UNIVERSITY OF CAPE COAST

# CHALLENGES OF INTEGRATING INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) IN BASIC SCHOOLS OF CAPE COAST METROPOLIS

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# CHALLENGES OF INTEGRATING INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) IN BASIC SCHOOLS OF CAPE COAST METROPOLIS

BY

DOUGLAS YEBOAH

Dissertation submitted to the College of Distance Education of the University of Cape Coast, in partial fulfillment of the requirements for award of Master of Education Degree in Information Technology

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## DECLARATION

### Candidate's Declaration

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

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

Name: Douglas Yeboah

### Supervisor's Declaration

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

Supervisor's Signature:…….. Date:…….

Name: Mr. Palmas Anyagre

# ABSTRACT

The study investigated challenges of integrating information and communication technology (ICT) in basic schools of the Cape Coast metropolis in the Central Region of Ghana. The purpose of the study was to find out ICT resources available for use in Basic schools, ICT resources teachers actually use, ICT skills teachers have, factors that militate against the use of ICT in teaching and learning of various subjects, and possible solutions to the challenges of integrating ICT in teaching and learning of various subjects in Basic schools.

The descriptive survey design was used. Questionnaire was used as the main instrument for data collection and data obtained were analyzed using percentages and frequency distributions.

The population of the study comprised all the teachers of public Basic schools in the Cape Coast Metropolis of the Central Region of Ghana. A sample size of 242 teachers was selected from 22 schools out of 82 public basic schools. The random number method of the simple random sampling technique was used in the sampling procedure.

Among other findings were that, ICT resources available for use in Cape Coast public basic schools are mainly computers, with very few schools having television sets. Also, inadequate and unavailable ICT resources, lack and unstable sources of electricity, and lack of integration skills were mentioned as the inhibiting factors of ICT integration into the curriculum.

Recommendations based on the findings and conclusions were made to stakeholders of education in Ghana and future researchers. Among the recommendations was that the government and other stake holders of education in Ghana should consider providing a variety of Information and Communication Technologies or resources proportionally to all public basic schools to encourage more effective teaching and learning.

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# DEDICATION

To my wonderful mother, Madam Esi Egyirba and in memory of my late father

Mr. Sebastian Kwabena Aborokwa Yeboah

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# CHAPTER ONE

# INTRODUCTION

## Background to the Study

Information and Communication Technology (ICT) is developing at a very fast rate and its impact on socio-economic activities cannot be over-emphasized. It has been integrated into virtually every arena of life, including commerce, education, civic activities and governance among others, in developed countries and has become a critical factor in creating wealth worldwide (Opoku, 2004).

Ghana, a developing country, also recognizes the relevance of Information and Communication Technology to her socio-economic development. In the light of this, the Ghana ICT for Accelerated Development (ICT4AD) policy was formulated with an overall objective to "engineer an ICT-led socio-economic development process with the potential to transform Ghana into a middle income, information-rich, knowledge-based and technology driven economy and society"(Republic of Ghana, 2003, p.8). Among its specific objectives, the ICT4AD is to "promote an improved educational system within which ICTs are widely deployed to facilitate the delivery of educational services at all levels" (Republic of Ghana, 2003, p. 9). It is expected that the introduction of ICT into the educational system would improve the academic performance of teachers by encouraging them to improve their ability to use and apply technology in their

jobs. It is hoped that teachers' use of technology in education would improve educational outcomes and increase technological skills.

In January 2009, the then minister of education Mr. Alex Tettey-Enyo stated in the forward of a document on ICT in Education Policy (2008), in Ministry of Education [MOE] (2009) that:

> The deployment of ICT into Education will result in the creation of new possibilities for learners and teachers to engage in new ways of information acquisition and analysis. ICT will enhance access to education and improve the quality of education delivery on equitable basis.
>
> The Government is therefore committed to a comprehensive programme of rapid deployment and utilization of ICT within the Education Sector to transform the education system and thereby improve the lives of our people (p. 4).

The minister's statement indicates that equitable deployment and effective utilization of ICT potentially would enhance access and quality of education delivery thereby improving learner achievement.

In harmony with perception of the prospects of ICT in education, the NDC Government under the presidency of His Excellency Mr. John Dramani Mahama from 2013 supplied notebook computers to various Basic and Senior High Schools in the country and also organized one-week workshops for teachers on district bases on the use of computers in education, all through the RLG Communications Inc.

The foregoing discussions emphasize the importance Government of Ghana and various stake holders attach to integration of ICT in education. It is therefore pertinent to appraise the status quo in this regard, identifying possible challenges militating against the efforts of integrating technology in learning and teaching environments, if any, in order to address them and ensure successful ICT policy implementation.

**Statement of the Problem**

Commitment by the Government of Ghana and other stakeholders to enhance quality of education through ICT integration seems to be very high. However, in my visits to some schools, I noticed that there were some computers and other communication technologies such as television in the schools but were not used in teaching and learning of various subjects other than ICT as a subject. It is therefore imperative to investigate the challenges that militate against successful integration of ICT in the teaching and learning of various subjects in harmony with educational policies and efforts of various stakeholders in this light.

