and empirical on ICT teachers' competency (knowledge and skills) areas as well as non-competence area (perception and infrastructure). It begins by scrutinizing the definition of ICT vis-à-vis what is in the JHS curriculum. This is as a result of the diverse applications of the term ICT within several contexts and treatments. It then explores ICT in education especially in the Ghanaian context, adding its benefits. This is followed by discussions on the rationale for ICT in education and scope of content of Junior High School ICT curriculum.

The review further highlights significant factors known to contribute to effective teaching. They include perception of teachers about the ICT curriculum and issues of teacher competence. Under the teacher competence, Shulman's Classification of Teachers' Knowledge, followed by Mishra and Koehler's Technological Pedagogical Content Knowledge were discussed. Finally, Training and Development and Training Needs Assessment were discussed.

ICT Defined

The acronym ICT stands for Information and Communication Technologies. There is not a universally accepted definition of ICT. This may be attributed to the fact that the concepts, methods and applications involved in ICT are constantly evolving on an almost daily basis. That notwithstanding, it can be said to be an umbrella term often used in many different contexts. It is also commonly used as a synonym for computers and computer networks. Lever-Duffy, McDonald, and Mizell (2003) state that ICT comprise the use of at least a computer and the Internet as well as computer hardware and software, networks, and a host of devices that convert information into general digital formats. This broad definition of ICT includes such technologies as: radio, television, video, DVD, telephone, satellite systems, computer and network hardware and software; as well as the equipment and services associated with these technologies, such as Videoconferencing and email (UNESCO, 2002).

In education, ICT generally refers to teaching and learning the subject matter that enables understanding the functions and effective use of ICT. Haddad (2002) on his part categorized it into three: (a) instruments (computer), (b) instructional (video and multimedia modules) and (c) dissemination (TV broadcast, CD or Web), but emphasized that the choice of technology and the way it is used is partially determined by what is expected in terms of education, learning and teaching objectives. In Ghana the term ICT is used to describe the study of and the use of computers and other technologies that are used for

Communication and Information Systems (GoG, 2003) for realising the goals of teaching-learning as well as management of the educational system.

ICT in Education

Developments about and ubiquitous use of ICT influence all fields of life, one of which is education. Education has immensely contributed to an increase in developing knowledge, providing an enabling environment for innovation and in building human capital required for a potential economy. Global developments in education and challenging ICT demands have made a remarkable shift in the structure of the enabling ICT environment and the utilization of ICT technologies in education. Such technologies have become the key force of the digital network in an era of technology-driven education. More schools and communities now have access to ICT resources to join the global economy (Buabeng-Andoh, 2012).

ICT which includes newer digital technologies such as computers and the Internet have been touted as potentially powerful enabling tools for educational change and reform. When used appropriately, different ICT is said to help expand access to education, strengthen the relevance of education to the increasingly digital workplace, and raise educational quality by, among others, helping make teaching and learning into an engaging, active process connected to real life (Pelgrum & Law, 2003). Allied to this, early advocates of ICT in education, saw it as a catalyst for change, fostering skills in problem solving and critical thinking, as well as the development of student centred learning (McGrail, 2005, p. 6).

Despite the relative success of the education enterprise, Haddad and Draxler (2002) write that, the new century brings a fresh set of challenges and

pressures for which educational institutions, in their present form, are not prepared. Even the best of them have served a different set of demands for a different age. They contend that these challenges in the context of the Information Age have put schools and school systems across the world under tremendous pressure to provide every classroom (if not every student) with ICTs. Therefore providing an adequate level of ICT knowledge and skills, at different levels of education, is important for the students to progress and contribute towards national development. Successful implementation of the ICT curriculum is a complex process, determined by pedagogical values, attitudes, curricular needs and physical infrastructures (Granger, Morbey, Owston, & Wideman, 2002).

ICT in Education in Ghana

Countries see ICT as potential tools for change and innovation in education (Papanastasiou & Angeli, 2008) and thus, make investments in ICT. For instance the Government of Ghana has placed a strong emphasis on the role of ICT in contributing to the country's economy in general and specifically in education. The country's medium-term development plan captured in the Ghana Poverty Reduction Strategy [GPRS II] (GoG, 2006) Paper and the Education Strategic Plan (ESP) 2010 -2020 all suggest the use of ICT as a means of reaching out to the poor in Ghana ICT4AD (GoG, 2003). Furthermore, there is evidence to suggest a positive correlation between the use of ICT and academic outcomes, including higher test scores, better attitudes towards schools, and better understanding of abstract concepts. It further states that ICT helps to familiarize

new generations with the technologies that have become integral components of the modern world.

Ghana on her part has ICT in Education Policy Framework document (MoESS, 2006) in which the key issues and benefits of ICT in Education were highlighted. The overall goal of the ICT in Education Policy is to enable every Ghanaian to be able to use the ICT tools and resources confidently and creatively to develop the skills and knowledge needed to achieve personal goals and be full participants in the global economy by 2015 (Frempong, 2010).

Another document which indicates how Ghana attach seriousness to ICT is the Ghana's ICT4AD (2003) policy which is currently at various stages of implementation. It represents the vision of Ghana in the information age and addresses 14 priority focus areas which include. The specific objectives for the education sector as outlined in the ICT4AD (GoG, 2003) policy document include:

1. the facilitation of the deployment, utilization and exploitation of ICTs within the educational system to improve on educational access and delivery and to support teaching and learning from primary school upwards;
2. modernising the educational system to improve the quality of education and training at all levels of the educational system and expanding access to educational, training and research resources and facilities;

3. orientating all levels of the country's educational system to the teaching and learning of science and technology in order to accelerate the acculturation of science and technology in society and produce a critical mass of requisite human resource and a well-informed citizenry etc.

On the basis of the above there is a plethora of initiatives and projects that are at various stages of implementation to achieve the stated goals. Some of these initiatives and projects include: ICT being made a core subject at the JHS level, the Global e-Schools and Communities Initiative (GeSCI), in collaboration with Ministry of Education funded by UNICT Task Force, to expand the deployment of ICT in Ghanaian schools to promote the effective use of these ICT to achieve Ghana educational and community development objectives (Mangesi, 2007). HP, Microsoft, Oracle, and Cisco and Ministry of Education under New Partnership for Africa's Development (NEPAD), also supported six schools in six regions with ICT infrastructure. The project ICT Programme has already seen the release of about 6220 laptops to various universities, polytechnics and individuals across the country (Mangesi, 2007).

There is the National ICT College of Education connectivity programme for Colleges of Education to ensure that teachers reappraise their methodologies to meet the learning needs of their students (Mangesi, 2007). Perhaps the most significant of all the activities is the government Better Ghana ICT Project. This ICT project provides JHS students and all teachers (65,186 JHS teachers) with free laptops (Myjoyonline of August 14, 2012).

The use of ICTs in Ghanaian schools and African countries is generally increasing and dramatically growing (Tella, Tella, Toyobo, Adika & Adeyinka, 2007) since 1995 when Ghana became the first country in sub-Saharan Africa to have full internet connectivity. The Ghanaian tertiary education sector is the most advanced in the deployment and use of ICTs in the country (Mangesi, 2007). In the basic and secondary education sector, a project to set up computer laboratories in all science schools in the country has led to a significant number of computers being installed across the country. There is, however, a great disparity between public and private schools as well as between urban and rural areas with access to ICTs (InfoDev, 2005). In schools where ICTs exist, a number of teachers use the Internet for research. Unfortunately, at the JHS level, the first terminal point in Ghana's education, very little is done in ICT education.

Benefits of ICT in Education

Since the beginning of this century, education has faced a variety of social, cultural, economic, and technical challenges. ICT in education has been continually linked to higher efficiency, higher productivity, and higher educational outcomes, including quality of cognitive, creative and innovative thinking (Oyenike, 2010). In fact, there is growing evidence that ICT application to the core business of education can accelerate and improve learning on a number of fronts, from motivation (Sherry et al, 2001; Grabe & Grabe, 2007); establishing life-long learning habits (Schollie, 2001); concepts development (Yelland, 1998) and this affect all subject areas (Chambers, 2003).

ICT impacts on a large section of education, from record keeping and school websites to the creation of online learning communities (Bishop, 2007). Educational institutions can use specialised websites to make learning resources available online at any time. Some educational institutions do not even require students to be physically present. Virtual classrooms have flourished in tandem with improved internet accessibility. The significant barriers of time and distance are rendered almost obsolete in such virtual classrooms (Stennes, 2008). However, the benefits of ICT use in the classroom depend on the success with which it has been integrated (Condie & Munro, 2007). ICT in education undoubtedly has potential, to be influential in changing teaching methodologies.

Panagiotakopoulos and Ioannidis (2001) have also demonstrated that computer use can result in effective literacy gains. Haddad and Jurich (2002) on their part indicate that the traditional model of learning emphasizes mastery of facts and concepts but ICT diversifies the system of representation through the use of various stimuli (images, sounds and movement) and address the needs of diverse types of learning (visual, psychomotor, and affective). The UNESCO (2005) study explains it further, postulating that ICT potentially offers numerous advantages and provides opportunities for facilitating learning for children who have different learning styles and abilities, including slow learners, the socially disadvantaged, the mentally and physically handicapped, the talented, and those living in remote rural areas. It indicate further that it makes learning more effective, involving more senses in a multimedia context and more connections in a hypermedia context; and providing a broader international context for

approaching problems as well as being more sensitive response to local needs. Furthermore, Kozma and Anderson (2002) claim that ICT is transforming education by introducing new curricula based on real life problems, providing different tools to enhance learning, providing students and teachers with more opportunities for feedback and reflection.

These ideas are reflected in the Department for Education and Employment [DfEE] (1999) report which indicates that ICT prepares pupils to participate in a rapidly changing world in which work and other activities are increasingly transformed by access to varied and developing technology. It states further that‘‘pupils use ICT tools to find, explore, analyse, exchange and present information … for home and work both now and in the future’’ (p. 7). Learning ICT skills, builds the capacity of the student to be better equipped for the world of work, which increasingly demands such competency.

In short, ICT can cause positive changes in education. It is thus not surprising to find increasing interest, attention and investment being put into the use of ICT in education all over the world (Yuen, Law & Wong, 2003). Despite all justification for the need for and use of ICT in the teaching and learning processes to achieve the goals of education at all levels, the pessimist’s view is that ICTs have succeeded in widening already huge digital divide between the developed and the developing world (Polikanov & Abramova, 2003; Warschauer, Knobel, & Stone, 2004). Again, computers encourage students to hand in “hypermedia projects” instead of written assignments, encouraging plagiarism (Stoll, 1999) among other problems such as its misuse.

Stoll for instance cautions that simply downloading any material from the internet does not mean that the student has learnt anything. It raises the question of whether computer skills are enough to prepare students for the information age, and how important are computers in schools in the information age?

Rationale for ICT in Education

Kozma (2008) identifies three rationales for the introduction of ICT into education. These are economic, social and educational or pedagogic rationale. The economic rationale identifies the role ICTs play in preparing students as future workers and supporting economic development. The social rationale refers to where ICT investment aims to: increase knowledge sharing, encourage cultural creativity, increase civic participation, make government services more accessible and finally enhance social cohesion. Finally, the educational or pedagogic rationale adduces argument for ICT advancing educational reform and improves educational management structures.

Similarly, Trucano (2005) suggests a coordinated developmental approach to the students developing ICT literacy. He advocates ICT literacy to incorporate learning about, with, and through, ICT. A schematic view of this is presented in Figure 1:

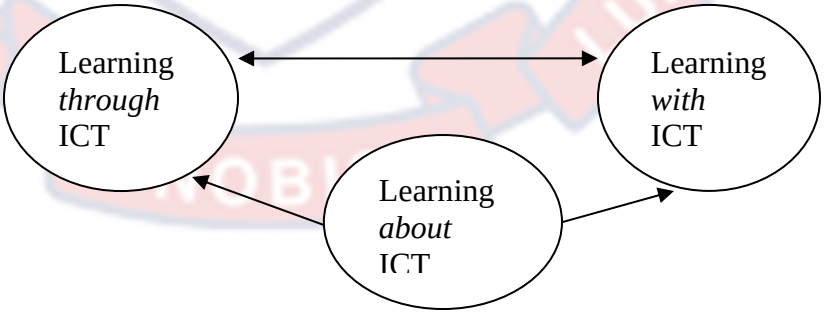

Figure 1: Objective of ICT in Education

Learning 'about' ICT refers to developing skills in, and knowledge of, the potential uses of ICT, the acquisition of ICT skills as well as understanding new developments in ICT, their potential to afford new experiences, and the skill sets they require. In this way, learning about ICT is continuous and life time. It further entails comprehension of the human, social, and ethical issues concerning ICT and learning when to use ICT, what ICT is most appropriate, and how to use it to support a learning situation or task. Successful use of ICT by teachers and students is dependent on this basic understanding of its use (National Council for Curriculum and Assessment [NCCA], 2004).

Learning 'with' ICT centers on teaching and learning in a curriculum context using ICT. Teachers and students use ICT resources to support the classroom curriculum, for example, using tools such as word processing to create written materials, power points for presentations, using drawing and painting software to enhance work in visual arts. NCCA (2004) indicates that in certain ways, learning with ICT may be perceived as a natural integration of ICT with existing classroom processes. Learning with ICT also supports learning, through the use of 'practice' type software to reinforce concepts already learned, or to access the digital encyclopedia such as Encarta. Thus, learning with ICT not only supports self-directed learning by affording students enhanced opportunities to select individual paths to learning, but also can also make learning meaningful and contextualized.

Learning 'through' ICT may automatically include learning with ICT, but it focuses on teachers' and students' use of ICT to engage with the curriculum in

ways that would not previously have been possible without ICT. Learning 'through' ICT results in more authentic learning experiences for teachers and students. Previously, students could access a certain level of resources and materials at first hand, but much classroom learning was achieved through vicarious experience. In cases where the real or actual experience is out of reach, ICT offers another dimension, which is 'virtual'. For example, using the Internet, students in classrooms can now access live data, (which supports the curriculum in any of the subjects) and have the same opportunities to analyse the data. (NCCA, 2004). It is important to note that learning with, through and about are infused in the JHS ICT curriculum (MoESS, 2007).

Similarly, Webb (2002) perceives ICT in school education in three separate aspects: (a) Using ICT as a tool to support teaching and learning processes, for example using a word processor, spreadsheet or database in other subject areas such as mathematics or science, (b) Learning through ICT where the ICT facility becomes the whole learning environment by providing learning materials, and(c) Learning ICT as a subject, that is to say learning the knowledge, concepts, skills, and processes of ICT.

Rationale for ICT Curriculum in JHS

The basic school curriculum in Ghana is officially defined by the syllabuses developed on behalf of the Ministry of Education by the Curriculum Research and Development Division (CRDD) of the Ghana Education Service (GES). Modern economic, social, political, and technological requirements demand that all members of society have a minimum level of basic education.

No country can afford to leave anyone behind. People without the ability to acquire essential knowledge and skills will live precariously, and society will be deprived of their contributions. ICT is so important in the world today that it makes it imperative for every young person to be competent in the use of ICT for the many tasks that he/she will have to accomplish. This import was not lost on the Education Review Committee. They therefore included ICT in the new JHS curriculum (MoESS, 2007).

Scope of Content of JHS ICT Syllabus

As outlined in the preamble of the JHS ICT syllabus (MoESS, 2007), the content of the ICT course has been designed to offer basic knowledge and skills to students to afford them the opportunity to explore the use of ICT as a foundation for further study of the subject. For enhancing teaching and learning, the course is based on the following themes to be covered in three years of Junior High School (JHS): an introduction to personal computer e.g. Name, parts and functions of Hardware ; Standard Office Applications, these include Word processing e.g. Microsoft Word for Write letters, reports; Spreadsheets e.g. Microsoft Excel for analysis of financial information, calculations, create forecasting models etc.; Database software e.g. Oracle, Microsoft SQL Server, Access for managing data in many forms, from basic lists (e.g. customer contacts through to complex material (e.g. catalogue); Presentation software e.g. Microsoft PowerPoint for presentations, either directly using a computer screen or data projector. Publish in digital format via email or over the; Graphics software e.g. Adobe Photoshop and Illustrator for creating and editing images such as logos, drawings or pictures;

Ethics of using ICT e.g. Computer virus, Copyright issues; Internet and World Wide Web and Keyboard/Mouse skills.

Students to undertake this course should basically have pre-requisite skills of good reading, writing, numeracy and keyboarding skills, and should have gone through the Primary ICT Syllabus. In addition, students should acquire responsible behaviour in following rules, regulations and performing task according to procedure (MoESS, 2007).

The ability to achieve all of the above implies that teachers must have a comfortable level of ICT knowledge and skills. They must acquire the basic skills in ICT and then go on to ensure that the students in their charge can also make progress in use of ICT in an incremental way. Unless teachers are functioning at a comfortable level of ICT skills and knowledge they will be unable to teach ICT or use ICT as a primary tool for teaching and learning.

Perception of Teachers on the ICT Curriculum

Among the factors that determine the success of ICT education are ICT attitudes, knowledge and use (Tezci, 2010), individual characteristics such as gender, age, teaching experience (Aydın, 2007), self-efficacy (Paraskeva, Bouta & Papagianni, 2008), and culture (Li & Kirkup, 2007). Some of the others mention experience of ICT use (Aral *et al*., 2006; Paraskeva, Bouta & Papagianni, 2008) learning and teaching approaches, (Teo, Chai, Hug & Lee, 2008b), access to technology and attitudes (Hong & Koh, 2002), beliefs (Teo, Chai, Hug & Lee, 2008), and perception of the teachers of the ICT curriculum. This is because there is a strong positive correlation between teachers' perception and students'

performance. Studies have shown that the adoption of ICT by teachers depends on their values and beliefs about the importance of ICT for learning (Moseley et al., 1999).

The term perception is nebulous and it is often defined contextually. Eggen and Kauchak (2001) gave cognitive dimension of perception; they see perception as the process by which people attach meaning to experiences. They explained that after people attend to certain stimuli in their sensory memories, processing continues with perception. Present thoughts are therefore interpreted in the light of past experiences, which influence peoples' past and future thinking. These experiences when put together, form an individual's beliefs that manifest in behaviour as personal values, judgments, opinions, ideologies, conceptions, dispositions, theories, etc. (EURYDICE, 2004). These groups of beliefs about phenomena form attitudes and later translate into actions. When connected, the beliefs constitute one's values which guide action and behaviour (Bandura, 1986).

Perceived usefulness (of the ICT syllabus) reflects the prospective users' subjective probability that applying the new technology will be beneficial to his/her personal and/or the adopting organisation's well-being. Teachers have their own perceptions regarding professional practice, which are central to the successful integration of educational innovations such as ICTs (Zhao & Cziko, 2001). Imperatively, teachers' beliefs and perceptions play a crucial role in shaping their future teaching behaviours. Perceived usefulness of ICT has been shown to be a significant predictor of course satisfaction. According to Zhao and Cziko (2001) teachers should believe in the effectiveness of technology, that the

use of technology will not cause any disturbances and that they have control over technology. Garofalo, Kersaint, Horton, and Stohl, (2003) agree by stating that teachers who have positive attitudes toward technology feel more comfortable using it in teaching.