**Purpose of the Study**

The purpose of the study was to investigate the possible challenges that militate against successful integration of ICTs in Ghana's Basic educational institutions, specifically, in the Cape Coast Metropolis. The specific research objectives were to identify:

1. ICT resources available for use in Basic Schools.

2. ICT resources teachers actually use in teaching their respective subjects.
3. ICT skills Basic school teachers have.
4. factors that militate against the use of ICTs in teaching and learning of various subjects.
5. possible solutions to the challenges of integrating ICTs in teaching and learning of various subjects in Basic schools.

**Research Questions**

The following research questions were used to assist in the achievement of the purpose of the study.

1. What ICT resources (software, hardware, etc.) are available for use in basic schools?
2. What ICT resources do teachers use in teaching their respective subjects?
3. What ICT skills do Basic School teachers have?
4. What factors militate against the use of ICTs in teaching and learning of various subjects?
5. What are the possible solutions to the challenges of integrating ICTs in teaching and learning of various subjects in Basic schools?

## Significance of the Study

The findings of the study will inform policy makers and other stakeholders of education on challenges faced by teachers of Basic Schools in integrating ICTs in teaching and learning of various subjects. This will enable appropriate measures to be instituted to support successful ICT integration.

Again, the study will inform heads of schools, Human Resource Department officers, circuit supervisors, managers of education units and directors of education among others on the skills teachers need to successfully integrate ICTs in teaching their respective subjects. Furthermore, the study will add to the stock of research materials on ICT integration in education. It will be useful to researchers seeking information related to ICT integration in schools and also inform through recommendation other related areas worthy of further research.

## Delimitation of the Study

Many are the teachers in the Cape Coast Metropolis that might be of relevance to the study. However, the study was delimited to teachers of 22 basic schools out of a total of 82 public basic schools in the Cape Coast Metropolis.

Again, ICT in education is a broader topic with several aspects. In this study, however, the main concern was about the challenges teachers of Basic Schools face that militate against successful integration of ICT in the teaching and learning of various subjects.

## Limitations of the Study

One limitation of the study is that the results might not be 100% true representation of the situations in all the schools in the Cape Coast Metropolis because only teachers of a sample of schools was used as respondents of the study. This might affect the generalizability of the findings; it might not be appropriate to generalize the results to all the Basic schools in the metropolis. The findings, however, presented a better understanding of general challenges of ICT integration across the curriculum.

Another limitation in relation to the design is that some participants might misrepresent the facts in order to present to me a favorable impression or to save the image of their school. This might distort the true nature of the existing state of affairs thus affecting the internal validity.

Lastly, a limitation of the measuring instrument – questionnaire – is that there were low return rate thus not getting the representation of the originally selected sample.

## Organisation of the Study

This study was structured into five main chapters. Chapter one is the introduction of the study. It describes the background to the study, statement of the problem and purpose of the study. It also sets out four research questions the study was expected to answer, significance of the study, delimitation of the study and limitations of the study. It further explains terms as used in the study which readers might find difficult to understand, as well as organization of the study.

Chapter two contains an in-depth review of related literature on the topic. The chapter ends with a summary of the literature.

Chapter three describes the methods used in conducting this research. It comprises the research design, population of the study, sample size, sampling procedure, data collection instrument, pilot-testing, administration of instrument and data analysis plan.

The analyses of the results and findings from the study are discussed in chapter four. Chapter five contains summary, summary of the main findings, conclusions drawn from the findings, recommendations of the study and suggestions for further study.

# CHAPTER TWO

# REVIEW OF RELATED LITERATURE

## Overview

This chapter discusses the opinions expressed by various authors on the subject. It examines how ICT in education is implemented through the teacher. Teachers' philosophies of education are informed by the learning theories they hold. Therefore the chapter takes a look at the place of ICT within pedagogy which will inform how ICT is used within pedagogy. It then discusses the theories behind the use of ICT in education and the role of the teachers as informed by learning theory.

Because this study examines the integration of ICT, it is necessary to discuss the concept of "integration" of ICT. The discussion is extended to the processes that are believed to take place where ICT is integrated. Previous research on ICT integration are then reviewed taking notice of teachers' perceptions of the integration of ICT into the curriculum, with attention to some challenges faced by teachers in integrating ICT into the curriculum.

Because ICT integration is also guided by policy, the chapter reviewed the ICT policies of some developed countries and developing countries and then examined the Ghanaian policy in particular. The chapter ends with a summary of the review.

## ICT in Pedagogy

Before examining ICT in pedagogical context, I discuss the concept "ICT" to assist in determining the position of ICT within pedagogy.

### What is ICT?

The Qualification and Curriculum Authority in the United Kingdom (UK) (cited in Kennewell, Parkinson, & Tanner, 2000, p. 1) defines ICT as "the range of tools and techniques relating to computer-based hardware and software; to communications including both directed and broadcast; to information sources such as CDROM and the Internet; and to associated technologies such as robots, video conferencing and digital TV." This means ICT is an extension of Information Technology (IT) that includes hardware, software and Internet connectivity. Connectivity provides access to the internet, local networking infrastructure, and videoconferencing and thus provides communication within IT (Shelly, Cashman, Gunter & Gunter, 2002).

Toomey's definition elaborates upon the underlying purposes of using ICT's in education. He defines ICT as a tool for teaching and learning that "relates to those technologies that are used for accessing, gathering, manipulating and presenting or communicating information" (UNESCO, 2003). This means ICT is a resource or tool that can be used for different purposes in the pedagogical environment.

## ICT in a Pedagogical Context

It is important to understand what is meant by pedagogy in order to be able to locate the place of ICT within the context of the former. Pedagogy is defined in many ways, but is broadly based on the common understanding that pedagogy is the science of teaching (Webb & Cox, 2004). According to Webb & Cox, pedagogy does not remain static over a period of time. Webb and Cox assert that pedagogical changes are influenced by "growing knowledge that has become more differentiated and more integrated and that the developments in our understanding of cognition and metacognition have influenced the conceptualization of pedagogy" (2004, p. 237). Therefore pedagogy can be changed to suit the needs of the time. Watkins and Mortimore describe the current model of pedagogy as:

> "Offering an increasingly integrated conceptualisation which specifies relations between its elements: the teacher, the classroom or context, content, the view of learning and learning about learning" (as cited in Webb & Cox, 2004, p. 237).

The first identified element, the teacher, is responsible for organising all the other elements in order for learning to take place. Cloke and Sharif (as cited in Maholwana-Sotashe, 2007) view pedagogy as being about teachers' behaviour in the classroom. Mumtaz (2000) highlights that the teachers' behaviour in the classroom is influenced by the teachers' pedagogical content knowledge. Pedagogical content knowledge includes knowing what s/he wants to achieve (the outcomes of the lesson), knowing the learners' level of knowledge (learners'

knowledge), knowing the subject content (subject matter), organising the subject matter to fit the learners' knowledge (lesson planning) and organising the relevant teaching and learning materials that can be accessible in the learning environment (affordances) (Mumtaz, 2000).

ICT is one of the resources that can be organised to be accessible in the learning environment. Therefore in teaching, ICTs are placed under the affordances (Shulman as cited in Webb & Cox, 2004). Gibson (as cited in Armstrong et al, 2005) suggests that any tool provides affordance as perceived by the user. Therefore affordance is the kind of support the tool provides a user in terms of the user's perception and belief. Webb and Cox view ICT as a tool that increases the degree of affordance; however suggest that teachers "need to be able to identify affordances in any suitable software for exploring and developing the ideas and skills that are to be taught" (2004, p. 238).

In light of the fact that ICT is a relatively new resource and that most of the teachers were never exposed to use of ICT in their training (Kearsley, Hunter & Furlong, 1992), it is useful to reflect upon how this affects the teachers' role in the classroom. In doing so, I need to discuss the role of the teacher and the use of ICT within teaching. Cloke and Sharif argue that: "Teachers' beliefs and [learning] theories about teaching are major factors influencing teachers' use of ICT in their teaching" (as cited in Maholwana-Sotashe, 2007). I therefore discuss the teachers' role and the use of ICT with reference to the key learning theories: behaviourism, cognitive constructivism and social constructivism. Under each learning theory I discuss how the theorists view knowledge and the role of the

teacher. Subsequently, I discuss the role of ICT as underpinned by each learning theory.

## Behaviourism

General Description

This is a theory of learning which emphasizes that learning takes place when there are observable changes in learners' behaviour (Orlich, 2000). B.F. Skinner, the behaviourist, believes that we know because of the world that acts on us; we "grasp or take in" what the world brings to us (Skinner as cited in Ozman & Craver, 1986). In elaborating upon the behaviourist approach, Hinchey (1998) argues that behaviourists believe that knowledge is out there to be found and as such constitutes factual and verifiable information.

The role of scientist is therefore to discover the "true facts" about the world and bring them as tied or fixed knowledge to the recipients of knowledge. The recipients include the teacher who cannot argue against what scientists claim to be "true" knowledge. In other words the teachers' understanding of knowledge is subject to what scientists believe to be true. In turn, teachers view learners as tabula rasa which suggests the teachers' role as "passive transmitters of knowledge" (Elbaz as cited in Maholwana-Sotashe, 2007) to learners who cannot argue against what teachers believe to be "true knowledge".

Kennewell et al. (2000) view the behaviourist approach as implying a very limited role for the teacher. The teacher is seen to be the deliverer of instruction or the transmitter of knowledge that cannot be contested by the learner. Instructivist teachers begin their lessons by presenting information from lower order tasks to

higher order tasks. As the knowledgeable elements in the teaching process, the teachers "identify the type of discrimination required in particular tasks, and design a specific sequence to teach the discrimination so that only the teacher's interpretation of the information is possible" (Magliaro, Lockee & Bruton, 2005, p. 44).

Within the behaviourist perspective, the teacher repeatedly presents facts to the learner. Repeated presentation encourages memorization of facts by learners (Magliaro et al., 2005). Corno and Snow (as cited in Magliaro et al. 2005, p. 43) refer to this as "Direct Instruction" (DI) which describes a "range of instructional models used in face-to- face teaching and learning contexts – all designed to promote on-task student behaviour by the teachers' effort to monitor and control student classroom attention and persistence".