Most teachers, even teachers who have low levels of competence in ICT support the introduction of ICT into the curriculum (Rodden, 2010). Lau and Sim (2008) state that these findings compare to a number of studies which also conclude that teachers are strong advocates of ICT use in education. Teachers are more likely to have a positive attitude to the use of ICT in the classroom if they perceive the ICT curriculum to be useful. Sim and Theng (2006) concur by revealing that a high percentage (87%) of the teachers perceived ICT as an important tool to accomplish their professional tasks.

ICT Infrastructure

ICT infrastructure may also include the software used to send, receive, and manage the signals that are transmitted. In some usages, it refers to interconnecting hardware and software. However, to some ICT users, infrastructure is viewed as everything that supports the flow and processing of information. Shiel and O'flaherty (2006) discuss ICT infrastructure under (functional) computers, student-computer ratio, network computers, internet access, software application and other hardware. For the purpose of this study ICT infrastructure refers to space, computers and accessories, electricity supply, internet connectivity, software application, and everything that supports the flow and processing of information to facilitate the teaching and learning of ICT.

For any successful teaching and use of ICT, it is imperative that certain facilities and resources are available and accessible. There is no point in spending any time and effort equipping teachers with the necessary knowledge and skills to teach ICT if schools do not have the necessary infrastructure to put their skills into practice with the learners. ICT infrastructure is therefore crucial for the implementation of every curriculum. Katz (2012) notes that the importance of ICT infrastructure and refers to it as a 'driver of change'. However, there are many challenges in bringing ICT infrastructure into the education process in general across Africa and most developing countries. Hennessy and Onguko (2010) identified a range of physical and cultural factors that affect ICT use by teachers, including lack of reliable access to electricity, limited technology infrastructure (especially internet access, bandwidth, hardware and software provision). In this regard ICT infrastructure cannot be underestimated in a bid to implement the ICT curriculum due to its practical nature.

Availability and Accessibility of Computers

The most commonly infrastructure referred to in the teaching and learning of ICT is the computer (EURYDICE, 2004). A computer will include personal computers (PCs), laptops, notebooks, terminals connected to mainframes and minicomputers that are intended for shared use and are in working condition. Other additional criteria may be applied, such as the age of the computer, its configuration and capacity, the kinds of software available (UNESCO, 2009). The need for computers and software in the classroom especially in the JHSs cannot be over emphasized.

Lack of computers inhibits the teaching of ICT (Organisation for Economic Co-operation and Development [OECD], 2003) because there would be no tools to be used for practice. It is common knowledge that although ICT is expensive to purchase, availability and accessibility of computers in the schools is central to the success of teaching and learning ICT. In the Second Information Technology in Education Study (SITES), conducted in 1997-1999, it was found that an insufficient number of computers in schools were the main reason for not realizing a school's computer-related goals (Pelgrum, 2001) and very few schools have computers or Internet access (Hennessy & Onguko, 2010). Farrell, Isaacs, and Trucano (2007) in their work show that since the previous census (2002) there has been an increase of approximately 15% in the number of computers in schools. In Ghana, however, only 2.5% of 32,000 schools have computers.

Rather than the number of computers per school, perhaps a more appropriate indicator of accessibility of the computers in schools is the student-computer ratio (SCR). How can a school claim to be having computers when they woefully inadequate. Osbourne and Hennesey (2003) contend that limitation on access to hardware and software is a challenge. Finland however has a ratio of one computer for every 12 students, while Italy has a ratio of one computer for every 28.5 pupils. Granger, Morbey, Lotherington, Owston and Wideman (2002) cite SITES, Module 2, which SCR was 1:9 in elementary schools in Canada in 1999.However, there has been a significant progression in the SCR over the past few years, particularly at primary level. At post-primary level the improvement is less marked, though still significant.

In Ghana, availability and accessibility of computers dwindle as one move down on the academic ladder. The tertiary sector is the best (44.5%), followed by the secondary sector. The basic schools are the least with the rural area at the receiving end of this problem. For instance, access to ICTs still remains highly inadequate and unevenly distributed through Ghana, with an urban bias (Mangesi, 2007).

Clearly, if computers are not available or cannot be accessed by the teacher, as well as the students in the JHS, then the curriculum objective cannot be achieved. The process of tooling the schools in this context is painfully slow. The situation, however, seems to be improving these last few years with African Ministries of Education becoming more proactive (Hennessy & Onguko, 2010). It must be noted that civil society, principally Non-governmental Organisations (NGOs) together with others such as Faith Based organizations (FBOs), Community Based Organisations (CBOs), Parent Teachers Association (PTAs), and Telecommunication companies, continue to play a major role in providing computers to schools. For instance in Mfantseman Municipality, communities such as Anomabo, Yamoransa, Biriwa, Akatakyiwa, Narkwa, Baifikrom, and MankessimSrafa /Imuna have benefited from such benevolence. The government of Ghana ICT project meant to supply laptop computers to teachers and student also go a long way to reduce the problem of access to computers. Care should however be taken since statistics indicate that, of the government-led ICT projects in developing countries, 35% are regarded as total failures, 50% partial failures and only 15% are considered a success (Heeks, 2005).

Internet Connectivity

This factor is corollary to the availability of computers in schools. Korte and Husing (2007) report the lack of broadband connectivity as an important new barrier to teaching and use of computers in schools. Data to monitor broadband access in schools exist in many developed countries and a number of developing countries. They suggested initially that, by 2010, practically all schools in developed countries will be connected to the Internet (Empirica, 2006). In fact, many developed countries have stopped tracking ICT infrastructure in schools, since connectivity for instance was approaching 100%. Empirica (2006) indicates that majority of schools in Europe had Internet access and in many countries, including Croatia, Sweden and the United Kingdom, 100% of schools were already connected with broadband (Farrell, Isaacs, & Trucano, 2007). South American countries are approaching 50% mark with Brazil passing 50% mark (International Telecommunication Union [ITU], 2010). In Asia and the Pacific countries like Brunei, Japan, the Republic of Korea, Malaysia, Singapore and Thailand have 100% school connectivity. Australia had not been different as far back as 2003, and intends the increase the connectivity speed (International Telecommunication Union [ITU], 2010).

There is however not much information in the literature on access and use of ICT among teachers and students in schools in Africa in general and the data that do exist suggest that more needs to be done. Internet access in Africa is among the lowest in the world even though it is on the rise (Polikanov & Abramova, 2003). In 2005, it was 2%, it increased to 10% in 2010 and 16% in

2013 (ITU, 2013) According to Polikanov and Abramova (2003), many African states now have Internet access in their schools, with South Africa (41.6%) being the leader. In Ethiopia and Senegal, less than 10% of schools are connected to the Internet. This is basically due to cost so countries are making arrangement to have this inhibition reduced. For instance in Lesotho, the Ministry of Education has negotiated, at least in principle, Internet access to schools at reduced rates (InfoDev/World Bank, 2007). Similarly, in Senegal, Sonatel makes discounted Internet access available to schools, and in Namibia, an agreement between SchoolNet Namibia and Telecom Nambia provides 24/7 flat rate access to all schools.

Ghana achieved 'full Internet connectivity' in1995, directly connected to the world's first submarine fibre-optic cable system, SAT-3/WASC/SAFE, which links Africa to Europe and Asia (Frempong, 2010),the second country in sub-Saharan Africa to achieve this status. In spite of this, ICT development is still in its infancy in the country. Ghana is currently placed at 118th position in the ICT development Index (Frempong, 2010). This may have influenced the low levels of internet connectivity in schools in Ghana. Added to this is lack of computers in the schools and cost. Due to the high cost of Internet connectivity, it is not always possible for schools, especially poor schools, to make use of the Internet for teaching and learning. That notwithstanding, the government is doing its best to ameliorate the situation. For instance, the regional, municipal and district education directorates have been connected to internet to facilitate education management. Conscious of the need to resource the schools, the government is

embarking on an internet access project, to be implemented by GES, in collaboration with the MoE, Vodafone Ghana, Global E-Schools Communities Initiative and USAID, to increase access to ICT by providing and supporting internet connectivity to 400 SHS in Ghana (GeSCI, 2012). Mention can also be made of the Government ICT connectivity project which covers 38 Colleges of Education (formerly Teacher Training Institutions), 37 public Technical Institutes, 510 public Senior High Schools, and 23,000 public Basic Schools with computing infrastructure which was initiated through Ghana Investment Fund for Electronic Communications (GIFEC).

Source of Reliable Power

International Telecommunication Union [ITU], (2010) indicates that while the promise of broadband and wireless technologies heralds effective solutions for many education systems wishing to reap the benefits of ICT for their curricula, the relative scarcity of basic electric power in schools in many developing countries is an obstacle to accessing many of the technologies that support pedagogical objectives. ICT equipment are electrical equipment that require electricity for operation. Irregular or non-existent electricity supply is a common feature and a major barrier to the use of the ICTs, especially outside the major towns. Regular power outages for many hours are common occurrences. This reduces the life span of hardware, militates against effective usage and ultimately adds to cost. For instance, an enthusiastic teacher and students who have computers available and access to them may be debarred from using them as a result of power outage. In fact, because of this problem SchoolNet (Namibia)

piloted the use of solar panels in schools. In Nigeria schools have invested in generators to accommodate regular power outages. In Ghana, the laptops supplied to schools have rechargeable solar batteries. This goes to affirm the need for regular supply of power. Power, which is almost a given factor in schools for many developed countries is still lacking in many African schools making it almost impossible to use ICTs in schools particularly located in rural areas (O'Sullivan & Hamaide, 2001). For instance, in Ghana (37%), Senegal (26%) and Ethiopia (5%), only a minority of basic and secondary schools have electricity (Gillwald & Stork, 2008). Perhaps the Internet Schools (among others) promised by Samsung can overcome many of the obstacles preventing wider access to information technology in Africa. Since many rural areas in Africa do not have reliable power sources. These schools, already found in South Africa, Kenya, Sudan, Senegal and Nigeria, run on self-contained solar power.

In conclusion, although ICT infrastructure development has not progressed rapidly, Ghana compares favourably with other low-income countries, particularly those in sub-Saharan Africa, in terms of bridging the global divide between it and the developed world. Ghana has made significant progress. For instance, in 2005/06, Ghana was ranked 61st in the World Economic Forum's Global Information Technology [WEF] (2006) Report but the situation is improving steadily with 0.4% in 1995 and 2.9% in 2000, comparable to other low-income countries globally and above the 1.1% average for Sub Saharan Africa (World Bank, 2001) but there are however huge gaps between urban and rural areas in terms of access.

Teachers and Issues of Competence

There are two basic elements involved when teachers use or teach ICT: the competencies they possess and their use of technologies. Besides, these two components are very much interconnected as competency in ICT (Almerich, Suárez-Rodríguez, Jesús, Belloch, & Rosa, 2011). Hattie (2003) reveals that teacher quality is the single greatest in-school influence on student engagement and outcomes. His analysis of over half a million academic studies on the effects of different educational interventions on student learning found that teaching has a measurable impact on students' cognitive, affective and behavioural outcomes, ranging from 30% to 59%. This makes the impact of the teacher more important than other factors such as resources, curriculum guidelines and school organization. The leading roles of the teacher bring into focus the issue of teachers' competence which is crucial in investigating the training and development needs of the teachers.

Merriam-Webster 11th Collegiate Dictionary defines competence as the quality or state of being competent or having the knowledge that enables a person to perform. Rychen and Salganik (2003) move a step further and state "Possessing a competence means that one not only possesses the component resources, but is also able to mobilize such resources properly and to orchestrate them, at an appropriate time, in a complex situation"(p. 44).

Competence is usually associated with highly professional performance and there is a direct link in the field of education between a teacher's professional competence and pupil performance. There are two distinct meanings of

competence in education. From a theoretical point of view, competence is understood as a cognitive structure that facilitates specified behaviours. Whitty (1999) identifies professional competence, which includes knowledge and understanding of children and their learning, subject knowledge, curriculum, the education system and the teacher's role. Professional competence also necessitates skills such as subject application, classroom methodology, classroom management, assessment and recording and undertaking a wider role. From an operational point of view, competence seems to cover a broad range of higher-order skills and behaviours that represent the ability to deal with complex, unpredictable situations.

The problem of teacher competence is not related only to the level of teacher instruction but also to the level and quality of training. Both the academic level achieved and the quality of the professional training received, contribute to the competence of a teacher. Regardless of the quantity and quality of technology placed in classrooms, the key to how those tools are used is the teacher; therefore teachers must have the competence (Kadel, 2005). This means teachers knowledge and skill is crucial to the debate.

Teacher Knowledge and Skill

An aspect of competence is knowledge and skill. The vast existing literature on education production functions hints at teacher knowledge as one - possibly the only factor reasonably consistently associated with growth in student achievement. This persistent theme in the education literature is the view that a growing knowledge base of the teacher is needed to improve teacher quality.

This is basically because lack of knowledge is regarded as a significant teacher related barrier. Metzler and Woessmann (2010) agree and state that teacher subject knowledge exerts a statistically and quantitatively significant impact on student achievement. A teacher's lack of knowledge and skill of ICT serves as a considerable barrier to the use of computers in teaching methods and practices. Pelgrum (2001) found that lack of knowledge in technology, among teachers in developing nations, is the primary obstacle to the uptake of ICT in education. In Nigeria for instance teachers possess lower level skills in use of ICT and this has affected teachers' use of ICT in the classroom (Adeosun & Maduekwe, 2008).

Similarly, others like Albirini (2006), Korte and Husing (2007) found that although overall attitudes of teachers towards ICT were positive, a lack of competence (knowledge and skills) in computer technology was cited as the main obstacle to ICT in teaching. Contributing to the debate, Newhouse (2002), on his part, found that teachers lacked knowledge and skills to use computers… is important. A lot has been said and from evidences available in literatures it is established why teachers' knowledge of subject matter is highly essential for effective teaching. In other words, teacher effectiveness is impeded if the teacher is unfamiliar with the body of knowledge taught and that teachers' effectiveness is subject specific. The implication of this for teachers is that they must thoroughly understand the content of what they teach. The teacher whose understanding of topic is thorough use clearer language, appropriate language level and their discourse is more connected. That is, they provide a better explanation than those whose background is weaker.

Theoretical Framework for Teacher Knowledge

Educational theorists, researchers, practitioners and educators of the 20th and 21st centuries have espoused a plethora of definitions and models of pedagogy, pedagogical approaches and implications for teachers' classroom practices. Informing these theories are philosophies, values and assumptions about how we learn and the subsequent approaches that enable learning. One of such theories is Shulman's (1986) classification of teacher knowledge which identifies essential blend of knowledge and skills required for effective teaching.

Shulman's Classification of Teacher Knowledge

Shulman (1986) postulated that teacher knowledge is at the heart of teacher quality and developed a seven-part classification of teacher knowledge. These are: content knowledge; general pedagogical knowledge; curriculum knowledge, pedagogical content knowledge; knowledge of learners and their characteristics with special reference to those broad principles and strategies of classroom; knowledge of educational contexts and knowledge of educational aims, purposes and values.

Content Knowledge

Content knowledge (CK) is knowledge about the actual subject matter that is to be learned or taught. The content to be covered in for instance ICT or social studies in Junior High School are very different from the content to be covered in computer science or art history in a tertiary institution. Evidently, teachers must know and understand the subjects that they teach, including knowledge of central facts (themes), concepts, theories, and procedures within a given field; knowledge

of explanatory frameworks that organize and connect ideas; and knowledge of the rules of evidence and proof (Shulman, 1986). Teachers must also understand the nature of knowledge and the principles of inquiry that help answer two kinds of questions: What are the important ideas and skills in this domain? How are new ideas added and deficient ones dropped by those who produce knowledge in this area? in different fields. For example, how is a proof in mathematics different from a historical explanation or an ICT skill? Teachers who do not have these understandings can misrepresent those subjects to their students.

General Pedagogical Knowledge

Shulman (1987) regards general pedagogical knowledge as the broad principles and strategies of classroom management and organisation that appear to transcend subject matter. It involves teaching methods that are not subject specific, such as classroom management strategies and organizational procedures (Shulman, 1986, 1987). The rationale behind these pedagogical skills is to create a classroom environment "where pupils can attend to instructional tasks, orient themselves toward learning with a minimum of disruption and distraction, and receive a fair and adequate opportunity to learn" (Shulman, 1987, p. 10).

Curriculum Knowledge

Curriculum knowledge serves as 'tools of the trade' for the teacher. It facilitates the choice and sequence of materials and activities for instruction. The curriculum is represented by the full range of programmes designed for the teaching of particular subjects and topics at a given level, the variety of instructional materials available in relation to those programmes, and the set of

characteristics that serve as both the indications and contraindications for the use of particular curriculum or programme materials in particular circumstances (Shulman, 1986). It is what should be taught to a particular group of pupils? It requires understanding of children's learning potential, national syllabuses, school planning documents and year group plans. In addition any examination or testing syllabuses must to be taken into account and any local or contextual requirements considered.

An additional and often overlooked aspect of curriculum knowledge has been the teacher understanding the goals and expected outcomes in the other disciplines that comprise the student's grade level. This cross-disciplinary knowledge allows the teacher "to relate the content of a given course or lesson to topics or issues being discussed simultaneously in other classes" (Shulman, 1986, p. 10). Even though interdisciplinary considerations are a key strategy for highly effective teachers (Porter & Brophy, 1988), cross-curricular knowledge is usually lacking in the vast majority of teachers.

Pedagogical Content Knowledge

Perhaps the most original and significant aspect of Shulman's classification is the category of pedagogical content knowledge (PCK). PCK identifies the distinctive bodies of knowledge for teaching. It represents the blending of content and pedagogy into an understanding of how particular topics, problems or issues are organised, represented, and adapted to the diverse interests and abilities of learners, and presented for instruction (Shulman, 1987, p. 4).

According to Shulman, this knowledge includes knowing what teaching approaches fit the content, and likewise, knowing how elements of the content can be arranged for better teaching.

Unlike others, PCK is concerned with the representation and formulation of concepts, pedagogical techniques, and knowledge of what makes concepts difficult or easy to learn, knowledge of students' prior knowledge, and theories of epistemology. It also involves knowledge of teaching strategies that incorporate appropriate conceptual representations in order to address learner difficulties and misconceptions and foster meaningful understanding. It also includes knowledge of what the students bring to the learning situation, knowledge that might be either facilitated or dysfunctional for the particular learning task at hand. This knowledge of students includes their strategies, prior conceptions (both ''naıve'' and instructionally produced), misconceptions that they are likely to have about a particular domain, and potential misapplications of prior knowledge.

In developing this construct, Shulman generated interest in the importance of 'deep' knowledge of the subject itself, and knowledge of the pedagogy needed to successfully teach it. Shulman offers a way of distinguishing the distinctive form of teachers' professional knowledge, by describing the relationship between the traditionally mutually exclusive knowledge bases of content and pedagogy. This form of knowledge builds upon, but is different from, teachers' content knowledge or knowledge of general principles of pedagogy.

In his view it is "the special amalgam of content and pedagogy that is uniquely the providence of teachers, their own special form of professional

understanding" (1987, p. 8). He argues that it is the capacity "to transform the content knowledge he or she possesses into forms that are pedagogically powerful and yet adaptive to the variations in ability and background presented by the students" (1987, p. 15).