Over and above teacher control, face-to-face teaching is used to ensure that learners remain active participants in the teaching and learning process even if their participation is non-verbal: "It is important to emphasize that student does not passively absorb knowledge from the world around him but must play an active role, and also that action is not simply talking. To know is to act effectively, both verbally and nonverbally" (Skinner as cited in Magliaro, Lockee, & Burton, 2005, p. 42). It is therefore, within the teacher's capacity to create an environment that will trigger learners' behaviour in the classroom. Because behaviourists believe in "quantity" of content they believe that the factual knowledge presented to learners should be timeously measured by teachers.

Frequent testing is used as an instrument to measure changes in learners' behaviour (Kanuka & Anderson as cited in Maholwana-Sotashe, 2007). "Teachers use some form of behaviour modification with a reward system to reinforce students for displaying appropriate behaviours" (Orlich, 2000, p. 47). The purpose of using the reward system is to strengthen the occurrence of positive behaviours (Schunk, 2004).

## ICT Supported by Behaviourist Principles

Even before the sophisticated ICT's came into being, computers were already being used for teaching. In the 50's, technology was introduced in education in the form of teaching machines which were invented by Skinner to assist teachers with the delivery of instruction during the teaching process. He believed that the teaching machine would perform the teaching role far better than teachers (Kennewell et al. as cited in Maholwana-Sotashe, 2007). The machines were programmed so that they

presented the learners with the facts or information that they (learners) had to acquire. Memorisation of facts was done through drill and practice. After continuous drill and practice the machine was able to test the learners' knowledge and if the learner performed well, the machine would provide the learner with the next tasks, which acted as a type of reinforcement.

In the 1980s computer based activities were designed to assist the teachers in the teaching process. Amongst these was Computer Assisted Instruction (CAI) which Taylor (1980) termed the 'tutor mode'. He defines the tutor mode as the

process where computers are programmed by experts to act as a "surrogate teacher" (Reeves & Hedberg, 2003, p. 6) instructing the learner through a predefined lesson on the computer. Instead of the teacher, the computer courseware delivers instruction on the assumption that learners will acquire information as it is repeatedly presented by the instructor (Clark & Mayer, 2003). In the same way as the teaching machine, the tutor mode used drill and practice to encourage acquisition of knowledge by the learner. Similar to the role of the teacher in behaviourism, the tutor mode is able to "provide routines necessary, such as combining text and graphics, answer judging, and student control functions" (Alessi & Trollip as cited in Maholwana-Sotashe, 2007). Jonassen (1996) refers to this traditional way of using computers as learning from computing. He views this process as a process whereby computers present static knowledge to the learners. Jonassen (1996) believes that learning from computers plays no role in developing the learners' cognitive structures.

Hartley (2007) and Magliaro et al. (2005) argue that even though drill-and-practice programs are aligned with behaviourism, they are most commonly used to support learners with learning barriers in the classrooms today. Drill-and-practice programs are designed to develop students' "specific often quite limited competencies and abilities" (Reigeluth as cited in Bottino, 2004, p. 555). In addition to remedial teaching, DI is used in distance teaching where computers are used as stand-alone to represent the teacher (Hartley, 2007).

With regard to the Web of the 2000s, Lankshear (as cited in Maholwana – Sotashe, 2007) highlighted that even though the Internet is viewed as

transforming teaching and learning by some, for others "the Internet can seemingly be understood as an elaborate infrastructure for transmitting, receiving and manipulating information." Manipulation of information and other related practices are viewed in a similar vein as possession of knowledge by scientists (Thagard as cited in Lankshear, 2000). This means the use of the Internet depends on the user; it can be used to facilitate the traditional teaching approach underpinned by behaviourist principles.

In short, "the metaphor that prevails [in the use of ICT-based educational tools in the transmission model] is that of the system as an environment where knowledge is transmitted in order to be acquired by the user" (Bottino, 2004 p. 556).

## Role of the Teacher in Behaviourist Pedagogy

Lajoie and Derry (as cited in Maholwana-Sotashe, 2007) "believe that the teacher, whether human or machine, has roles to play while students are engaged in learning activities" (1993, p. 294). While Skinner's intension was to replace teachers with the machine, Hartley (2007) maintains that instead of replacing the teacher, "the teacher and the technology work together – one is not pitted against the other".

Magliaro et al. (2005) recognize that the teacher remains responsible of choosing the learning objectives that must be mastered by the students and further selects appropriate CAI programs which present information from lower level tasks to higher level tasks.

Although the computer is able to provide tutoring to the learners, it is the teachers' role to monitor the learners' progress on tasks (Kennewell et al., 2000). This means the teacher has to observe the learners' performance during the tutoring process. As an instructionist, the focus of the teacher in a CAI classroom is to encourage learners to acquire knowledge through information delivery (Hartley, 2007).

## Cognitive Constructivism

### General Description

In contrast to behaviourism, cognitive constructivist Piaget argues that "the child acts on the world, with expectations about consequent changes, and, when these are not met he enters into a state of cognitive conflict or disequilibrium" (Ravenscroft, 2001, p. 136). Schunk (2004) describes cognitive development as a process that is dependent on four factors: biological maturation, experience with the physical environment, experience with the social environment and equilibration. The effects of the first three depend on the fourth, equilibration. "Equilibration is the central factor and the motivation force behind cognitive development. It coordinates the actions of the other three factors and makes internal mental structures and external environment reality consistent with each other" (Schunk, 2004, p. 447). This means before new knowledge is constructed, the new experiences need to conflict the old experiences. Therefore the constructivists view knowledge as based upon individual constructions that are

not tied to any external reality, but rather to one's interactions with the external world" (Jonassen as cited in Kanuka & Anderson, 1999, p. 5).

In further elaborating Piaget's theory, it is noted that it is through the process of learning that the child becomes socialized, the incidence of egocentric speech declines, a decline which Piaget regarded as a surface manifestation of fundamental changes in underlying cognitive schemata. Tudge and Rogoff (1989) argue that even though Piaget believes in self-discovery or individual learning, he understands that in order for learning to take place the child should be socialised in the environment. Although Piaget criticised the adult – child interaction, he "allowed for possibility that adults may be able to interact with children in a cooperative fashion" (p. 24). Piaget argues that "it is despite adult authority, and not because of it, that the child learns. And also it is to the extent that the intelligent teacher has known to efface him or herself, to become an equal and not a superior, to discuss and examine, rather than to agree and constrain morally" (Piaget as cited in Tudge & Rogoff, 1989, p. 24). Therefore in applying cognitive theory, teachers should consider the role of designing the environment for conceptual change to take place, not to decide on how learners should create meaning and understanding of the new concepts provided in the learning environment. In designing the learning environment the teachers are supposed to first consider learners' prior knowledge which serves as a base in the construction of new knowledge.

**ICT Supported by Cognitive Principles**

Inspired by Piaget's theory, Papert (1980) developed a programming language which was known as LOGO. The "LOGO was designed to prompt a purely learner-centered interaction in which the student "told the computer what to do' and observed its response" (Ravenscroft, 2001, p. 136). LOGO was programmed in the computer to act as curriculum innovation program through which learners were encouraged to learn through self-discovery; allowing them to develop their own knowledge and understanding without guidance from the teacher. This means that "learning is progressively considered as being based on the active exploration and personal construction, rather than the transmission model" (Bottino, 2004, p. 556).

Taylor (1980) termed this type of program "tool mode". The "tool relieves the learner of routine and tedious mechanical tasks" (Hodgkinson-Williams, 2006, p. 4). In contrast to learning from, when using computers as tools the learner constructs knowledge. This means learner is no longer learning from the computer, she or he learns with the computer. Jonassen and Reeves (1996) argue that software tools do not improve teaching when they are relegated to service of traditional instructivist pedagogy. Instead Jonassen and Reeves (1996, p. 694) suggest that software tools should be "employed as cognitive tools to solve challenging problems, pursue personal learning goals, or accomplish authentic tasks".

### Role of the teacher in Constructivist Pedagogy

Although the teacher's role is more facilitative than concerned with direct instruction as in the traditional approach, the teacher decides on the lesson objectives. The choice of appropriate software for the lesson is made by teacher to ensure active cognitive reorganization (Duffy & Cunningham, 1996). This is guided by the fact that it is the teacher who knows the mature and less mature learners in his or her classroom (Lajoie & Derry, 1993). It is further argued that the teacher should always be around the learners during the use of computers as cognitive tools "since learners can become highly confused and demoralized by undetected errors" (Anderson et al.) as cited in (Lajoie & Derry, 1993, p. 147). It is the teachers' role "to determine when and how the observed knowledge-construction activity of a particular student deviates from a predetermined set of solution path" (Lajoie & Derry, 1993, p. 147). In this way the teacher can create an environment that will encourage and stimulate learners to construct knowledge using cognitive tools, such as computers.

## Social Constructivism

### General Description

Parallel to Piaget's cognitive constructivist theory, is the social constructivist theory proposed by Lev Vygotsky, which still influences many of the teaching approaches in the 2000s. Vygotsky and Piaget share the idea that knowledge is constructed, however they differ on how knowledge is constructed. Vygotsky viewed learning as an activity that takes place through mediation

processes which cannot be facilitated without the use of tools (Bannon, 1997). The tools include psychological and semiotic tools. The semiotic tools are "both the tools that facilitate the construction of knowledge and the means that are internalised to aid future independent problem solving activity" (Palinscar, 1998, p. 353). Conceptual development takes place during this internalisation process. Extending Vygotsky's argument of knowledge, Rorty says knowledge transforms as the learner continues to participate in different socio-cultural activities. He defines knowledge as "a consensus of beliefs, a consensus open to continual negotiation" (Duffy and Cunningham, 1996, p. 178).

Psychological tools are those symbolic artifacts – signs, text, formulae, graphic organizer – that when internalized help the individuals master their own natural psychological functions of perception, memory, attention, etc. (Kozulin, 2003 p. 15).