Knowledge of Learners and their Characteristics

In many cases, pedagogical decisions are influenced by how the teacher views the cognitive and physical development of the student. This knowledge structure contains major implications for the development and modification of PCK, particularly in light of conceptual change teaching, because it deals with the knowledge of students, what they currently think about the subject, their misconceptions, and what knowledge they lack.

Knowledge of Educational Contexts

Knowledge of educational contexts, which involves a thorough understanding of one's professional surroundings ranging from the working the group or classroom, the governance and financing of school districts, to the character of communities and cultures. In order to perform effectively as a professional educator, the teacher should be familiar with: institutions with their hierarchies, their explicit and implicit system of rules and roles; professional teachers' organisations with their functions of negotiation, social change, and mutual protection; government agencies from the district through the state and federal levels; and general mechanisms of governance and finance (Shulman, 1987). In addition to these "political" considerations, the teacher should be aware of the importance of community and culture in the educational context.

Knowledge of Educational Ends, Purposes, Values and their Philosophical and Historical Grounds

Finally, the effective teacher should possess a philosophy of education, or instructional theory, which clearly defines her beliefs about teaching and learning. This belief system comprises the knowledge structure that deals with educational ends, purposes, and values. It should contain the teacher's "visions of what constitutes good teaching, or what a well-educated youngster might look like if provided with appropriate opportunities and stimulation" (Shulman, 1987, p. 10).

All seven of these knowledge structures contribute to the development of a highly effective teacher even though the last two components are often overlooked or minimized. They are all extremely important in promoting academic excellence; however, a major concern, however, among educational researchers is how the various aspects of knowledge development interact in both the pre-service and in-service teacher. More importantly, is there an underlying knowledge component that forms the foundation for further development? Although, some researchers argued against Shulman's theory, most agree that it is a major basis for teacher development.

It should be noted although Shulman did not discuss technology and its relationship to pedagogy and content, I do not believe that these issues were considered unimportant but that when Shulman first made his argument, issues surrounding technologies and its attendant pedagogical issues were not foregrounded to the extent that they are today but with ICT come with it the debate of teachers' knowledge and how it informs the debate on what teachers need to know. This brings the issue of technology knowledge.

Technology Knowledge

Technology knowledge (TK) is knowledge about computers, internet and digital video. This involves the skills required to operate particular technologies. In the case of digital technologies, this includes knowledge of operating systems and computer hardware, and the ability to use standard sets of software tools such as word processors, spreadsheets, browsers, and email. TK includes knowledge of how to install and remove peripheral devices, install and remove software programs, and create and archive documents. Most standard technology workshops and tutorials tend to focus on the acquisition of such skills.

Mishra and Koehler's Technological Pedagogical Content Knowledge

More recently, scholars have begun to assert the importance of connecting technology, pedagogy, and content in teacher preparation and professional development (Mishra and Koehler, 2006; Zhao, 2003). Building on Shulman's idea of Pedagogical Content Knowledge, Mishra and Koehler (2006), have added technology to the equation and designed a model that they call 'Technological Pedagogical Content Knowledge' (TPCK) to refer to the interrelationship of the three key components of learning: content, pedagogy, and technology. It emphasizes that the knowledge and skills of the 21st century teacher intersect these three fundamental areas. Koehler (2011) contends that TPCK can be adopted into all learning levels and curricular areas. The basis of the framework is to understand that teaching is a highly complex activity that draws on many kinds of knowledge. Teaching is said to be a complex cognitive skill occurring in an ill-structured, dynamic environment (Spiro, Feltovich, Jacobson, & Coulson, 1991),

there is therefore the need to put together a mix bag of knowledge to enable one achieve expected objectives.

Mishra and Koehler (2006) developed TPCK to assist with the integration of technology across the curriculum, the implication is that properly prepared teachers can take advantage of the unique features of technology to teach content in ways they otherwise could not.

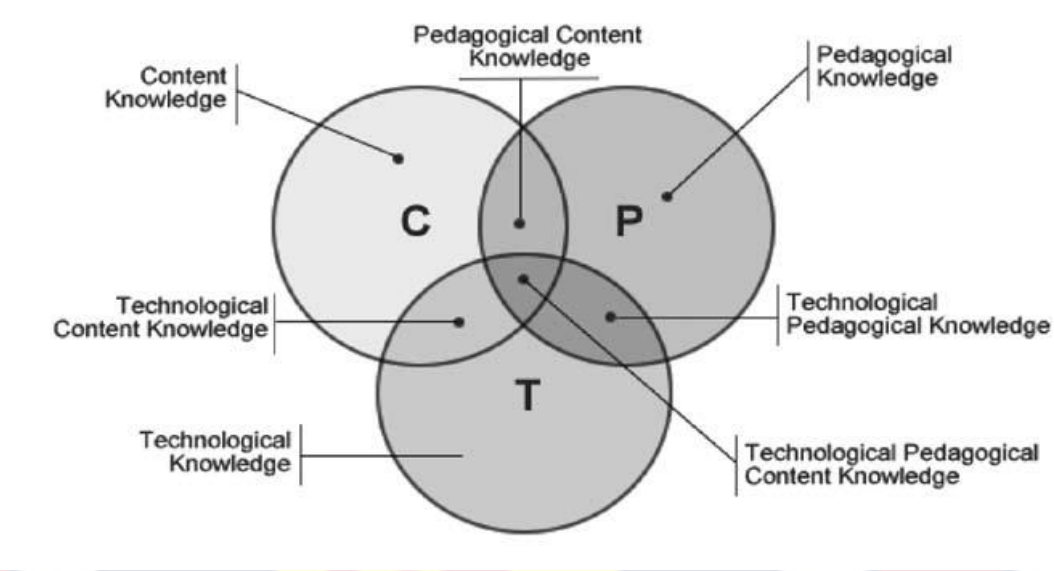

Figure 2: Components of TPCK.

As noted in Figure 2, TPCK as adapted from Mishra and Koehler (2006) attempts to capture some of the essential qualities of knowledge required by teachers for technology use in their teaching, while addressing the complex, multifaceted and situated nature of teacher knowledge. At the heart of the TPCK framework, is the complex interplay of three primary forms of knowledge: Content Knowledge (CK), Pedagogical Knowledge (PK), and Technology Knowledge (TK).

Effective technology integration for pedagogy around specific subject matter requires developing sensitivity to the dynamic, transactional relationship between all three components. How are teachers to acquire an understanding of the complex relationships among content, pedagogy, and technology?

The standard approach suggests that teachers simply need to be trained to use technology. Underlying this approach is a view of technology that sees it as being a universally applicable skill; unlocking the power and potential of technology can be achieved by acquiring basic competency with hardware and software packages.

From the review of the literature, one can conclude that the concept of teacher knowledge and skill involves a combination of factors as portrayed by Shulman (1986, 1987), Mishra and Koehler (2006). One fact however runs through that, in order to improve teachers' competence the issue of training and development is imperative.

Training and Development

Training is the acquisition of knowledge, skills, and competencies as a result of the teaching of vocational or practical skills and knowledge that relate to specific useful competencies. In other words training has specific goals of improving one's capability, capacity, and performance. Similarly, training is also said to be the planned and systematic modification of behaviour through learning events, activities and programmes which result in the participants achieving the levels of knowledge, skills, competencies and abilities to carry out their work effectively (Armstrong, 1995). McNamara (2008) however made a distinction

between training and development. He pointed out that training involves an expert working with learners to transfer to them certain areas of knowledge or skills to improve in their current jobs while development is a broad, ongoing multi-faceted set of activities (training activities among them) to bring someone or an organization up to another threshold of performance, often to perform some job or new role in the future. According to Asare-Bediako (2002) employees must be trained, and where possible developed to meet their own career needs and the need of the organization. He indicates that development activities are designed to reinforce strength, overcome limitations, provide relevant, new competencies, and broaden outlook. Organizations must therefore have the responsibility to develop and implement training and development systems and programmes that best help them to achieve their objectives because it is a known fact that training enhances Skills, Knowledge, Attitudes and confidence and ultimately worker performance in organizations.

Teaching is becoming one of the most challenging professions in our society where knowledge is expanding rapidly and much of it is available to students as well as teachers at the same time (Perraton, & Creed, 2000) especially in this 'ICT age'. As new concepts of learning have evolved, teachers are expected to facilitate learning and make it meaningful to individual learners rather than just to provide knowledge and skills. Modern developments of innovative technologies have provided new possibilities for teaching professionals, but at the same time have placed more demands on teachers to learn how to use these new technologies in their teaching (Robinson & Latchem, 2003). These challenges

task teachers to continuously train and retrain themselves and acquire new knowledge and skills while maintaining their jobs (Carlson & Gadio, 2002). This is even so with the introduction of new curriculum with its attendant challenges.

In Ghana, training in education takes the form of pre-service and in-service training. Taking into account the age profile of teachers in Ghana as well as the number of graduates, it is reasonable to note that the majority of practising teachers did not receive pre-service training in the use of ICT. Even pre-service training with ICT component of the training only has short period for the training. That calls for in-service training. In-service training has been known to focus on teachers' responsibilities and is aimed towards short term and immediate goals and Professional development on the other hand seeks to facilitate growth of teachers' understanding of teaching and themselves as teachers. It is common knowledge that a teacher who receives intensive in-service training has a high degree to perform than those who did not. Government's White Paper on the Report of the Education Reform Committee (GoG, 2008) agrees and promises continuous teacher development to upgrade and update the competences and skills of serving teachers to enable them offer quality teaching and learning in our schools. Ghana Education Service is also expected to provide ICT in-service training that would empower teachers to effectively use ICT in teaching and learning. The rapidly changing nature of technology however renders much ICT professional development inadequate or out of date in a relatively short period of time (one week workshops and seminars) (NCCA, 2004). These inform the need to train and retrain the ICT teachers.

Importance of Training and Development

The ultimate aim of every training and development programme is to add value to human resource. According to Quinn, Anderson and Finkelstein (1996), training is for employees to master the knowledge, skill, and behaviours emphasized in training programmes and to apply them to their day-to-day activities.

Contributing to the debate on the general benefits from employee training and development, McNamara (2008) stated that it leads to increased capacity to adopt new technologies and methods, and reduced employee turnover. According to Leach, et al. (2006), the output of teachers work improved remarkably after training and development programmes. The programmes enhanced the teaching quality and impact in the classroom. In a study in America on the impact of human-capital investments such as education and employer-provided training, Black and Lynch (1996) citing Bishop (1994) indicated that employer-provided training raises productivity measure by almost 16%, stressing the importance of career training development.

Travers and Rebore (2000) as cited by Shirley and Nafsiah (2004), state, teachers need to update skills and knowledge in subject areas where the discipline is continuously evolving. Teachers also need to keep abreast of societal demands that are placed in schools and this calls for lifelong learning. Kington et al., (2003) added that "… lifelong learning is necessary for sustaining teacher morale, for career advancement and promotion, for a vibrant workforce, for managing change, for improving skills, content knowledge or pedagogy" (pp. 43-44).

Obviously, one-day awareness courses are inadequate to address this huge skill gap, yet this is the most commonly experienced form of in-service training. One-shot training, no matter how effective and successful, will not suffice especially in the face of technological changes that occurs daily. A new paradigm must emerge that replaces training with lifelong professional preparedness and development of teachers, along a continuum.

British Educational Communications and Technology Agency [BECTA] (2004) concurs, asserting that training is particularly complex, because it is important to consider several components to ensure the effectiveness of the training. This is because technology training appears to focus mainly on technology knowledge and skills while overlooking the relationships between technology, pedagogy, and content (Geer & Sweeney, 2012).Similarly, a study conducted by Cox, Preston, and Cox,(1999) argues that ICT training for teachers needs to incorporate pedagogical aspects. This study concluded that when teachers received basic ICT training without considering the pedagogical aspects of ICT, they still did not know how to use ICT in class. Research by Gomes (2005) also concluded that lack of training in digital literacy, lack of pedagogic and didactic training in how to use ICT in the classroom and lack of training concerning the use of technologies in specific subject areas, were obstacles to the use of new technologies in classroom practice. Cox, Preston, and Cox,(1999) assert that if teachers are to be convinced of the value in using ICT in their teaching, their training should focus on pedagogical issues.

Paradoxically however, some studies assert that attention must be given to both skills training and pedagogical training (BECTA, 2004). According to Newhouse (2002), some training is still needed for teachers to develop appropriate skills, knowledge and attitudes, regarding the effective use of computers to support learning by their students. He argued that this also requires continuing professional development, to maintain these appropriate skills and knowledge. Jimoyiannis and Komis (2007) investigated 1165 teachers, following their participation in ICT basic training skills and concluded that training and the acquisition of ICT knowledge and skills, can remove a number of challenges facing the ICT teacher. Fundamentally, when there are new tools and approaches in education, teacher training is essential if they are to use them in their teaching (Osborne & Hennessy, 2003) but to ensure the success of the training there should be training needs assessment of the teachers (Obisi C., 2011).

Training Needs Assessment

Training needs assessment is an ongoing process of gathering data to determine what training needs exist so training can be developed to help the organization accomplish its objectives. Conducting needs assessment is fundamental to the success of a training programme. Often, organisations will develop and implement training without first conducting a needs analysis. These organizations run the risk of overdoing training, doing too little training or missing the point completely.

The training needs assessment is a critical activity for the training and development function. The first step in designing a training and development

programme is to find the needs of the staff (teachers) by conduct a needs assessment or analysis. The assessment begins with a "need" which can be identified in several ways but is generally described as a gap between what is currently in place and what is needed, now and in the future (Miller & Osinski, 1996). It seeks the capacity gaps and how they can be bridged. (Peterson, 1998). In context, it identifies training and non-training solutions (Miller & Osinski,1996) to teachers' performance using data collecting methods such as interviews, surveys/questionnaires, observation,and existing data. This then become the basis for developing training module.

Summary of Literature Review

To sum up, a number of theories and empirical studies have been reviewed under this chapter to give credibility to the study. It is evident from the review that teachers should have positive perception of the curriculum, be knowledgeable in the subject matter, and have the skills in using ICT in teaching as well as undergo training as they combine to help the teacher achieve his / her objective. The availability and accessibility of the ICT infrastructure especially in the schools is also very vital.

CHAPTER THREE

METHODOLOGY

This chapter outlines and explains the research methods used in the study. It highlights the rationale for the choice of study design, and points out the strengths and weaknesses of the design. It further identifies and describes the population, sample size and sampling procedure. The instruments, pre-testing of instruments, data collection procedure and how the data collected was analysed were discussed.

Research Design

A descriptive research method was employed in the study. Descriptive research involves the collection of data in order to test hypothesis or answer research questions concerning the current status of the subject of the study (Gay, 1996). The Association for Educational Communications and Technology [AECT] (2001), a handbook of research for educational communication and technology notes that descriptive research is used to obtain information concerning the current status of the phenomena to describe "what exists" with respect to variables or conditions in a situation. Borg and Gall (1989) on their part maintained that descriptive studies are aimed at finding out "what is," so observational and survey methods are frequently employed to collect descriptive

data. It can involve collecting quantitative data and typically seeks to ascertain respondents' perspectives or experiences on a specified subject in a predetermined structured manner. A study of this nature affords me the opportunity to seek explanations of certain aspects of social phenomena such as measuring respondents' perceptions, opinions, knowledge, and attitudes. It is also used to conducting a needs assessment using primarily closed-ended questions.

This design was thus employed considering the desire of the researcher to obtain first hand data from the respondents (ICT teachers) so as to formulate rational and sound conclusions and recommendations of the study. Becker's (1986) series of survey reports concerning the implementation of ICT curriculum (computers) into schools fit partially within the realm of descriptive research. Galloway as cited in AECT, (2001) also bases recommendations for teaching with computer analogies on descriptive survey data from which important recommendations on training and development of teachers were made.

It can also be argued that this design relatively demands low budget, saves time and information is easily assessable because tremendous volume of information can be collected within a short period of time (AECT, 2001).

Although, descriptive design is best for this study, it has some weaknesses which include the difficulty encountered in the collection of data because not all the respondents may respond to the questionnaire (Fowler, 1984). Then there is also the challenge of comprehensive understanding of respondents perspective (in-depth information) compared to in-depth interviews. The responses may not be well understood. Siniscalco and Auriat (2005) added to the challenges by

indicating that this design also requires some statistical knowledge, sampling and other specialized skills to process and interpret results. It may be hard for participants to recall information or to tell the truth about a controversial question (McMillan, 2000).

Population

The research population for the study was drawn from Mfantseman Municipality, a district of the Central Region in Ghana that achieved Municipal status in 2008. The Mfantseman Municipal is divided into Ekumfi and Mfantseman West constituencies and located along the Atlantic coastline of the Central Region of Ghana and extends from latitudes 5° T to 5° 20' North of the Equator and longitudes 0° 44' to 1° 11' West of the Greenwich Meridian, stretching for about 21 kilometers along the coastline and for about 13 kilometers inland and constituting an area of 533 km^2 (206 sq mi). It has population of196, 563, of which 50.4 % is urban with the other 49.6 % being rural (Ghana Statistical Service, 2013). The population is mainly employed through fishing, farming or trading.

In the education sector, Mfantseman Municipal has 120 registered Junior High Schools and 160 primary schools, comprising both public and private. The enrolment in the basic schools is 57,382 with 1,323 teachers in public basic schools (GES, 2010b). The population for the study is 120 ICT teachers in the Junior High Schools (public and private schools). They were chosen because they are directly responsible for teaching the students ICT.

Sample and Sampling Procedure

In order to collect data in this case, "census" sampling was used. Census sampling is described as including all members of the population in the study as a sample (Muijs, 2004). A census sampling of 120 ICT teachers was used. Sarantakos (1998) contends that in many cases a complete coverage of the population in the study is not possible, at best very challenging but in this study the population is relatively small. One ICT teacher from each of the schools totaling 120 teachers was involved. Out of the 120 respondents 85 (71%) were males and 35 (29%) were females. The majority of 79 (65.8%) are 'professionally trained' with a substantial number of 41 (34.2%) being 'untrained professionally'. Many of the untrained teachers are teachers from the private schools. This confirms the Ghana Ministry of Education (2012) report that a substantial number of non-professional teachers are in the private sector.

The breakdown of the teaching qualification of the respondents is as shown in Table 1.

Table 1: Qualification of ICT Teachers

Qualification	No.	%
Trained		
Certificate 'A'	47	39.2
Diploma in Education	28	23.3
Bachelor in Education	4	3.3
Untrained		
Senior High School	29	24.2
Higher National Diploma	8	6.7
Other Degrees	4	3.3
Total	**120**	**100**

As indicated in Table 2, 48 (40%) of the respondents have had 2 years' experience in teaching ICT with 42 (35%) having 3 years' experience. Another 19 (16%) of them have had just a year of ICT teaching experience and the rest 11 (9%) have had 4 years and above of ICT teaching experience.

Table 2: Participants' ICT Teaching Experience

Teaching Experience	No.	%
1 Year	19	16
2 Years	48	40
3 Years	42	35
4 + Years	11	9
Total	**120**	**100**

Rice (2004) highlights the importance of experienced teachers in schools specifically, the learning by doing effect in the early years of teaching. Ijaiya (2000) has also given different opinions about teaching experience and students' learning outcomes in schools. The focal point of his arguments is that experience improves teaching skills while pupils learn better at the hands of teachers who have taught them continuously over a period of years. It is therefore good for the ICT teachers to have had some experience.

This sampling was convenient in this study as it allowed me to collect more data from a large number of teachers and at the same time avoid sampling bias. Again, it is a fact that a larger and more representative of the population increases data validity.

Instruments

Good research requires that data are collected using an instrument that is valid and reliable. Before choosing an instrument to collect data, I had to be certain about what kind of data is needed in order to answer the research questions. According to Fraenkel and Wallen (2000), the most common types of instruments used in survey research are the questionnaire, the interview schedule and classroom observation instrument (COI). The choice of instruments depends not only on research questions but also on cost, resources and time at the disposal of the researcher so considering the nature of the study and the data required, teacher questionnaire and classroom observation were combined and found to be most suited to this study as they offered the opportunity to get closer to the respondents. Combining instruments made validation of the data possible as different sources were consulted in order to overcome inherent weaknesses of each of the techniques to improve the authenticity of the study. The ICT teachers were the respondents to the questionnaire and the same teachers were observed in the classroom setting teaching the subject.

Questionnaire is seen as an important tool for eliciting information on specific problem from knowledgeable informants (such as teachers). The overriding objective is to translate the researcher's information needs into a set of specific questions that respondents are willing and able to answer.

The teachers' questionnaire is made up of 30 items which is divided into five sections (sections A-E). Section A consisted of teachers' biodata (gender, highest qualification and teaching experience of the respondents), section B

consisted of items on ICT teachers' perception about the introduction and usefulness of ICT curriculum that employed a five-point Likert-type scale of 'Strongly Disagree'(1); 'Disagree' (2); 'Mostly Agree' (3); 'Agree' (4), 5-'Strongly Agree' (5). Section C explores availability and accessibility of ICT infrastructure for implementation of the ICT curriculum and time for teaching the subject. It employs Yes/No questions as well as adequacy functionality. Also, section D deals with ICT teachers' knowledge and skills in ICT. This section employs ratings scales. This aspect is based on the JHS ICT syllabus (MoESS, 2007) requirement as well as framework for ICT competency Standards for Teachers (UNESCO, 2008) which emphasizes teachers' need to be able to help students become collaborative, problem solving creative learners through using ICT so they will be effective global citizens. The last Section E deals with training and development, where the ICT teacher is implored to indicate ICT training experience and the areas where training is required.

The questions adopted in the questionnaire are close-ended.Slavin (2007) describes a closed-ended questionnaire as an instrument for which a limited number of possible responses are specified in advance. In the opinion of Fraenkel and Wallen (2000), they enhance consistency of response across respondents because they are easier and faster to tabulate. The authors indicate that close-ended questions may however limit the breadth of responses; take more time to construct, and requires more questions to cover the research topic. However, it can be given a number or value so that a statistical interpretation can be assessed, for that matter better suited for computer analysis.

Although close-ended questions tend to suit this study, International Institute for Educational Planning (UNESCO-IIEP, 2005) indicates it has challenges which include the fact that because of the simplicity and limit of the answers, it may not offer the respondents' choices that actually reflect their real feelings, therefore not allowing the respondent to explain that they do not understand the question or do not have an opinion on the issue. Also, they can introduce bias; either by forcing the respondent to choose between given alternatives or by offering alternatives that otherwise would not have come to mind or tick systematically either the first or last category, to select what may be considered as the most socially desirable response alternative, or to answer all items in a list in the same way, and they require skill to write because response categories need to be appropriate, and mutually exclusive.

That notwithstanding, I used both mutually exclusive and exhaustive response categories for the questions as well as reverse the wording in some of the questions to help prevent response sets. Classroom Observation Instrument (COI) also acted as a buffer for the inadequacies of the questionnaires.

A reliability test was carried out to determine the internal consistency of items in the questionnaire by using Cronbach's Alpha reliability test. Cronbach's alpha coefficients were 0.897 and 0.750 respectively for questionnaire items on perceptions and knowledge and skill. According to Kline (2005), alpha value of 0.90 is considered excellent, 0.80 very good and 0.70 acceptable. In this study, the observed variables had good internal consistency.

COI is the other instrument used to gather data on how the teachers teach the subject. It has many valid and important educational purposes. Observations are usually valued for their authenticity and objectivity as well as for their potential for exposing the researcher to both every day or habitual behaviors and unexpected events or actions. Good and Brophy (2000) on their part state that, one role of observational research is to describe what takes place in classrooms in order to delineate the complex practical issues that confront practitioners.

The COI was developed from the teacher appraisal forms used by the colleges of education and the appraisal criteria of teachers of basic schools (GES, Addendum to Headteachers Handbook, 2002). It sought to answer questions concerning effective and relevant introduction based on RPK, systematic and sequential presentation from one activity to another adapted to the level of the students, uses variety of methods question techniques, and organises learner-centred activities involving practical work, demonstration etc. Others include effective use of TLM e.g. computers, textbooks, etc., motivating and sustaining students' interest, use of language to improve learner understanding, use of varying feedback techniques and mastery of subject matter throughout the lesson etc. The COI focuses on lesson presentation and has 22 items. These items have ratings from 1-5. The number is compared to the standard average of GES which is Excellent (5), Good (4), Satisfactory (3), Needs Improvement (2) and Poor (1). The ICT lessons were observed and scored using a scoring guide. The observation was within one term of thirteen weeks with each teacher observed at least three occasions.

Classroom observation has limitations. Popkewitz, Tabachnick, and Zeichner (1979) state that classroom observation as a research approach has a behaviourist orientation which is a form of limitation to the approach. They note "it is possible to identify, control, and manipulate specific outcomes of teaching by altering selected aspects of a teacher's overt behavior" (p. 52). Although the observer effect is also a limitation, its effects are not serious concerns. The possibility that this threatens the validity and reliability of data collected however exists. Measures such as simulation training and pretest of the instruments contributed to the reduction of reliability and validity issues.

Pilot-testing the questionnaire is an essential step before its completion. The purpose of the pretest is to check question wording, and to obtain information on open-ended questions with a view to designing a multiple choice format in the final questionnaire. Siniscalco and Auriat (2005) discuss considerations when testing questions and questionnaires and go further to state the need for pretesting. They posit that while pretest is not intended to be exhaustive, it tries to include the most serious problems affecting the reliability and validity that a researcher would want to know about and addressed. Pilot test basically helps to determine the strengths and weaknesses of the survey question format, wording and order.

A pilot-test was therefore conducted with a teacher each from 20 Schools (20 teachers) from Mfantseman municipality, sampled using stratified random sampling method. The population (120 schools) was divided into public schools and private schools. The ratio of public schools to private schools is 3:1 so 15 public and 5 private schools were sampled. Each of the 20 teachers was

personally given the questionnaire after his or her class has been observed by the researcher assistants. The teacher is expected to complete the questionnaire the same day. The researcher estimates that this time period is sufficient for teachers to respond comprehensively to the questionnaire. The necessary revisions were made on the questionnaire and COI and were given to the supervisor to ascertain its face content and construct validities before the final instruments were printed and given to the research assistants for the collection of data.

Data Collection Procedure

According to Amedahe (2002), training field workers for classroom observation is for the purpose of obtaining data with maximum efficiency and minimum bias. The research assistants therefore received an appropriate level of basic training before setting out to administer the questionnaire and conduct non-participant classroom observation of ICT lessons. The training took the form of simulation exercise where one ICT teacher taught for the field workers to observe and score using the COI and guidelines (written instructions to score). The best practices in teaching ICT and the scores assigned were discussed thoroughly. This was to improve the quality of data and reduce inter-rater reliability problems. How to go about handling the questionnaire was also discussed at length using the experiences from the pretesting.

After training, the questionnaire and COI were supplied to the administrators, who administered them with the permission from various authorities of the schools. The questionnaires are given out to the teachers to be completed within the first 3 weeks before the observation were conducted for the

next 10 weeks of the second term of the 2011/2012 school year. Before the observation the teachers were assured that the result of the observation would be for the purposes of research so they should do the normal teaching.A Master Data Sheet was kept where all the data sheets were tracked for accurateness and completeness of data.A total of 120 copies of the questionnaire and 360 classroom observation instruments which represent 100 percent of the total number administered were collected and analyzed accordingly.

Data Analysis

The mass survey data was collected and classified, because some of the questions in the questionnaire were of Likert-scale format which were pre-coded and others were converted into quantitative form by assigning numeric value to responses in the questionnaire. Some of the responses were collapsed into one response. For instance, in section A of the questionnaire, the responses of 'strongly disagree' were collapse together into 'disagree' and 'strongly agree' were collapsed into 'agree'. Similarly, in section D, the responses 'expert', and 'confident' were collapsed into 'good' and that of 'basic' and 'beginner' into 'poor'.

In the case of the COIs, the evaluation criteria 'Excellent', 'Good' and 'Satisfactory' were collapsed into 'Good' while 'Needs Improvement' and 'Poor' were put together under 'Poor'. The data were then keyed in IBM SPSS version 20 for analysis.

The criteria ‘50% or above’ was adopted to make a value judgment. For instance, 50% or above of the teachers' agreement/disagreement with the statement was used to analyze data of the first research questions on teachers’ perception of ICT. Similarly, the criteria 50% or above of the ‘poor’ were adopted in Teachers’ ICT knowledge and skill and pedagogy to determine their training needs. In other words, if 50% or above of the teachers are ‘poor’ in knowledge and skill of a particular application software, it becomes their training need. Again, if above 50% of teachers are ‘poor’ in some the elements of effective teaching, it also becomes their training need. It further implies that the highest percentage category is the greatest training need of the ICT teachers. A similar approach was employed with the research question on ICT infrastructure, where 50% and above was used to determine the availability and accessibility of ICT infrastructure.

In relation to the related research questions and the items displayed in the questionnaire, descriptive statistics were used to analyze the questions. The results were presented in tables of frequencies and percentages to display the data. Excel was also used to generate graphs with percentages to give a visual impression on values without necessarily reading long sentences and also to help in the discussion and interpretation of the data collected. This was used extensively for items on research question two.

CHAPTER FOUR

RESULTS AND DISCUSSION

This chapter presents and analyses the data collected for the study. The discussions of the findings are also presented in the light of the previous literature review. The analysis is done on the basis of the research questions.

Research Question 1: What is ICT Teachers' Perception of the ICT Curriculum?

Table 3 indicates that the majority of 112 (93%) respondents perceived the introduction of the ICT curriculum to be good. Again, 88 (74%) of them indicated their agreement with the statement that ICT help students learn. Another 102 (85%) were in agreement that ICT supports classroom learning. Similarly, 102 (85%) of the respondents agreed with the statement that ICT helps to vary teaching methods. All 120 (100 %) respondents agreed that ICT broadens teachers' horizon. Again, 104 (86%) of the respondents agreed that they have knowledge of ICT curriculum standards. As much as 75 (63%) agreed that ICT is difficult to teach. This is summarized in Table 3.

Table 3: Descriptive Statistics of Teachers' Perception of the ICT Curriculum

Statement	D	MA	A	Total
	No. (%)	No. (%)	No. (%)	No. (%)
JHS ICT curriculum is good	8 (7)	10(8)	102(85)	120(100)
Teaching ICT subject is difficult	45(37)	37(31)	38(32)	120(100)
Teachers have knowledge of ICT syllabus standards	16(13)	41(34)	63(53)	120(100)
ICT helps students to learn	32(26)	24(20)	64(54)	120(100)
ICT supports classroom learning	18(15)	30(25)	72(60)	120(100)
ICT helps to vary teaching method	18(15)	14(12)	88(73)	120(100)
ICT broadens teachers' horizon	0(0)	10(8)	110(92)	120(100)
Teachers are well prepared to teach	96(80)	18(15)	6(5)	120(100)

Key: D = Disagree MA= Mostly Agree A = Agree

A number of studies (Korte & Hüsing, 2007; Balanskat et al., 2006; BECTA, 2008) have identified contrasting perceptions of the teachers. While some have positive inclinations, others are negative; however, the results of this study generally suggest that majority of ICT teachers' perceived introduction of JHS ICT curriculum as good and useful. This supports general literature (Pelgrum & Law, 2003; GoG, 2003; Korte & Husing 2007; Sheard & Carbone, 2007 Papanastasiou & Angeli, 2008) which indicates that most teachers have a positive perception of ICTs, even teachers with low levels of competence in ICT (Rodden, 2010).

The seemingly positive perception reflects the prospective users' subjective probability that applying the new technology will be beneficial to the teacher and students (Van Veen & Sleegers, 2006). This was confirmed by Lau and Sim (2008) when they indicated that teachers can see the value of ICT in enhancing teaching and learning. It should be noted that a significant minority of teachers are skeptical about the benefits to learning regardless of the sophistication of their ICT systems (Korte & Hüsing, 2007). Other points that go to buttress the general positive perceptions of teachers are that ICT helps students to learn (Loveless, 2003), support classroom, teaching methods and broadens teachers' horizon (Sim & Theng, 2006).

Oldfield (2010) contends that although teachers' positive perceptions of the potential benefits of ICT use do not necessarily lead to its improvement of teaching and learning it has been shown to be a significant predictor of course of action. According to Eggen and Kauchak (2001), teachers' positive attitudes or perception is fundamental to effective teaching. If teachers do not see the need for the introduction of ICT, they may reject the curriculum through their action. Omah (2002) supports this position when he indicated that it is uncommon to discover that teachers are sabotaging the efforts of government via their perception and characters towards their profession, the result of which has adverse effect on the academic performance of the student.

In spite of their positive perception, 75 (63%) teachers indicated the difficulty in teaching the subject, a finding that agrees with Lagrange, Artigue, Laborde and Trouche (2003) who posited that bringing ICT into teaching and

learning adds complexity to an already complex process. This finding may not be surprising in the face of the challenges and pressure of training a child to fit into the technological world. If that is the case then it is evident that there is a gap to be filled.

Research Question 2: What Extent is ICT Infrastructure for the Implementation of ICT Curriculum Available and Accessible?

In dealing with availability and accessibility of infrastructure, functional computers, its ratio to students, availability of power, internet connectivity and adequacy of time allocated to access them were reported and discussed.

The result indicates that the majority of 80 (67%) of the schools under study possess functional computers for teaching and learning of ICT. Asked further to indicate the adequacy of these functional computers available in the school, 31 (39%) indicated that the computers are adequate with 16 (20%) responding in the negative. This is summarized in Figure 3.

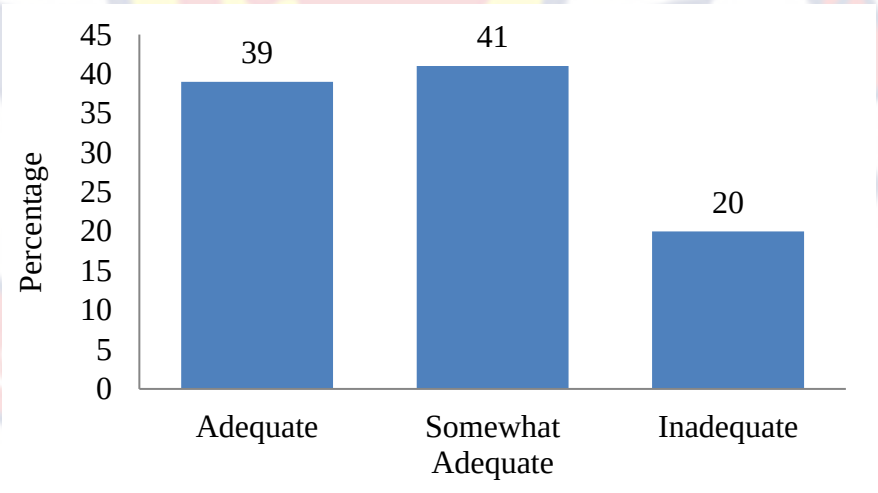

Figure 3: Adequacy of the Functional Computers

It is important to note that 50 (42 %) of the respondents indicated that they own personal computers.

Figure 4 depicts that, of the 40 schools that do not own functional computers, 28 (70%) have access to computers elsewhere outside school.

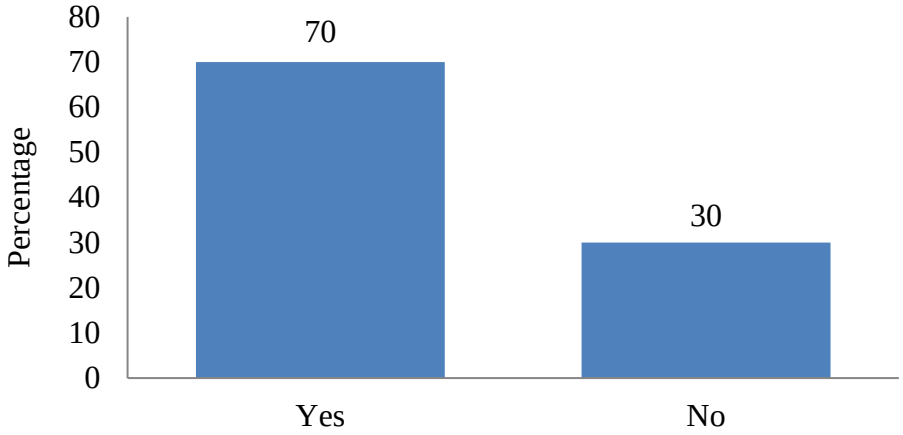

Figure 4: Availability of Computers Outside the Schools

In order to find out the adequacy of these computers outside the school, the respondents were asked to state the ratio of computers - to - student. The result indicates in Figure 5 that only 12 (29%) have computer - to -student ratio of 1:1.Also, as much as 10 (25%) have more than 4:1.

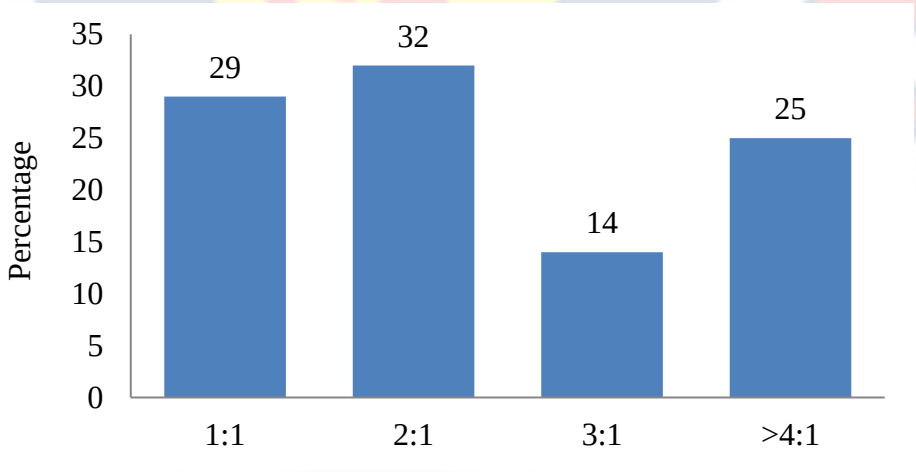

Figure 5: Ratio of Student-to-Computer Outside the Schools

ICT infrastructure is a factor that cannot be overlooked when it comes to teaching and learning of ICT. Researches (Mooij & Smeets, 2001, Intsiful, Okyere & Osae, 2003; Bingimlas, 2009) have cited non -functional computers and software, insufficient or absence of infrastructure or lack of hardware as some impediments to teaching and learning ICT. This brings with it the need to own a computer. According to Varank (2006), a teacher is guaranteed total access and freedom to experiment with the computer as the machine tool that it is if he/she owns one and thereby improve in its usage especially in the classroom due frequency of use. Across Africa and most developing countries therefore focus on acquiring ICTs.