Unlike in behaviourism and cognitive constructivism where the role of the teacher is viewed to be limited, Vygotsky views the teacher as the key driver of the teaching and learning process. In the classroom situation the teacher designs an environment where learning takes place in a form of dialogue with others (i.e. group learning or collaborative learning). The dialogue continues until the learner reaches a stage where he/she experiences tensions between scientific experiences and spontaneous experiences (unsystematic everyday concrete concepts) (Ravenscroft, 2001). Vygotsky called this a Zone of Proximal Development (ZPD) p. "The zone of Proximal Development [ZPD] is defined as the distance between the actual developmental level of the child as determined by independent

problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (Duffy & Cunningham, 1996 p. 183).

In order for learning to be successful the teacher or capable peers should support or "scaffold" the learner within his/her ZPD to encourage conceptual change. Because teachers are in possession of "authentic knowledge of the subject – that is organised, systematic in reasoning, and because of its more abstract language, less dependent on contextual reference they can assist in enculturating the learner with their scientific knowledge and understanding" (Ravenscroft, 2001, p. 141). Therefore in social constructivism "the idea of teaching is characterised as support within the ZPD" (Kennewell et al., 2000, p. 91), and is called scaffolding (Kennewell et al., 2000). Social constructivism suggests that interaction within socio-cultural activities and scaffolding are the key components that help in knowledge construction.

**ICT Supported by Social Constructivist Principles**

Social constructivist authors such as Duffy and Cunningham (1996) argue that computers are grouped under the semiotic mediation tools which Vygotsky considers to have indirect communicative actions in teaching and learning processes. These include computer mediation tools such as computer conferencing and electronic mail (Romiszowski & Mason, 1996).

"Pedagogically, mediation tools are based on cooperative learning precepts" (Johnson & Johnson as cited in Hodgkinson-Williams, 2006). "ICT does not exist

in isolation: it is interwoven with the rest of the tools and participants in the learning environment" (Lim, 2002, p. 411).

According to Lagos, Nussbaum and Capponi (2005) as cited in Maholwana-Sotashe, 2007) ICTs "mediators" are used to mediate interactions between actors in the classroom. Their role is more than just communicating tools since information is transformed in the process of mediation. Mediators such as Personal Digital Assistants "act as instruments that support and regulate relations between actors, and provide:

1. Organization of information

2. A negotiation space

3. Coordination between activity states" (Lagos, Nussbaum & Capponi, 2005, p. 264).

What transpires from Lagos, Nussbaum and Capponi's arguments on mediators, is that there are ongoing conversations that take place during the use of ICT for teaching and learning. This process provides an opportunity for the development of higher order learning objectives associated with problem-solving and critical thinking skill (Romiszowski & Mason, 1996).

It is evident then that the concept of "cognitive tool" is also appropriate for a socio-cultural learning environment. In support of this notion, Azevedo uses the concept "metacognitive tool" which he describes as "any computer environment that resides in a specific learning context where peers, tutors [or] humans may play some role in supporting students' learning by serving as external regulating agents" (2005, p. 194). This means computers are used as

tools that encourage interaction with others in order to encourage thinking about thinking.

"Research indicates that cognitive conflicts embedded in a social interaction are more conducive to cognitive growth than is an individual's experience with conflicting viewpoints within his or her own mind" (Lajoie & Derry, 1993, p. 295). The ZPD emerges when there are conflicting viewpoints within the learners' mind. It is through scaffolding that the conflicting ideas within the learners are developed to the next level of understanding. "Scaffolding refers to support provided so that the learner can engage in activities that would otherwise be beyond their abilities" (Sherin, Rieser & Edelson, 2004, p. 391).

According to Sherin et al. (2004) the scaffolding metaphor is extended to learning artifacts such as computer educational software. This means computers can provide the learner with necessary support when she or he is stuck
with new concepts. What is implicit in this discussion is that computers act as "catalysts" in the socio-cultural learning environment.

**Using Computers as Catalysts in Teaching**

Hawkridge (1990) proposed a catalytic rationale of using computers in education. In Hawkridge's view the catalytic rationale is the rationale with most hidden power. The catalytic rationale aims at changing both the teacher and the learner (Hawkridge, 1990). More control is given to learners who are expected to take charge of their learning. Hawkridge argues that in the catalytic rationale

"computers will help children move away from rigid curricula, rote learning and teacher-centred lessons, by giving children more control of their own learning".

Therefore in this rationale learning is transforming from one that is teacher-centred to one that is learner-centred. Teachers are expected to change their roles because of the new role that learners play in their learning. Furthermore the use of computers as catalysts can help teachers develop skills that are needed in the changing curriculum. The catalytic rationale seems to be in line with the use of computers that aims to transform pedagogical practices.

**Role of the Teacher in a Social Constructivist Computer Classroom**

In a social constructivist computer classroom some of the traditional teacher's roles are retained (e.g. class leader, discussion leader). McGhee and Kozma (2003) identified the following as the roles of the teacher in a computer classroom underpinned by social constructivist tenets:

1. Instructional designer
2. Collaborator
3. Advisor
4. Team coordinator
5. Monitoring and assessment specialist

In elaborating these roles, I used Lajoie and Derry's (1993) descriptions of the role of the tutor in a computer classroom where the use of computers is underpinned by social constructivist principles.