It is a truism that most African countries do not have the wherewithal to procure the infrastructure needed to promote the study of ICT, so most schools do not have the required infrastructure (computers). The study however revealed that the situation in Mfantseman Municipality is not that desperate even though a substantial number of schools do not have computers; those with computers exceed those without. Also, majority of those schools without computers in their schools have access to computers elsewhere outside the school albeit not the best. It was therefore evident that the facilities to help implement the ICT curricula are relatively adequate for the teachers to use.

Many schools are now being resourced albeit painfully slow. In Ghana for instance, the Ministry of Education has drawn up plans which are at various stages of implementation to supply all teachers throughout the country with laptop computers. Under the initiative, 65,000 teachers as well as are expected to benefit

from the package which takes off before the end of the year 2012. Then there is also the Schools Computerization Project under which 60,000 laptop computers are being distributed to Basic schools throughout the country. Mfantseman basic schools for instance have distributed 24 laptops each to 20 schools to be used by the students for ICT lessons. In order to maximize the use of these computers to teach ICT, they should be connected to the internet.

On the issue of internet connectivity, Figure 6 indicates that majority of respondents 75 (70%) with access to computers indicated that their schools and where they access computers are not connected to internet.

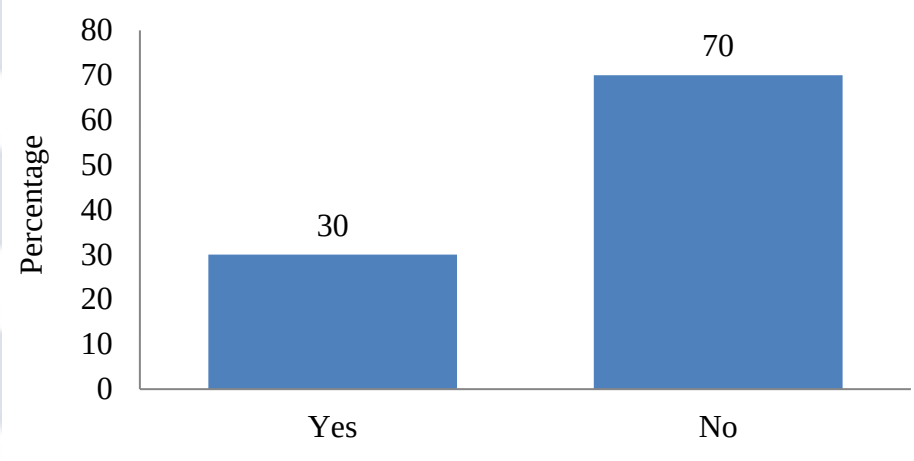

Figure 6: Availability of Internet Connectivity

Ghana has made tremendous progress in ICT infrastructure deployment but has left behind internet. Internet connectivity is one of the prerequisites for teaching and learning ICT, a point emphasized by Sullivan (2010). In fact, internet connectivity provides a platform for both teachers and students to obtain ICT skills as they engage in teaching and learning of crucial topics such as E-mailing, Internet and World Wide Web. Korte and Hüsing (2007) contend that

majority of schools now have access to the internet though this access still varies greatly across countries and among schools in each country.

An aspect of ICT infrastructure that is required to be able to use of computers and accessories to teach ICT is a reliable power supply. Figure 7 illustrates the situation in schools under study. As indicated, 88 (73%) of the respondents have source of power to the schools.

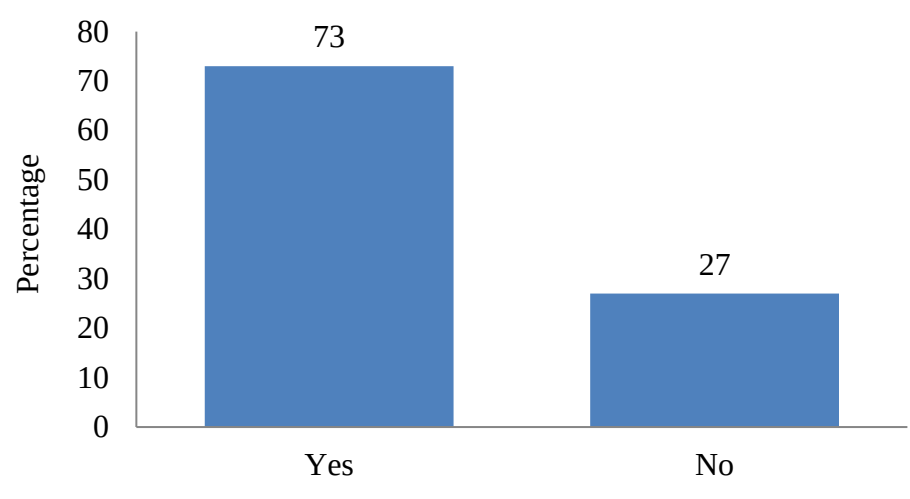

Figure 7: Availability of Reliable Power

Access to good quality electricity is a primordial provision for implementation of ICT to schools. According to Ndukwe (2007), all ICT equipment, infrastructure and terminals depend on electricity to energize. In agreement with this, Osakwe (2010) urges that for ICT to be effective there must be a steady power supply In other words, unless this vital source is always available and reliable, Ghanaian schools and for that matter teachers and learners will not be able to fully enjoy the benefits that the digital revolution offers. Electricity has assumed a critical factor as a result of the energy crisis that Ghana is going through. There is a need, therefore, to maintain a smooth

supply of power to the schools that are connected to the national grid or other alternative should be considered. For instance solar panels to power computer terminals located in areas that were not connected to electricity grid.

It should be noted that access to reliable supply of power is a general problem but is particularly severe in rural and remote areas because of the difficulty of connecting to national electrical grids. Fortunately, the situation is manageable in Mfantseman as indicated by the study. Most of the schools are connected to the national grid and the laptops supplied to the teachers and students under Ghana government laptop project also have attached solar chargers.

Time allocated (periods) is of the essence when it comes to teaching and learning ICT. Figure 8 indicates that 94 (78%) of the respondents have 3 periods per week for the teaching of ICT allocated on the timetable.

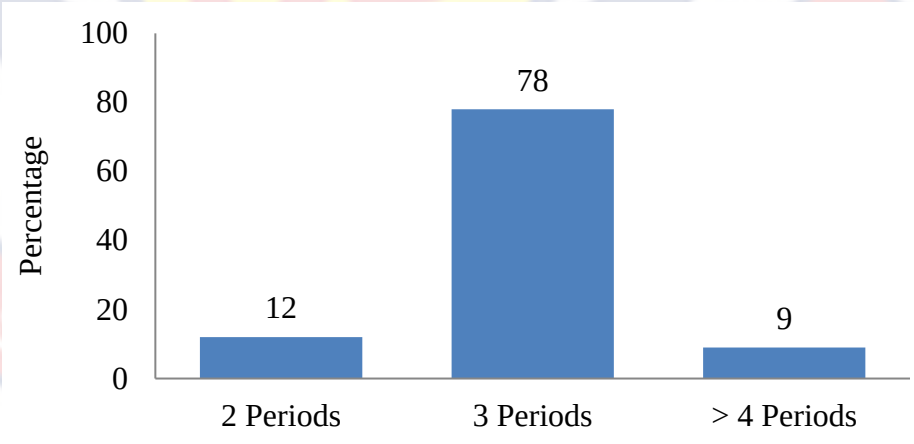

Figure 8: ICT Teaching Periods Allocated on the Timetable

When the views of the respondents were further sought concerning the adequacy of the periods (time allocated on the timetable per week) they use to

teach ICT, 70 (58%) of the respondent describe the time allocated on the timetable as inadequate. This is clearly illustrated in Figure 9.

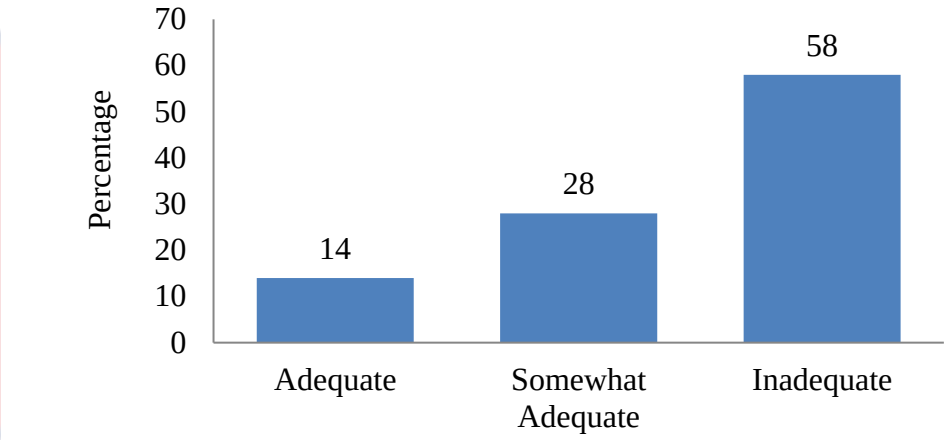

Figure 9: Adequacy of ICT Periods on the Timetable

It is clear from this study that most of the schools were spending three periods per week on the subject which agrees with the stipulated time in the syllabus, however, majority of the respondents agree that the period is inadequate. This finding concurs with the work of Elgort, Marshall, and Mitchell (2003) who reported that teachers continue to identify a lack of time as a barrier to the use of technology. While this has been interpreted to mean that the period allocated on the timetable is not enough, it more reflects the fact that teachers have not had the time to acquire the necessary knowledge and skills in the use of ICTs in teaching and therefore do not manage the time well.

Introducing and using ICT to support teaching and learning is time consuming for teachers, both as they attempt to shift pedagogical practices and strategies and when such strategies are used regularly. This situation poses a challenge to teachers because of the amount of time that teachers need to conduct an effective practical lesson. This is crucial because the syllabus states

that as much as possible theory should be de-emphasized and the emphasis placed on practical (MoESS, 2007). However that is not the case since most of the teachers were emphasizing on the theory with the excuse that they do not have enough time for the practical lessons even for schools that have computers (Rodden, 2010). The period issue needs to be addressed if the objective of the subject is going to be achieved.

In conclusion, it must be said that the importance of the issue of availability and accessibility of infrastructure is continuously reducing. It is therefore not surprising that Cuban, Kirkpatrick, and Peck (2001) suggest that providing ICTs alone is not enough to help teachers teach well. Pelgrum (2001) points out that in many schools, what is perceived as lack of access, could actually be due to poor organisation of resources, while Fabry and Higgs (1997) note that quantity of equipment alone may not ensure sufficient access so the issue of facilities should critically be examined to reduce the emphasis on it as the main barrier to teaching ICT. Regardless of the quantity and quality of ICTs available and accessible in classroom, laboratories or elsewhere outside the school, the key is the teacher.

Research Question 3: What is the Extent of ICT Teachers' Knowledge and Skill in ICT?

Respondents' knowledge and skill of various computer application software, hardware and newer versions of them were sought and the results of teachers' rating are summarized as shown in Table 4.

Table 4: ICT Teachers' Knowledge and Skills in ICT Applications

Application Software	Good No. (%)	Average No. (%)	Poor No. (%)	Total No.(%)
Word Processing	46(38)	30(25)	44(37)	120(100)
Spreadsheet (Excel)	13(10.9)	17(15)	89(74.2)	120(100)
Data Base Mgt.System	14(11.7)	45(37.5)	61(50.8)	120(100)
PowerPoint	45(37.5)	55(45.8)	20(16.7)	120(100)
Graphic/ Drawing	15(12.5)	42(35)	63(52.5)	120(100)
E-mail	53(44.2)	52(43.3)	15(12.5)	120(100)
Internet	54(45.0)	53(44.2)	13(10.8)	120(100)
Keyboard/Mouse skills	11(9.5)	54(45)	55(45.5)	120(100)
Hardware	3(2.5)	7(5.8)	110(91.7)	120(100)
Newer versions	1(0.8)	12(10.0)	107(89.1)	120(100)

As shown in Table 4, 53 (44.2%) of the respondents are comparatively good in E-mail and 54 (45%) are good when it comes to teachers' knowledge and skills in ICT applications. However, knowledge and skill of the other applications as well as its newer versions and the hardware are relatively low. For instance, majority of 110 (91.7%) of respondents need improvement when it comes to knowledge and skill in Hardware. Similarly, 107 (89.1%) need improvement in the newer versions of the software applications. Again, as much as 89 (74.2%) need improvement in Spreadsheet (e.g. Excel application), 63 (52.5%) in Graphics and 61 (50.8%) in Data Base Management System.

This study seems to suggest that the teachers' ICT literacy is generally low. This is not surprising because the e-skill capability in Ghana is 0.5 which is generally very weak (Frempong, 2010). The result further agrees with the report that 70% of teachers are ICT 'illiterate'(MoE, 2011).This poses a major challenge to teachers since the way ICT is taught and used in lessons successfully is influenced by the teacher knowledge about the subject, and how ICT resources such as computers can be utilized. Teachers' content mastery especially in the use of various applications such as Spreadsheet, Data Base Management System, Keyboard / Mouse Skills and Hardware as well as the newer versions of the applications is therefore a key to successful teaching of the subject especially in the face the fast pace of technological development and knowledge of the students. Shulman (1986) postulated that for teachers to be effective they should understand the subjects that they teach, including knowledge of central facts (themes), concepts, theories, and procedures within a given field; knowledge of explanatory frameworks that organize and connect ideas; and knowledge of the rules of evidence and proof. Ohakwe and Okwuanaso (2006) contend that the knowledge of computer application softwares such as Spreadsheet, Powerpoint and Database is important skills in teaching and such skills should be impacted, what Koehler and Mishra (2008) refer to as Technological Pedagogical Content Knowledge. In effect, the teachers' competence or knowledge and skill was generally low, a situation that agrees with the findings of Howie, Muller and Paterson (2005), and Ofsted (2008) which found that lack of computer literacy among the (ICT) teacher and

absence of developed computer skill were the barrier to teachers' use of the applications.

Overall, the results are consistent with the findings of Slaouti and Barton (2007) as cited in Buabeng-Andoh (2012) that teachers are moderately competent in the use of word processing and internet. This may be attributed to the frequency of its use as demonstrated by Preston, Cox and Cox (2000). Computers are often used to write using word processing. It is therefore not surprising that teachers are familiar with word processing. ICT teachers' knowledge and skill in the use of internet (world browsing software) is also high which is consistent with the findings of Becker, and Ravitz, (1999) which found that word processing software and World Wide Web browsing among others is commonly used by teachers.

The competency level of the rest of the applications and hardware under review is generally low. This is a great challenge in the face of improving ICT facilities in the schools. It could be said that this finding is not surprising because 70% of the teachers in Ghanaian schools are not computer literate (MoE, 2011). It perhaps also explains why most ICT teachers are teaching without the use of the computers even if computers are available. It even raises certain questions about the confidence of such a teacher in the face of growing knowledge level of the students who are increasingly having access to computers and internet facilities? It should be noted that most teachers depend on the old curriculum. This problem raises the issue of training for the ICT teachers.

According to the study, the teachers have had various forms of training before they started teaching the subject. This is summarized in Table 5:

Table 5: Forms of Training ICT Teachers Received

Forms of Training	No.	%
None	34	28
Pre-service	20	17
In-service	54	45
Self-Tutored	6	5
Private Classes	6	5
Total	**120**	**100**

On training and development 86 (72%) of the respondents indicated that they have experienced some form of training with 34 (28%) with no form of training before they started teaching ICT. Of the number who have had some form of ICT training, 54 (45%) indicated that they have had In-service training, with 20 (17%) having had pre-service training. Of the number who have received some form of training, 58 (67%) rated their training as 'Inadequate'. Twenty (23%) rated it as 'Satisfactory' with only 8 (9%) declaring it as 'Good'.

It is clear from the Table 5 that a substantial number of 86 (72%) teachers had some training but it is obvious that the training did not yield the required result. This is evident in the response the teachers gave when asked to indicate whether they are well prepared to teach the subject. Nine-six (80%) of them indicated that they were not adequately prepared. This could be ascribed to

the haphazard manner, the short period, and the 'one solution for all' methods employed in some of the training conducted for teachers (Armstrong, 2010).

This led to another question that required the respondents to indicate areas they require training to improve the ICT knowledge and skills. Figure 10 illustrates their responses.

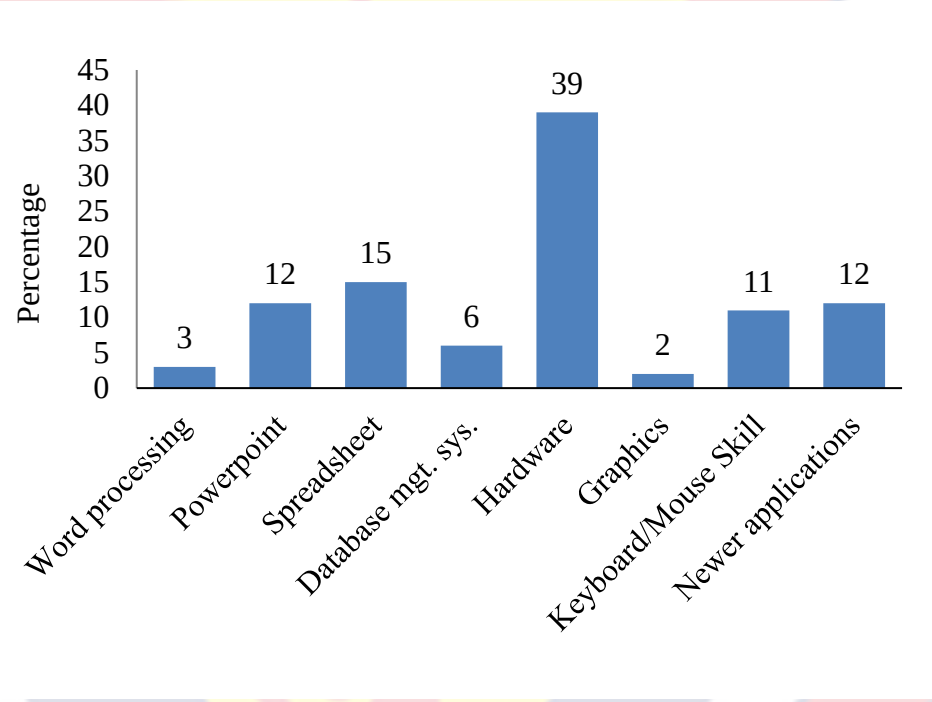

Figure 10:Teachers' ICT Training Needs

When asked to indicate the areas they would like to be trained to enhance the teaching of ICT, 47 (39%) indicated that they would like to be trained mainly in computer hardware, 18 (15 %) in Spreadsheet and 14 (12%) in PowerPoint and Newer version of the applications and 13 (11%) in Keyboard and Mouse skills.