Instructional designer: As is the case with roles of teachers in the classroom informed by traditional principles and in the classroom underpinned by cognitive principles, the teacher in the classroom informed by social constructivist principles first decides on the objectives of his or her lesson. This includes choosing appropriate ICT resources that support knowledge construction.

Collaborator: Teachers are no longer knowledge transmitters; they act as partners, co-workers in the learning process.

Advisor: The role of being an advisor is one of the main roles that the teacher plays when engaging learners in collaborative activities. They argue that the teacher provides advice when it is needed. This means teachers can support learners in "carrying out assigned tasks, much like mentor or coach" (p. 294).

Team coordinator: Team coordination is applied by "providing quality control over peer critiquing and other collaborative activities, ensuring that students learn what they are expected to learn, and do not mislead one another" (p. 294).

Monitoring and assessment specialist: Teachers monitor learners' work throughout the learning process. She or he manages all the activities; she or he identifies the learners' problems and selects an appropriate task for the learner. The teacher decides on the type and time of assessing the learner.

Having considered what the role of the teacher is when using computers as underpinned by the three principles (behavioural principles, cognitive constructivism principles and social constructivism principles), it is clear that the effective integration of ICT remains within the teachers' competence and sphere of influence. I examine the concept "integration" in the context of ICT next and

then look at the different phases of integrating ICT as proposed by different authors.

## Understanding the "Integration" of ICT into Education

### Meaning of the Concept "Integration" in the Context of ICT

The concept of "integration" is understood differently by those who perceive themselves as "integrating" ICT into the curriculum. In understanding what it means to integrate ICT into the curriculum it is argued that ICT integration applies across the curriculum, it is not a separate course as others might think (Flanagan & Jacobsen, 2003).

At the most elementary level integration of ICT can simply mean using word processing to type school projects, and at the most sophisticated level, "integrating" ICT can refer to a simulation that would not be possible without computer technology. However the definition alone does not clarify what it means to integrate ICT across the curriculum. Further examination is needed to clarify how schools can integrate ICT into the curriculum.

### Integrating ICT into the Curriculum

Many attempts have been made to clarify what is meant by "integrating ICT into the curriculum". This encompasses a range of approaches that different school teachers use to integrate ICT into their school curricula. According to Bottino (2004, p. 555) "three models can be singled out as a starting point for eliciting ideas about crucial issues in ICT based learning systems:

1. The transmission model;

2. The learner centred model;

3. The participative model".

The transmission model is nothing else but the drill-and-practice programs that are used to assist learners with development of limited abilities together with tutorial systems that substitute teachers as transmitters of knowledge. The learner centred model is based on the interest that learners learn more when given opportunity to explore and discover concepts on their own. This means considering active exploration and personal construction of knowledge rather than acquisition of knowledge. Lastly, the participative model is where learning activities are organised to take place in a social environment (Bottino, 2004). In his models, Bottino confirms the relationship between the learning principles and the use of computers in the classroom.

In elaborating this I discuss the three levels of ICT integration by McCormick and Scrimshaw that are similar to Bottino's models of integrating ICT into the curriculum.

In studying the relationship between ICT and pedagogy McCormick and Scrimshaw (2001) suggested that ICT integration takes place through three levels of pedagogical change:

1. improving efficiency and effectiveness

2. extending the reach of teaching and learning with ICT and

3. transforming the concept of the subject with ICT (p. 44-45).

Improving efficiency with the use of ICT helps teachers to improve their practice by providing the teacher with accurate and efficient tools. These include use of spreadsheets to plot graphs and word processing for writing compositions.

Extending the reach of teaching and learning with ICT refers to the use of Internet that enables teachers to extend the resources found in the teaching environment. This provides opportunity for both the teacher and the learner to search for worldwide up-to-date information. However, the teacher should monitor the searching process by educating learners on how to use Internet for them to research an agreed question.

Transforming conception of the subject with ICT: During this level teachers support learners to develop a sense of independence through the use of ICT. Learners are free to explore and interact with all sorts of data on their own. The teachers' role is to develop learners' judgment, skills and their ability to appraise critically what is of particular importance.

Similar to the three levels by McCormick and Scrimshaw are the three levels of ICT integration by Bialobzerska and Cohen (2005). Bialobzerska and Cohen suggested three levels under which ICT can be integrated:

1. Functional practice: Computers are used to assist in tasks that can be done by other means such as being hand written, which includes use of spreadsheets and word processing.
2. Integrative practice: Teachers begin to make use of the computer in a way that could benefit the learner, e.g. when learners are asked to write compositions using the computer, they use editing tools to check grammar

mistakes, spelling mistakes and more appropriate words. The teacher expects learners to draft and redraft and by doing so new insight is gained.

3. Transformational practice: This level considers "learning which occurs as a result of activities and opportunities which do not exist in computer less environments" (p. 33). This includes the use of communicating tools whereby learners interact with learners from other countries.

While the authors mentioned above considered the levels of change by teachers, UNESCO (2003) and Yeun, Law and Wong (2003) move beyond ICT integration by teachers only to the broader context of ICT integration within a school environment.