Teachers' computer literacy is determined by training attended. This is supported by other literature (Albirini, 2006; Balanskatet al., 2006; Ozden, 2007)

which indicate that lack of effective training is one of the most challenging barriers to the teaching of ICT well. Judge, Puckett, and Cabuk (2004) sum up the situation this way, that Teacher familiarity, confidence, and skill in choosing software are dependent on teacher training and time. This point is particularly crucial in the face of the fact that ICT keeps changing with some student having access to computers and connectivity to enable them learn ahead. This will affect the confidence level of the teachers who do not consider themselves to be well skilled in using ICTs (BECTA, 2004). It is not surprising because though in-service is planned in the Education Sector Plan (ESP, 2010-2020), it is infrequent or of too short duration and is generally no more effective than no in-service training at all (GoG, 2012). While there are no firm guidelines on "how much, how often", any in-service training provided under the plan should be deliberately structured in a way which is calculated to bring about a sustainable improvement in quality teaching and learning.

Although, the majority of the teachers indicated that they have undergone various forms of ICT training mostly in a form of in-service training (Workshops, seminars, and short courses), the study seems to point to teachers' ill-preparedness to teach the subject. The numbers of teachers who have had Pre-service training in ICT are few compared to the number of schools in the study. The duration of ICT Pre-service training was also obviously not sufficient for the teachers to teach the subject well. Due to the relative newness of computer technology and the subject, many ICT teachers have not received adequate training to assist them to select the appropriate methodology and technologies to

teach. What compounds this issue even more is that most current teachers' pre-service preparation, and subsequent in-service courses were devised in reference to traditional educational technology and settings. Thus, the participants in these courses are not familiar with the processes, interaction patterns, features and possibilities of technology-mediated educational transactions. That said, designing and implementing successful In-service training programmes in the application of ICT is neither easy nor inexpensive and often woefully under-funded. There are also more cases of inadequate and ineffective training programmes than there are success stories. Moreover, success stories are not automatically transferable to other situations. Under such circumstances if teachers' knowledge level is low it will surely affect the students (OECD, 2010). Perhaps that is the main reason for the teachers' non-performance because if teachers are well instructed in the use of the ICT, they will be more competent to using the ICTs personally, in the classroom and also to instructing their students in the use of it. It appears therefore that the kind of training the teachers received was inadequate.

It should be noted that teachers' indication that they need training in hardware, a situation arising perhaps because they would like to be able to fix the computers when the need arises. Frustration with barriers such as technical problems with the computer hardware could affect the confidence of the teacher. It is obvious that in the event that there is a problem with the hardware, the teacher would like to attempt to rectify it instead of calling for an expert with any little problem that the computer develops.

Research Question 4: How Well Do the ICT Teachers Teach ICT?

The result of the observation of the ICT teachers over a period of one term spanning 13 weeks to ascertain their needs in pedagogy indicates that the teachers were not teaching well and therefore need improvement in their pedagogy. This is summarized in Table 6:

Table 6: ICT Teachers' Lesson Presentation Appraisal

Factors of Effective Teaching	Good No. (%)	Need Improve. No. (%)	Total No. (%)
Systematic lesson presentation	115(32)	245(68)	360(100)
Use of variety of methods	94(26)	266(74)	360(100)
Question techniques	72(20)	288(80)	360(100)
Practical activities using ICT tools	98(27)	262(73)	360(100)
Provide demonstration/guidance	74(21)	286(79)	360(100)
Effective use of TLM	176(49)	184(51)	360(100)
Class monitoring	88(24)	272(76)	360(100)
Motivating students	91(25)	269(75)	360(100)
Maintain control and discipline	239(66)	121(34)	360(100)
Appropriate level of language use	265(73)	95(27)	360(100)
Feedback techniques	93(26)	267(74)	360(100)
Mastery of subject matter	85(24)	275(76)	360(100)
Conclusion of the lesson	203(55)	157(45)	360(100)

As indicated in Table 6, elements of effective teaching such as 'Maintaining control and discipline in classroom', 'appropriate level of language use' to improve learners' understanding, and 'conclusions of the lessons', can be said to be 'Good'. However, the same cannot be said of the rest of the elements which was scrutinized, especially in the areas which are considered to be crucial to the teaching and learning of ICT. For example, 262 (73%) lessons need improvement in 'practical activities using ICT tools'. Similarly, 286 (79%) lessons observed need improvement in 'demonstration/guidance', 245 (68%) in 'systematic lesson presentation', and 275 (76%) in 'mastery of subject matter'. In fact, the general pedagogy is generally poor because all the salient areas of effective teaching especially in connection with ICT is weak and thus is a training need.

Research (Darling-Hammond, 1999; Rivkin, Hanushek, and Kain 2005; UNESCO, 2005) indicates that the most important school-based factor affecting student learning and for that matter effective teaching. The immediate and clear implication of this finding is that more can be done to improve education by improving the efficiency and effectiveness of teachers than by any other single factor in the school environment. If the teacher is ineffective, students under that teacher's tutelage will achieve inadequate progress academically. Many factors contribute to the quality of teaching, as posited by Shulman (1987) and Mishra and Koehler (2006). Unfortunately, the study showed that the ICT teachers are generally not teaching well and for that matter lack the pedagogical knowledge, which confirms the Mfantseman Education Annual Report (GES, 2010).

This study revealed that apart from the teachers maintaining control and discipline in the classroom, using appropriate language to improve learners' understanding and concluding the lesson well, all other elements of effective teaching variables were low. Classroom discipline for instance is designed to produce well-mannered students with personal, social and ethical abilities. An undisciplined classroom wastes time and energy, robs students of a quality education and diminishes a teacher's overall effectiveness in classroom control because the teachers would expend most of his or her energies in correcting the student. In fact time on task is also diminished if not wasted. Larrivee (2005) attests that there is a positive correlation between maintaining discipline and control in classroom and students' performance and therefore these are essential preconditions to teaching and learning. The question is why are the students not performing well in spite of these positive signals? The answer may not be far-fetched. 'Disciplined' environment which characterizes the classrooms as portrayed by this study, if stretched far has elastic limit. Edwards (1994) states that some educators stretch discipline to the extent that they see it as more important than the learning that goes on in the classroom. In such an environment every mistake is punished or severely chastised. If this situation is allowed to persist, it breeds anger, lack of cooperation and rebellious attitude towards the teacher. This in effect affects teaching and learning especially in an ICT classroom. As a result, if discipline is not properly applied it may defeat one of the general aims of teaching ICT which indicate that students are supposed to develop interest and use ICT in learning other subjects in a relaxed atmosphere.

After all, effective teaching is not about effective discipline, but about managing the classroom effectively.

This may be as a result of other factors which includes teachers having insufficient mastery of subject matter. The subject matter knowledge level of a teacher on topics has a direct bearing on the students' understanding of subject matter (Conant, 1963). Metzler and Woessmann (2010) make a point that teacher subject knowledge exerts a statistically and quantitatively significant impact on student achievement. It is therefore a challenge if the knowledge and skill of the ICT teachers are generally low as portrayed by this study.

Also, the methods used by the teachers to teach were not varied to the advantage of the students. Researchers have exposed the fact that quality teaching and learning can come about as a result of use of eclectic teaching method. This however was not the case. The study further revealed that there was no regular monitoring of individual or whole class performance. While appreciating the challenges involved in this exercise, especially taking into consideration some of the large classes, this feature is crucial for the teaching of ICT because the teacher has to go round to make sure that the students are following instructions to the letter, which will help improve their knowledge and skills. It is common knowledge that one of the ways to be effective as a teacher is to motivate your students to learn independently and continuously provide the students with opportunity to experience learning as enjoyable and satisfying to increase their self-motivation. Unfortunately, the teachers in this study did not motivate their student well.

One of the reasons for non-performance could be attributed to the fact that there was less use of demonstration in lessons and practical lessons. Perhaps it is because the period allocated to teach the subject is inadequate. The common question some teachers usually pose is what time will the teacher use to combine theory and practice? This raises the issue of teacher creativity and innovation.

ICT cannot be taught like other lessons. The pedagogical practices of instructing in ICT can range from only small enhancements of practices using what are essentially traditional methods, to more fundamental changes in their approach to teaching. Shulman (1986) reinforced this point with Pedagogical Content Knowledge and later by Mishra and Koehler (2006) who discuss the importance of the development of not just the pedagogy but Technological Pedagogical Content Knowledge for quality teaching. The teacher's own pedagogical beliefs and values play an important part in shaping learning opportunities so although teachers need extensive knowledge of ICT to be able to instruct properly, they also need to be helped to develop new pedagogies to achieve this. This has led to the call from various quarters for transformation of pedagogy.

In conclusion, this study provides a good picture of the views of ICT teacher that they generally have positive perception of the ICT curriculum in JHS. It was also evident that the facilities for implementing ICT curriculum are relatively adequate. That notwithstanding, it exposed the fact that ICT teachers' knowledge and skill in ICT as well as that of pedagogy is generally low. The ultimate question is what can be done to ameliorate the situation.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

This chapter summarizes the research study and also presents a summary of the findings of the study as well as conclusions drawn from the findings. Based on the findings and conclusions drawn from the study, recommendations are also made to guide educational practitioners and stakeholders.

Overview of the Study

The overriding purpose of this study was to determine the training needs of ICT teachers of Junior High Schools in the Mfantseman Municipality of Ghana by employing descriptive research method and census method of all 120 ICT teachers in the Junior High Schools of Mfantseman Municipality. The study was conducted over a period of 12 months with the help of one researcher and 5 research assistants. The research instruments deployed were teachers' questionnaire, which was used to collect data on the teachers' demographic profile, perception of the usefulness of the ICT curriculum, ICT infrastructure and ICT knowledge/ skill. Classroom Observation Instrument was also used to gather data on teachers' pedagogy in the classroom.

Key Findings

The study revealed that although most ICT teachers find teaching the subject difficult, they however have positive perceptions of the ICT curriculum. These teachers' positive perception of the ICT curriculum may have stemmed from the usefulness of the new curriculum. For instance teachers perceived ICT as helping to vary their teaching method, supporting classroom learning and broadening their horizon. This may have been informed by their firm knowledge of ICT curriculum. A number of studies have indicated that teachers' perceptions can have a profound effect on the teaching-learning process in particular teachers' perceptions of the usefulness of ICT both to the teacher and students.

On the question of availability and accessibility of ICT infrastructure, it came to light that the ICT infrastructure in Mfantseman JHSs was relatively adequate, especially in terms of functional computers and source of electric power. Most of the schools however are not connected to the internet. Time allocated on the time table (period) for teaching the subject was also found to be inadequate.

It is a fact that one factor that can make the most difference in improving a student's achievement is a knowledgeable and skillful teacher in front of the classroom especially in the use of ICTs. This study seems to suggest that while teachers' ICT knowledge level in Word Processing, Internet, and E-mail to some extent is relatively good; however, their ICT literacy level is generally low especially in Hardware, Spreadsheet, Keyboard/ Mouse skills and newer applications. This was corroborated by the teachers when they revealed that the

area that they require training to improve their knowledge and skill in ICT include Hardware, Spreadsheet, Powerpoint, New Application and Keyboard/ Mouse Skills in hierarchical order. The result further indicated that although majority of them have had some kind of ICT training, they found the training to be inadequate.

On the question of how well ICT teachers are teaching the ICT, the study showed that the majority of the teachers do not possess good pedagogical skills thus are not teaching ICT well as per the standard set out by GES and the colleges of Education.

Conclusions

A growing body of research clearly shows that student achievement is more heavily influenced by teacher quality than any other factor. The importance of teachers cannot therefore be over stressed. The perceptions of the teachers about a programme, their knowledge in the subject as well as pedagogy goes a long way to assist the teachers to perform well. The findings of this study on teachers' perception were good but that of knowledge of the subject matter and pedagogy poses a challenge.

Recommendations

Recommendations for Policy and Practice

To address the problems emanating from teaching ICT in the Junior High Schools, as per the result of this study, the following recommendations are made for policy and practice.

1. The government should ensure that schools without electricity are connected to the national grid so that they will also have a source of reliable power supply to power the computers for lessons. In the absence of power from the national grid, portable solar panels could be constructed in the hard-to-reach schools so that power will be accessible to the schools to be used.
2. In a long to medium term the government must team up with the telecommunication companies to explore ways to assist Junior High Schools get connected to the internet. In a short term the schools should be supplied with USB stick modems and routers.
3. The government should fully implement the laptops for students and teachers projects and it should be timely.
4. The government should by policy consider training more ICT teachers through pre-service form of education.
5. The Ministry of Education in collaboration with development partners (Universities, Non-Governmental Organisations, Faith Based Organisations, etc) should develop a systematized, initial and continuous, coherent and modular process of professional development in accordance with professional competency standards to build the capacity of the ICT teachers (in public and private schools).
6. There should be planned formal in-service training (INSET) which should be relevant and responsive to the needs of the ICT Teachers and must include Hardware, Spreadsheet, new versions of Applications,

Keyboard / Mouse Skills and Data Base Management System as well as general pedagogy. The duration for the training of the teachers should be considered. Obviously, the more time allocated for this, particularly hands-on time, the greater the mastery of these basic skills. Teachers should finish this basic course with at least the fundamentals necessary for them to practice and further develop their skills on their own back in their schools.

7. The Curriculum Research and Development Division (CRDD) should design ICT lessons on CD-ROMs to assist teachers to teach as well as encourage individual learning.
8. Ghana Education Service (GES) should create teacher development internet sites.

Suggestions for Further Research

1. The study covered only one out of hundred and seventy districts of the country, and therefore could not be used for generalization. It is recommended that similar studies could be conducted in other districts, regions or nation to prove, disprove or generalize the findings.
2. Students are the final recipients of whatever teachers do. I suggest therefore that future research should include students since their responses could feed into the needs of teachers.

REFERENCE

Adeosun, A.O., & Maduekwe, A.N. (2008). *Academic motivation and e-learning in teacher education: An ESL contextual analysis*. Proceedings of the 10th Annual Conference on WWW Applications, Cape Town, South Africa.

AECT. (2001). *A handbook of research for educational communication and Technology*, (Electronic version). Retrieved November 2011 from http://www.aect.org/intranet/publications/edtech/24/25-05.html

African Development Forum. (1999). *A strategy to accelerate African development through the in-creased use of information and communication technologies*. Retrieved on March 2012 from http://www.uneca.org/ADF99/adf99strategy.html

Albirini, A. (2006). Teachers' attitudes toward information and communication technologies, *Journal of Computer & Education, 47,* 373-398.

Almerich, G., Suárez-Rodríguez, J. M., Belloch, C., Bo, R. M. (2011). *Training needs of teachers in ICT: Training profiles and elements of complexity*. [Electronic version] Retrieved on April, 2012 from http://www.uv.es/RELIEVE/v17n2/RELIEVEv17n25eng.htm

Amadahe, F. K. (2002). *Fundamentals of educational research methods*. Mimeograph, U. C. C., Cape Coast.

Aral, N., Bütün-Ayhan, A., Ünlü, Ö.,Erdoğan, N., & Unal, N. (2006). Examination of attitudes towards computers among nursery school teachers. *ElektronikSosyalBilimlerDergisi, 5(17),* 25-32.

Armstrong, M. (1995).*A handbook of human resource management practice*. London :Kogan Page.

Armstrong, M. (2010). *A handbook of human resource management practice*. (10th ed.) London: Kogan Page. Cambridge University Press.

Asare-Bediako, K. (2002). *Professional skills in human resource management*. Accra: Kasbed Ltd.

Aydın, S. (2007a). Attitudes of EFL learners towards the internet. *The Turkish Online Journal of Educational Technology – TOJET, 6* (3), 18-26.

Balanskat, A, Blamire, R & Kefala, S. (2006). *A review of studies of ICT impact on schools in Europe*: Brussels. European Schoolnet.

Bandura, A. (1986). *Social foundations of thought and action*. Englewood Cliffs, NJ: Prentice-Hall.

Bauer, J. (2005). Toward technology in schools: Why it isn‘t happening. *Journal of Technology and Teacher Education*, *13*(4), 519-546.

Beardwell, I., & Holden, L. (1994). *Human resource management: A contemporary perspective*. London: Pitman Publishing.

Becker, H. J., & Ravitz, J. (1999). The influence of computer and internet use on teachers. Pedagogical practices and perceptions. *Journal of Research on Computing in Education, 31* (4), 356-384.

Becker, H. J. (1986*). Instructional uses of school computers: Reports from the 1985 national survey* (Issue l-6). Baltimore: Center for Social Organizations of Schools, Johns Hopkins University.

BECTA .(2004). *A review of the research literature on barriers to the uptake of ICT by teachers* [Electronic version] Retrieved on March 5, 2011 from http://www.becta.org.uk/page documents/research/barriers.pdf

BECTA. (2008). *Harnessing technology review 2008: The role of technology and its impact on education*. Retrieved on March 5, 2011 from http://dera.ioe.ac.uk/1423/1/becta_2008_htreview_report

Bernstein, B. (1996). *Pedagogy, symbolic control and identity: Theory research, critique*. London: Taylor & Francis.

Berry, A., & Milroy, P. (2002). Changes that matter. In J. Loughran, I. Mitchell & J. Mitchell (Eds.), *Learning from teacher research* (pp. 196 - 221). New York: Teachers College Press.

Bingimlas, K. A. (2009). Barriers to successful integration of ICT in teaching and learning environment: A review of the literature. *Eurasian Journal of Mathematics, Science and Technology Education,5*(3), 235-245. Retrieved on March 2011 from http://www.ejmste.com

Bishop, C.M. (2007). *Pattern recognition and machine learning: Information science and statistics.* New York, NY: Springer.

Black, S., & Lynch, L. (1996). Human-capital investment and productivity. *American Economic Review, 86* (2) 263-67

Borg, W. R., & Gall, M. D. (1989). *Educational research: An introduction* (5th ed.). New York, NY: Longman.

Nana-Amfoh, B. (Presenter). (2011, October 23). *Mission Ghana* [Television Broadcast]. Accra: Public Broadcasting Service.

Buabeng-Andoh, C. (2012). An exploration of teachers' skills, perceptions and practices of ICT in teaching and learning in the Ghanaian second-cycle schools, *Contemporary Educational Technology*, *3* (1), 36 - 49.

Bullock, D. (2004). Moving from theory to practice: An examination of the factors that preservice teachers encounter as they attempt to gain experience teaching with technology during field placement experiences. *Journal of Technology and Teacher Education*, *12* (2), 211–237.

Carlson, S., & Gadio, C. T. (2002). Teacher professional development in the use of technology. In W.D. Haddad & A. Draxler (Eds.*), Technologies for education: Potential, parameters, and prospects,* Paris and Washington, D.C.: UNESCO and AED, Retrieved April 25, 2011 from http://www.schoolnetafrica.net/fileadmin/resources/TeacherProfessionaDevelopmentIntheuseofTechnology.pdf.

Chambers, E. A. (2003). *Efficacy of educational technology in elementary and secondary classrooms: A meta-analysis of the research literature from 1992-2002*. Ph.D. dissertation, Southern Illinois University at Carbondale. ProQuest Digital Dissertations database.

Conant, J. (1963). *The Education of American Teachers*. NY: McGraw-Hill.

Condie, R., & Munro, B. (2007*). The impact of ICT in schools. -A landscape review*, BECTA Research, Retrieved on March 2011 from: http://partners.becta.org.uk/page documents/research/impact ict schools.

Cox, M., Webb, M., Abbott, C., Blakely, B., Beauchamp, T., & Rhodes, V. (2003). *ICT and pedagogy: A review of the research literature*. London: DfES and Becta

Cox, M., Preston, C., & Cox, K. (1999, September). *What factors support or prevent teachers from using ICT in their classrooms?* Paper presented at the British Educational Research Association Annual Conference, University of Sussex at Brighton. Retrieved on January 10, 2012 from http://www.leeds.ac.uk/educol/documents/00001304.htm

Cuban, L., Kirkpatrick, H., & Peck, C. (2001). High access and low use of technologies in high school classrooms: explaining an apparent paradox. *American Educational Research Journal*, *38* (4) 813 - 834.

Darling-Hammond, L. (December, 1999). *Teacher quality and student achievement: A review of state policy evidence*. Seattle: Center for the Study of Teaching and Policy, University of Washington

DfEE, (1999). *The national curriculum for England: ICT*. London: Department for Education and Employment.

Edwards, C. (1994). Learning and control in the classroom. *Journal of Instructional Psychology*, *21*(14) 340-346.

Eggen, P., & Kauchak, D. (2001). *Educational psychology: Windows on classrooms*. New Jersey Prentice Hall, Inc.

Elgort, I., Marshall, S. & Mitchell, G. (2003). *NESB student perceptions and attitudes to a new online learning environment*. Paper presented at the Annual International HERDSA Conference, Christchurch, NZ.

Empirica (2006). *Benchmarking access and use of ICT in European schools 2006.* Final report from Head Teacher and Classroom Teacher Survey. Bonn, Germany: European Commission.

European Round Table of Industrialists (1997). *Investing in knowledge: the integration of technology in European education*. Brussels: European Round Table of Industrialists.

EURYDICE (2004a). *Keeping teaching attractive for the 21st century. Key topics in education in Europe, Volume 3*. Brussels: European Commission EURYDICE.

Fabry, D., & Higgs, J. (1997). Barriers to the effective use of technology in education. *Journal of Educational Computing,17* (4), 385-395. Retrieved on March 2011 from http://www.tojet.net/articles/611.htm

Farrell, G., Isaacs, S., & Trucano, M. (2007). *Survey on ICTs in education in Africa*. Washington DC: International Bank for Reconstruction and Development.

Fowler, F. J. Jr. (1984). *Survey research methods*. Thousand Oaks, CA: Sage

Fraenkel, J. R., &Wallen, N.E. (2000). *How to design and evaluate research in education*, New York, NY: McGraw-Hill Companies Inc.

Frempong, G. K. (2010). *Ghana ICT sector performance review 2009/2010 : Towards evidence-based ICT policy and regulation 2, Policy Paper 8, 201*. Retrieved on December 2012 from www.researchictafrica.net

Garofalo, J., Kersaint, G., Horton, B., & Stohl, H. (2003). Technology beliefs and practices of mathematics education faculty. *Journal of Technology and Teacher Education*, *11*(4), 549–577.

Gay, L. R. (1996). *Educational research: Competencies for analysis and application*. New Jersey: Merrill, Prentice-Hall Inc.

Geer, R., & Sweeney, T. A. (2012). Students' voices about learning with technology. *Journal of Social Sciences*, *8*, 294-303.

GES (2002). Addendum to headteachers handbook. Accra: PaperPen Systems.

GES (2010). Detailed analysis of 2010 BECE result: Mfantseman Municipal. Saltpond: GES (Statistics and Planning Unit).

GES (2011). Detailed analysis of 2011 BECE result: Mfantseman Municipal . Saltpond: GES (Statistics and Planning Unit).

GES (2012). Detailed analysis of 2012 BECE result: Mfantseman Municipal . Saltpond: GES (Statistics and Planning Unit).

GES (2013). Detailed analysis of 2013 BECE results: Mfantseman Municipal. Saltpond: GES (Statistics and Planning Unit).

GES (2010, January). *Mfantseman education midyear review report*. Paper presented at annual review meeting of stakeholders in education in Mfantseman municipal. Saltpond: GES (Statistics and Planning Unit).

GES (2010, July). *Mfantseman education annual review report*. Saltpond: Paper presented at annual review meeting of stakeholders in education in Mfantseman municipal. Saltpond: GES (Statistics and Planning Unit).

GES [Basic Education Division] (2008). *Development in education in Ghana report*. Accra: Ghana Education Service.

GeSCI (2012). *Ghana senior high schools internet access project* Retrieved on December, 2012 from www.gesci.org/ghana-senior-high-schools-internet-access-project.html

Ghana Statistical Service (June, 2013). *2010 population and housing census: Regional analytical report, central region*. Accra : Ghana Statistical Service. Retrieved June 2013 from www.statsghana.gov.gh/2010_PHC_Regional_Analytical_ ReportsCentral

Gillwald, A., & Stork C. (2008). *Towards evidence-based ICT policy and regulation: ICT access and usage in Africa. Volume 1, policy paper 2. research ICT Africa network.* Retrieved September 2011 from http:// www.researchictafrica.net/publications

Gomes, C. (2005, April). Integration of ICT in science teaching: A study performed in Azores , Portugal. *Recent Research Development in Learning Technology, 47* (4) 47-61

Good, T. L., & Brophy, J. E. (2000). *Looking in classrooms*, (8th ed.). New York, NY: Longman.

GoG (2012). *Education strategic plan 2010 –2020: Volumes I: Policies, strategies, delivery, finance.* Retrieved on 12th January, 2013 at http://planipolis.iiep.unesco.org/upload/Ghana/Ghana_ESP_2010_2020 vol1.pdf

GoG. (2003). *The Ghana ICT for accelerated development [ICT4AD] policy: A policy statement for the realization of the vision to transform Ghana into an information-rich knowledge based society and economy through the development, deployment and exploitation of ICTs within the economy and society*. Accra: Graphic Communication Group. Retrieved on 30th November, 2011 from http://www.ict.gov.gh

GoG (2005). *Government of Ghana ministerial ICT policy statement*. Accra: NBS Multimedia.

GoG (2006). *The growth and poverty reduction strategy (GPRS II 2006 – 2009)*. Accra: National Development Planning Commission.

GoG (2008). *White paper on the report of the education reform review committee,* Accra: NBS Multimedia.

Grabe, M., & Grabe, C. (2007). *Integrating technology for meaning learning* (5th ed.). Boston, NY: Houghton Mifflin.

Granger, C. A., Morbey, M. L., Owston, R.D., & Wideman, H.H. (2002). Factors contributing to teachers' successful implementation of IT. *Journal of Computer Assisted Learning, 18,* 480 - 488. Retrieved on June, 2011, from http://web5.ebnet.com

Haddad, W. D. (2002). *ICT in education toolkit for policy makers, planners and practitioners*. Paris. UNESCO: Open Training Platform.

Haddad, W. D. (2007*). ICTs for education – A reference handbook. Part 2: analytical review. ICT in education toolkit*. Washington DC: World Bank.

Haddad, W.D., & Draxler, A. (Eds.), (2002*). Technologies for education: potential, parameters, and prospects*. Washington, D.C.: AED. Retrieved December 20, 2011 from http://ict.aed.org/infocenter/pdfs/TechEdBook.pdf

Haddad, W.D., & Jurich S. (2002). ICT for education: Potential and potency. In W.D. Haddad & A. Draxler (Eds.), *Technologies for education*. Paris: UNESCO and AED.

Hattie, J. (2003, October). *Teachers make a difference: What is the research evidence?* Paper presented at the Australian Council for Educational Research Annual Conference on Building Teacher Quality, Melbourne.

Heeks, R. (2005). *Foundations of ICTs in development: The information chain. DIG eDevelopment briefings, No.3/2005*. Manchester: Institute for Development Policy and Management

Hennessy, S., Harrison D., & Wamakote L., (2010). Teacher factors influencing classroom use of ICT in sub-saharan Africa. *Estoppel Online journal of African studies, 2* (2010) 39-54.

Hennessy, S., & Onguko, B. (Eds.). (2010). *Developing use of ICT to enhance teaching and learning in East African schools: A review of the literature*. Cambridge and Dar es Salaam: Faculty of Education, University of Cambridge and Aga Khan University Institute for Educational Development - Eastern Africa. Retrieved December 20, 2011 from http://www.educ.cam.ac.uk/centres/cce/publications/CCE_Report1_LitRevJune0210.pdf

Hong, K. S., & Koh, C. K. (2002). Computer anxiety and attitudes toward computers among rural secondary school teachers: A Malaysian perspective. *Journal of Research on Technology in Education*, *35*, 27- 48.

Howie, S. J., Muller, A., & Paterson, A. (2005). *ICT in South African secondary schools.* Cape Town: HSRC Press.

Ijaiya, N. Y. (2000). Failing schools' and national development: Time for reappraisal of school effectiveness in Nigeria. *Journal Educational Research. Evaluation*, *2* (2), 42.

InfoDev (2005). *Knowledge map: Teachers, teaching and ICTs.* Retrieved on November 10, 2009 from www.infodev.org

InfoDev/World Bank. (2007). *ICT-in-education toolkit for decision makers, planners & practitioners Version 2.0.* Retrieved on August 1, 2011 from www.ictinedtoolkit.org

International Telecommunication Union [ITU]. (2010).*World telecommunication / ICT development report [WTDR] 2010 monitoring the world summit on the information Society (WSIS), targets: A mid-term review. Geneva : Switzerland.* Retrieved January 28, 2011 from http://www.itu.int/pub/D-IND

Intsiful, J., Okyere, P. F., & Osae, F. (2003). *Use of ICT for education, research and development in Ghana: Challenges, opportunities and potentials.* Round table discussion on developing countries access to scientific knowledge, Abdus Salam International Centre for Theoretical Physics.

Isaacs, S., & Hollow, D., (Eds) (2012). *The eLearning Africa 2012 report*, ICWE: Germany. Retrieved on November 10, 2012, from http://www.elearning-africa.com/pdf/report/ela_report_2012.pdf

Jegede, P. O. (2008). Attitudinal characteristics and use level of Nigerian teachers. *Issues in Informing Science and Information Technology, 5*.

Jimoyiannis, A., & Komis, V. (2007). Examining teachers' beliefs about ICT in education: Implications of a teacher preparation program. *Teacher Development, 11* (2), 149-173.

Judge, S., Puckett, K., & Cabuk, B. (2004). Digital equity: New findings from the Early Childhood Longitudinal Study. *Journal of Research on Technology in Education, 36* (4), 383–396.

Kadel, R. (2005). How teacher attitude affect technology. *Learning and Leading with Technology, 39* (5), 34-47.

Karsten, R., & Roth, R. (1998). Computer self-efficacy: A practical indicator of student computer competency in introductory is courses. *Informing Science, 1* (3), 61-68.

Katz, R. (2012). Maximizing the impact of digitization: The global information 2012. *World Economic Forum 1* (11), 121-131.

Kington, A., Lee, T., Day, C., & Sammons P. (2003). *Critical review of the literature schools and teacher effectiveness and teachers work and lives: towards relational and relative effectiveness.* A vitae project symposium paper. Edinburgh: British Educational Research Association Conference.

Kline, R. B. (2005). *Principles and practice of structural equation modeling* (2nd ed.). New York, NY: Guildford.

Koehler, M. J. (2011). *TPACK – Technological pedagogical content knowledge*. Retrieved on 25 April 2012 from http: www.tpck.org

Koehler, M. J, & Mishra, P. (2008). Introducing TPCK. In AACTE Committee on innovation and technology (Eds.). *Handbook of technological pedagogical content knowledge (TPCK) for educators*. New York, NY: Routledge.

Korte, W. B., & Husing, T. (2007). Benchmarking access and use of ICT in European schools 2006. Result from head teacher and classroom teacher survey in 27 European countries. *Journal of E-Learning Papers*, *2* (1), 1-6.

Kozma, R., & Anderson, R. E. (2002). Qualitative case studies of innovative pedagogical practices using ICT. *Journal of Computer Assisted Learning 18*, 387-394.

Kozma, R. B. (2008). *Comparative analysis of policies for ICT in education in international handbook of information technology in primary and secondary education*. New York: Springer.

Lagrange J. B., Artigue M., Laborde C., & Trouche L. (2003). Technology and Mathematics Education, in A. Bishop, C. Keitel-Kreidt, J. Kilpatrick, F. Koon-Shing Leung (Eds.), *Second international handbook of mathematics education.* Part two, Dordrecht: Kluwer Academic.

Lau, C.T., & Sim, C.H. (2008). Exploring the extent of ICT adoption among secondary school teachers. *Malaysia International Journal of Computing and ICT Research*, *2* (2)19-36.

Leach, J. Ahmed, A. Makalima, S., & Power, T. (2006). Deep impact: An investigation of the use of information and communication technologies for teacher education in the global south. Research the issue, *DFID Research Series 58*. London: DFID

Lefebvre, S., Deaudelin, D., & Loiselle, J. (2006). *ICT implementation stages of primary school teachers: The practices and conceptions of teaching and learning.* Paper presented at Australian Association for Research in Education National Conference, Adelaide, Australia.

Lever-Duffy, J., McDonald, J. B., & Mizell, A. P. (2003). *Teaching and learning with technology.* Boston: Pearson: Allyn and Bacon.

Li, N., & Kirkup, G. (2007). Gender and cultural differences in internet use: A study of China and the UK. *Computers and Education, 48*, 301–317.

Loveless, A. M. (2003). The interaction between primary teachers' perceptions of ICT and their pedagogy. *Journal of Education and Information Technologies*, *8* (4), 313–326.

Mangesi, K. (2007). Survey of ICT and education in Africa: Ghana country report. *InfoDev ICT and Educational series*. Washington, DC: World Bank.

McGrail, E. (2005). Teachers, technology, and change: english teachers' perspectives. *Journal of Technology and Teacher Education, 13* (1), 5-24.

McMillan, J. H. (2000). Fundamental assessment principles for teachers and school administrators. *Practical Assessment, Research and Evaluation 7*(8) 10-25.

McNamara, C. (2008). *Employee training and development: reasons and benefits*. New York, NY: Authenticity Consulting, LLC. Retrieved on March 16, 2011 from http://www.managementhelp.org/index.html

Mehlinger, H. D., & Powers, S. M. (2002). *Technology and teacher education: A guide for educators and policymakers.* Boston: Houghton Mifflin.

Merriam-Webster Editorial Staff (2003). *Merriam-Webster's collegiate dictionary* (11th ed.). Springfield, MA: Merriam-Webster, Inc.

Metzler, J., & Woessmann, L, (2010). *The impact of teacher subject knowledge on student achievement: Evidence from within-teacher within-student variation*, IZA Discussion Papers No. 4999, Bonn: Institute for the Study of Labor.

Miller, J. A., & Osinski, D.M.,(1996). *Training needs assessment*. (Electronic version). Retrieved on July 23, 2011, from http://www.ispi.org/pdf/suggestedReading/Miller_Osinski.pdf

Ministry of Education, Youth and Sports [MoEYS] (October, 2004). *White paper on the report of the education reform review committee.* Accra: MoEYS

Ministry of Education Science and Sports [MoESS] (2007). *Teaching syllabus for information and communications technology (core): Junior high school*. Accra: MoESS.

Ministry of Education Science and Sports [MoESS] (August, 2006). *The Ghana information and communications technology (ICT) in education policy*. Accra: MoESS.

Mishra, P. & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record, 108* (6), 1017-1054.

MoE (2011). *Ghana ministry of education sector performance report* (2010). Retrieved on July 2012 from www.idpfoundation.org.

MoE (2012). *National Census 2011/2012 report on basic statistics and planning parameters for basic education.* Accra: EMIS.

Mooij, T. & Smeets, E. (2001). Modelling and supporting ICT implementation in secondary schools. *Computers and Education, 36*(3), 265-281.

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., Stout J. (1999). *Ways forward with ICT: Effective pedagogy using information and communications technology for literacy and numeracy in primary schools.* Retrieved on August 5, 2012 from http://www.ncl.ac.uk/ecl/research/project_ttaict

Muijs, D. (2004). *Doing quantitative research in education with SPSS.* London: Sage.

Myjoyonline (August 14, 2012). Teachers to go hi-tech with 65,186 laptops for teaching. Retrieved August 20, 2012 from www.myjoyonline.com.

National Council for Curriculum and Assessment [NCCA] (2004). *Information and communication technology in primary school curriculum: Guidelines for teachers*. Dublin: NCCA

Ndukwe, E. (2007). *ICT as a tool for achieving the MDG in Nigeria*. Retrieved on March 2011 from http://www.ncc.gov.ng

Newhouse, P. (2002). *Literature Review: The impact of ICT on learning and teaching*. Perth, Western Australian: Department of Education.

Obisi C. (2011). Employee training and development in Nigerian organisaitons: Some observations and agenda for research. *Australian Journal of Business and Management Research, 1* (9) 82-91. | Retrieved on August 2012, from http://www.ajbmr.com/articlepdf/AJBMR_16_09i1n9a9.pdf

OECD. (2003). Integrating information and communication technologies in Development programmes. Policy Brief. The OECD Observer, Paris: OECD. Retrieved on April 2012 from http://www.oecd.org

OECD]. (2010). Education at a glance: OECD indicators. Retrieved on April 2012 from http://www.oecd.org/edu/eag2010.pdf

Ofsted. (2008). *ICT in schools 2008-11: An evaluation of ICT education in schools in England.* Retrieved on March 2012 from http//www.ofsted.gov.uk/resources/11013

Ohakwe, S. N., & Okwuanaso S. I. (2006). Identification of information technology sub skills needed by national diploma secretarial studies graduates. *International Journal of Educational Research, 2* (1&2) 11.

Oldfield, A. (2010). A summary of teacher attitudes to ICT use in schools. *ITEC Project*. Retrieved on August 2011 from http://itec.eun.org/c/document_library

Omah, P. (2002). The Neutral Teacher, In: C. S. Brown (Ed) *Philosopher Discuss Education*, Banisngstoke. Macmillan.

Osakwe N.R. (2010). The influence of information and communication technology on teacher education and professional development in Delta State, Nigeria. *Asian Journal of Information Technology, 9* (5) 280-285

Osborne, J., & Hennessy, S. (2003). *Literature review in science education and the role of ICT: Promise, problems and future directions*. Bristol: Futurelab.

O'Sullivan, K., & Hamaide, M. (2001). *Calculation sheet of access to electricity by count*. Washington DC: World Bank.

Oyenike, A. (2010). Quality basic education development in Nigeria: Imperative for Use of ICT. *Journal of International Co-operation in Education, 13*(2).193-21.

Ozden, M. (2007). Problems of science and technology education in Turkey. *Eurasian Journal of Mathematics, Science & Technology Education, 3* (2)157-161.

Panagiotakopoulos, C. T., & Ioannidis, G. S. (2001). Assessing children's understanding of basic time concepts through multimedia software, *Computers & Education*, *38* (4), 331-349.

Papanastasiou, E.C., & Angeli, C. (2008). Evaluating the use of ICT in education: Psychometric properties of survey of factors affecting teachers teaching with technology . *Educational Technology & Society*, 11(1), 69-86.

Paraskeva, F., Bouta, H., & Papagianni, A. (2008). Individual characteristics and computer self-efficacy in secondary education teachers to integrate technology in educational practice. *Computers & Education, 50*, 1084–1091.

Pelgrum, W. J., & Law, N. (2003). ICT in education around the world: Trends, problems and prospects. Paris: *UNESCO*- International Institute for Educational Planning. Retrieved on January 17, 2010, from http://www.worldcatlibraries.org/wcpa/ow/.html

Pelgrum, W. J. (2001). Obstacles to the integration of ICT in education: results from a worldwide educational assessment. *Computers & Education, 37*, 163–178. (Electronic version). Retrieved on January 17, 2010, from ntua.gr/vvesk/ictedu/article5_pelgrum.pdf

Perraton, H., & Creed, C. (2000). *Applying new technologies and cost-effective delivery systems in basic education.* World Education Forum. Education for All. 2000 Assessment. Paris: UNESCO. Retrieved on March 10, 2011 from http://unesdoc.unesco.org/images/.pdf.

Peterson, R. (1998). *Training needs assessment* (2nd ed.). London: Kogan Page.

Polikanov, D., & Abramova, I. (2003). Africa and ICT: A chance for breakthrough? *Information, communication and society, 6* (1) 42-56.

Popkewitz, T., Tabachnick, B. R., & Zeichner, K. (1979). Dulling the senses: Research in teacher education. *Journal of Teacher Education, 30*, 52-60.

Porter, A. C., & Brophy, J. (1988). Synthesis of research on good teaching: Insights from the work of the institute for research on teaching educational leadership. *Journal of Teacher Education, 2* (4) 74-85.

Preston, C., Cox, M., & Cox, K. (2000). *Teachers as innovators in learning: An evaluation of the motivation of teachers to use information and communication technology.* South Croydon.: MirandaNet.

Quinn, J. B., Anderson P., & Finkelstein S. (1996). Managing professional intellect. *Harvard Business Review74* (2)71-80.

Rice, J. K. (2004). *Teacher quality: Understanding the effectiveness of teacher attributes.* Washington, DC: The Economic Policy Institute.

Rivkin S., Hanushek E. A. & Kain J. F. (2005). Teachers, schools, and academic achievement. *Econometrica 73*, (2) 341– 667.

Robinson, B., & Latchem, C. (2003). *Teacher education through open and distance learning*. London, Routledge Falmer.

Rodden N. B. (2010). *An investigation into the barriers associated with ICT use in the youthreach classroom. A case study of a centre for education in the North West.* Limerick: University of Limerick.

Ruthven, K., Hennessy, S., & Deaney, R. (2005). Incorporating Internet resources into classroom practice: Pedagogical perspectives and strategies of secondary school subject teachers. *Computers and Education, 44* (1), 1–34. Retrieved on July 22, 2010, from http://www.sciencedirect.com

Rychen, D. S., & Salganik, L. H. (2003). A holistic model of competence. In D. S. Rychen and L. H. Salganik (EDs.), *Key competencies for a successful life and a well-functioning society*. (pp. 41-62). Cambridge, MA: Hogrefe & Huber Publisher.

Sarantakos, S. (1998). *Social Research* (2nd ed.). Basingstoke: Macmillan.

Schollie, B. (2001). *Student achievement and performance levels in online education research study*. Edmonton: Alberta Online Consortium. Retrieved on July 22, 2010, from www.albertaonline.ab.ca

Sheard, J., & Carbone, A. (2007, November). *ICT teaching and learning in a new Educational paradigm: Lecturers' perceptions versus students' experiences*. Paper presented at the meeting of the Seventh Baltic Sea Conference on Computing Education Research Conference. Koli National Park, Finland 15-18.

Sherry, L. Billig S., Jesse D., & Waston-Acosta, D. (2001). Assessing the impact of instructional technology on student achievement. *T.H.E Journal, 27*(7), 40 - 43.

Shiel, G., & O'Flaherty, A. (2006). *NCTE 2005 census on ICT infrastructure in school statistics report*. Dublin: Educational Research Centre and National Centre for Technology Education. Retrieved on August 5, 2011, from http://www.ncte.ie/NCTEInitiatives/TechnologyintegrationinitiativeCensus Reports/.pdf

Shirley, B. S. O., & Napsiah, M. (2004). *The professional development needs of 'Ketua Panitia': A study of several secondary schools in Kuching, Sarawak.* Paper presented at Seminar KebangsaanPendidikanGuru, Kuching, Sarawak.

Shulman, L. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher, 15* (2), 4-14.

Shulman, L. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review, 57*(1), 1-22.

Sicilia, C. (2005). *The challenges and benefits to teachers' practices in a constructionist learning environment supported by technology*. Unpublished master's thesis, McGill University, Montreal.

Sim C. H., & Theng, B. (2006). The role of ICT in science education: Teachers perception, C*ambridge Journal of Education*, *32* (2), 219-232.

Siniscalco, M. T., & Auriat, N. (2005). *Questionnaire design: Quantitative research methods in educational planning*. Paris. UNESCO /International Institute for Educational Planning.

Slavin, R. E**.** (2007). *Educational research in the age of accountability*. Boston: Allyn & Bacon.

Spiro, R. J., Feltovich, P. J., Jacobson, M. J., & Coulson, R. L. (1991). Cognitive flexibility, constructivism, and hypertext: Random access instruction for advanced knowledge acquisition in ill-structured domains. *Educational Technology, 31* (1), 24-33.

Stennes, B. (2008). *Advantages and disadvantages of web-based learning* Retrieved on January 2, 2010, from http://www.selfgrowth.com/articlesWeb-based Learning.html.

Stoll, C. (1999*). High tech heretic: Why computers don't belong in the classroom and other reflections by a computer contrarian*. New York: Doubleday.

Sullivan, P. (2010). Empirical evidence of occupation and industry specific human capital, labour economics, *Elsevier, 17* (3) 567-580.

Tella, A., Tella, A., Toyobo, O. M., Adika, L. O., & Adeyinka, A. A. (2007). An assessment of secondary school teachers uses of ICTs: Implications for further development of ICT's use in Nigerian secondary schools. *The Turkish Online Journal of Educational Technology, 6* (3), 12.

Teo, T., Chai, C. S., Hung, D., & Lee, C. B. (2008). Beliefs about teaching and uses of technology among pre- service teachers. *Asia Pacific Journal of Teacher Education, 36* (2), 165-176.

Tezci, E. (2010). Attitudes and knowledge level of teachers in ICT use: The case of Turkish teachers (Electronic version). *International Journal of Human Sciences 7*(2). Retrieved on August 2011, from www.j-humansciences.com/ojs/index.php/IJHS/article/download

Toprackci, E. (2006). Obstacles at integration of schools into ICT by taking into consideration the opinions of the teachers and principals of primary and secondary schools in Turkey. *Journal of Instructional Science and Technology, 9* (1)1-16.

Travers, P. D., & Rebore, R. W. (2000). *Foundations of education: Becoming a teacher.* Boston: Allyn and Bacon.

Trucano, M. (2005). *Knowledge maps: ICTs in education*. Washington DC: InfoDev, World Bank

Trucano, M. (2006). A quick guide: ICT and education activities supported by USAID. InfoDev, World Bank. Retrieved on July 2011 from http://www.infodev.org/en/Publication.142.html.

United Nations (2005). *Millennium Development Goals Report*. New York: United Nations Department of Public Information.

United Nations Education Science and Culture Organization (UNESCO). (1998) . *World education report: Teachers and teaching in the changing world.* Paris UNESCO.

United Nations Education Science and Culture Organization (UNESCO) (2002). . *Information and communication technologies in teacher education: A planning guide*. Paris: UNESCO. Retrieved December 14, 2011, from http://unesdoc.unesco.org/images/.pdf

United Nations Education Science and Culture Organization (UNESCO) (2005). *EFA global monitoring report 2005. Education for all: The quality imperative.* Paris: UNESCO.

United Nations Education Science and Culture Organization (UNESCO) (2008). *ICT competency standards for teachers- Implementation guidelines version 1.0*. Retrieved 28th September 2011, from http://www.unesco.org/en/competency-standards-teachers

United Nations Education Science and Culture Organization (UNESCO) (2009). *World conference on education for sustainable development – Moving into the second half of the UN decade*. A paper presented at UNESCO conference in Bonn, Germany.

United Nations Education Science and Culture Organization (UNESCO) – International Institute for Educational Planning (IIEP) (2005). *Quantitative research methods in educational planning*. Paris: UNESCO /IIEP. Retrieved on August, 2010 from http://www.unesco.org/iiep.

Van Veen, K. & Sleegers, P. (2006). How does it feel? Teachers emotion in a context of change. *Journal of Curriculum Studies, 38*(1) 85-111.

Varank, I. (2006). *The effects of computer training on Turkish teachers' attitudes toward computers and the effects of computer supported lessons on Turkish students' reported motivation to lessons*. Unpublished Doctoral Dissertation.University of Turkey, Turkey.

Warschauer, M., Knobel, M., & Stone, L. A. (2004). Technology and equity in schooling: Deconstructing the digital divide. *Educational Policy, 18* (4), 562–588

Webb, M. E. (2002). Pedagogical Reasoning: issues and solutions for the teaching and learning of ICT in secondary schools, *Education and Information Technologies, 7*, (3), 237-255.

Whitty, G. (1999) Professional competences and professional characteristics: The Northern Ireland approach to the reform of teacher education. In D.Hustler and D, McIntyre (2001), *Developing Competent teachers; approaches to professional competence in Teacher Education*. London: David Fulton.

World Bank (2001). *ICT at a glance Ghana*. Accra. Development Data Group.

World Economic Forum [WEF] (2006). *Global information technology report, 2005/06. Leveraging ICT advancement for development* Retrieved on January 10, 2012, from http://www.weforum.org/en/initiatives/gcp/Global/Information/ Technology/.html

Yelland, N. (1998).Empowerment and control with technology in the early childhood years, *Educational Practice and Theory, 20* (2) 45-55.

Yuen, A., Law, N., & Wong, K. (2003). ICT implementation and school leadership. *Journal of Educational Administration*, 41 (2), 158-170.

Zhao, Y., & Cziko, G. A. (2001). Teacher adoption of technology: a perceptual control theory perspective. *Journal of Technology and Teacher Education, 9*(1), 5-30.

Zhao, Y. (2003b). *What should teachers know about technology: Perspectives and practices*. Greenwich, CT: Information Age.

APPENDICES

APPENDIX A

UNIVERSITY OF CAPE COAST

FACULTY OF EDUCATION

DEPARTMENT OF ARTS AND SOCIAL SCIENCE EDUCATION

QUESTIONNAIRE FOR TEACHERS

The purpose of this study is to collect information on training and development needs of ICT teachers in Junior High Schools in Mfantseman municipality of Ghana. I will therefore appreciate if you will provide frank answers to all the questionnaire items. You are fully assured of the confidentiality of all information provided in this paper. Thanks for your co-operation.

SECTION A: DEMOGRAPHIC DATA

Instruction: Please kindly tick (√) the appropriate responses to each item

1. Gender Male [ ] Female [ ]
2. Highest qualification (please specify) ……

   Senior High School Certificate,

   Certificate 'A',

   Diploma in Education [Dip. Ed.],

   Higher National Diploma[HND],

   Bachelor in Education [B Ed.]

   Others (please specify)
3. Number of years teaching ICT…….

SECTION B: TEACHERS' PERCEPTION ABOUT THE ICT CURRICULUM

Please answer questions 4 to 11 using the scale below. Please indicate the extent to which you agree or disagree with the following statements by a tick in the box. Mark EACH item.

No	Statement	Strongly Disagree (1)	Disagree (2)	Mostly Agree (3)	Agree (4)	Strongly Agree (5)
4.	The introduction of ICT into the JHS curriculum is good					
5.	Teaching ICT subject is difficult					
6.	Teachers have knowledge of ICT curriculum (syllabus)					
7.	ICT helps students to learn					
8.	ICT supports classroom learning					
9.	ICT helps to vary teaching method					
10.	ICT broadens teachers' horizon					
11.	Teachers are well prepared to teach ICT					

SECTION C: AVAILABILITY AND ACCESSIBILITY OF ICT INFRASTRUCTURE

12. (i) Does your school own functional computers?

Yes [ ] No [ ]

(ii) If yes, which of the options best describes the quantity?

Adequate [ ] somewhat adequate [ ] inadequate [ ]

(iii) If no, does your school have access to computers elsewhere outside school?

Yes [ ] No [ ]

(iv) If yes, what is the ratio of students to computers available?

1:1 [ ] 2:1 [ ] 3:1 [ ] 4: 1 and above [ ]

13. Does your school have internet connectivity?

Yes [ ] No [ ]

14. Does your school have source of reliable electricity?

Yes [ ] No [ ]

15. (i) Do you own a computer?

Yes [ ] No [ ]

(ii) If yes, do you use it for school work?

Yes [ ] No [ ]

16. How many periods are allocated on the timetable for ICT in a week?

1 period [ ] 2 periods [ ] 3 periods [ ] Above 4 periods [ ]

17. How would you describe the period allocated for ICT?

Adequate [ ] Somewhat adequate [ ] Inadequate [ ]

SECTION D: TEACHERS' ICT KNOWLEDGE AND SKILLS

Please answer questions 18-27 using the scale below:

Expert (5): able to do tasks with confidence and can teach others.

Confident (4): able to do tasks without help with confidence

Average (3): able to do tasks without help but lacks confidence

Basic (2): manages tasks with help

Beginner (1): cannot understand its function

Rate yourself in the use of the applications listed below. Tick [√] where applicable**.**

No.	Application software	Expert	Confident	Average	Basic	Beginner
18.	Word processing					
19.	Excel					
20.	Database management system					
21.	Power Point					
22.	Graphic/drawing					
23.	E-mail					
24.	Internet					
25.	Keyboard/Mouse s					
26.	Hardware					
27.	Newer versions of application above					

SECTION E: TRAINING AND DEVELOPMENT

Tick [√] where applicable

28. (i) Did you receive any form of ICT training before teaching ICT?

Yes [ ] No [ ]

(ii) If yes, what kind of training

Pre-service [ ] In-service [ ] self-tutored [ ] private [ ]

29. How would you rate your training in terms of preparing you to teach ICT subject?

Good [ ] satisfactory [ ] inadequate [ ]

30. Indicate the area (applications) that you require training to be able to improve upon your performance as ICT teacher .

……

Thank you for taking the time to complete the questionnaire!

APPENDIX B

CLASSROOM OBSERVATION INSTRUMENT

Number of Student……..... Level/Form …….....

Subject…….Topic……

Lesson Objective…….....

.....

RATINGS

Excellent - 5 Good - 4 Satisfactory - 3 Needs Improvement - 2 Poor - 1

LESSON PRESENTATION Tick[√] as appropriate

No.	Elements of lesson delivery	5	4	3	2	1
1	Effective and relevant Introduction based on RPK					
2.	Systematic and sequential presentation					
3.	Uses variety of methods					
4.	Questions techniques					
5.	Organizes learner-centered activities.					
6.	Effective use of TLM e.g. computers, textbooks,etc					
7.	Regular monitoring of individual/whole class					
8.	Motivating and sustaining students' interest					
9	Provide guidance and practice in class					
10.	Maintaining control and discipline					
19.	Use of language to improve learner understanding					
20.	Feedback techniques					
21.	Mastery of subject matter					
22.	Conclusion of lesson					

APPENDIX C

CLASSROOM OBSERVATION SCORING GUIDE

a.Lesson Introduction

Rating	Description
5	Effective and relevant introductory knowledge/skills/attitudes which are linked with previous knowledge
4	Effective introduction linked to previous knowledge
3	Introduction not linked to previous knowledge
2	Poor and irrelevant introductory activity
1	No introduction

b. Developing the lesson

i.Lesson sequence

Rating	Description
5	Systematically and sequentially presents activities through the lesson
4	Systematically and sequentially presents activities almost through the lesson
3	Sometimes presents activities logically
2	Poorly presents activities in the lesson
1	No attempt to presents activities in the lesson sequentially

ii. Use of teaching methods

Rating	Description
5	Effectively employs various methods with learner centred activities
4	Employs various methods with learner centred activities
3	Employs fewer methods, but activities insufficient to engage most student
2	Employs only one method of teaching with little students involvement
1	Overuse of lecture method with no students involvement

. iii. Questioning techniques

Rating	Description
5	Effectively employs various forms of questions and well distributed
4	Employs various forms of questions and well distributed
3	Employs various forms of questions but not well distributed
2	Employs only knowledge level questions
1	Teaches without asking questions

iv. Student centred activities

Rating	Description
5	Effectively uses many forms of student-centred activities
4	Uses many forms of student-centred activities
3	Uses m forms of student-centred activities
2	Uses only one form of student-centred activities
1	No use any forms of student-centred activities

v. TLM

Rating	Description
5	TLM is well prepared and utilized at the right time for maximum effect
4	TLM well prepared but not well utilized
3	TLM present but not used at the right time
2	TLM present but not used
1	No TLM is used

vi. Class monitoring

Rating	Description
5	Effectively and regularly monitors whole class and individuals
4	Regularly monitors whole class and individuals
3	Monitors only whole class / individuals
2	Poorly monitors whole class/ individuals
1	No monitoring

vii. Motivation and sustaining students' interest

Rating	Description
5	Uses various motivation strategies with effect
4	Uses few motivation strategies
3	Uses only clapping as motivation
2	Uses wrong motivational strategies
1	Uses no motivational strategies

viii. Practical

Rating	Description
5	Effective demonstration, guide and allows for student to experience
4	Demonstration and guide student to experience
3	No demonstration but guide student to experience
2	No demonstration and guide but student experience
1	No demonstration , no guidance and no student experience

ix. Class control and organization

Rating	Description
5	Very good Teacher - students relationship which leads to discipline during the lesson
4	Good Teacher-students relationship which lead to discipline during the lesson
3	Satisfactory Teacher - students relationship but no discipline throughout the lesson
2	Relates poorly with learners and does not promote good learner behavior and discipline sometimes in the lesson
1	Relates poorly with learners and does not promote good learner behavior and discipline throughout the lesson

x. Language level

Rating	Description
5	Effectively balances language and technical terms to promote understanding
4	Balances language and technical terms to promote understanding
3	Attempts to balance language and technical terms to promote understanding
2	Concentrate less on technical terms
1	Concentrate on technical terms

xi. Feedback

Rating	Description
5	Uses various feedback techniques to emphasize the main points and provide opportunity for correction
4	Uses only one feedback technique by asking the students to ask questions
3	Provides summary and highlights the main points only
2	Poor handling of learner questions and no opportunity for correction
1	No feedback technique is used

xii. Mastery of subject matter

Rating	Description
5	Confidence and refers less to the textbook, add unto the textbook, manipulate
4	Demonstrate knowledge and can adapt subject taught to JHS level
3	Refers less to the textbook and gives additional information (in context)
2	Refers to the textbook all the time and has difficulty responding to questions
1	Reads from the textbook and have difficulty manipulating TLM (computers)

c. Conclusion of the lesson

Rating	Description
5	Uses summary and various feedback techniques to conclude
4	Uses feedback techniques
3	Uses oral question and written exercise to conclude
2	Uses only questions to orally evaluate the student
1	No use of feedback technique or summary

APPENDIX D