In the study conducted by UNESCO (2003) four stages of ICT integration within school environment were identified:

1. Emerging,
2. Applying,
3. Infusing and
4. Transforming (p. 19).

Emerging stage: is evident when the school is in possession of few computers that can be used only by teachers and the administration. During this stage teachers are learning how to use computers. The purpose of this stage is to familiarise teachers with ICT literacy skills. Teachers are trained to use variety of tools and applications. Teachers begin to understand why they have to apply ICTs into their teaching (UNESCO, 2003). The major aim is to develop teachers in order for

them to feel comfortable and at ease with the application programs and confident in their use (Becta, 2005).

Applying stage: is evident when teachers feel reasonably confident with ICT applications. They can use application software and communication tool and browse the Internet confidently. Teachers are ready to implement or apply new technologies in the teaching of LAs. Teachers decide why, when, where and how ICT tools will contribute in the objective of the lesson. Teachers should then be able to choose the appropriate ICT tool that will benefit the learner in

understanding the new concepts of the new lesson. This includes being able to choose when the whole class or group multimedia presentations will be useful. It is also important for teachers to understand when and how they will assist learners to find, compare and analyse information from the Internet or from any other research source specific to the LA. At this stage not only teachers are applying ICT's in teaching, the management, secretaries as well as librarians are beginning to apply ICTs in administering their tasks (UNESCO, 2003).

Infusing stage: is noticeable when teachers begin to use all what they have learnt in every aspect of their teaching. ICT is incorporated in lesson preparation and management. What becomes critical is for teachers to explore the use of ICTs and to be creative. Through their creativity they are able to stimulate and manage learning of learners using different learning styles to achieve their goals (ibid).

Transforming stage: is visible when teachers use ICT tools with confidence. They are able to apply them in their teaching as well as in other aspects of their teaching. At the stage of transformation, the focus changes from being centred on

the teacher. The integration of ICT takes a new phase where the process of integrating ICT tools is no longer manipulated by the teacher.

Teachers cease to be drivers and repositories of ICT related knowledge. Learners are actively involved in the ICT activities and teachers assist and guide their learners during the process of constructing knowledge. Collaborative skills are developed. Learners work as groups in solving real life problems. They also work with other learning groups from other places using communicating tools by accessing resources on the Internet. Because of the change in learning style, teachers change their assessment strategies (UNESCO, 2003).

Using a slightly different conceptual framework, Yuen, Law and Wong (2003) suggested three models of ICT integration:

1. Technological adoption;
2. Catalytic integration; and
3. Cultural innovation.

Technological adoption model: At this stage the school looks at the adoption of technological infrastructure, formulating organisational structure and teacher technical skills. The teachers' concern is to be able to use computer effectively for the production of documents that can help them in presentation and evaluation of their lessons. At this stage the management is actively involved in the facilitation of technology adoption by teachers. They set targets and timetable for achieving specific ICT competencies. It is mentioned that at this stage the key element is to enhance teaching by stimulating learners interests with the use of multimedia in teaching.

Learners' involvement is limited (Yuen, Law & Wong, 2003), therefore technology adoption cannot be classified as a stage implementing effective integration of ICT, it is still a learning curve for knowledgeable teachers to help other teachers master computer skill and gain confidence.

Catalytic integration model: At this stage the integration of ICT is an integral part of both teaching and learning. ICT is integrated across all the LAs. Learners, as well as teachers explore the use of ICT in the teaching and learning process. Teachers are able to design activities that are problem based, task based and underpinned by a social constructivist approach. It is through interacting with problem based activities that learners get maximum control of their learning.

The integration process is led by the school principal. S/he ensures that all teachers are able to integrate ICT in their LAs. Teachers work in collaboration to achieve the outcomes of curriculum innovation.

Cultural innovation model: This model refers to schools where there is no conflict with infrastructure and teacher development. ICT is treated as part of the school mission and vision.

There is multiple leadership style, which means that the principal does not bother much about monitoring the use of ICT as the teachers are free to use ICT according to their beliefs. This means they integrate ICT into the curriculum when they feel the use of the tool will benefit the lesson. Teachers do more than just integrating ICT in their teaching; they develop ICT packages that can be used by other school teachers. There are no formal teacher development sessions.

Teachers empower one another in informal setting through information sharing. Learners are free to explore the use of ICT in different aspects of learning such as in extracurricular lessons (Yuen, Law & Wong, 2003).

Looking at Yuen, Law & Wong's (2003) model, it would seem that their technological adoption model conflates the emerging and applying phases suggested by UNESCO (2003). The effectiveness of this approach is obscure since the phase does not specify how long the training of teachers will take before they start implementing ICT in their subjects.

While UNESCO's model specifies that during emerging (the first level of integrating ICT) the number of computers received may not be enough for teachers to use them for their teaching ICT, Yuen, Law and Wong's (2003) first phases of integrating ICT (Technological adoption) does not specify the number of computers that may be available at that stage, however it fuses the adoption of ICT infrastructure together with teachers' use of computers. From my point of view, teachers may not be able to use ICT confidently when they are still in the process of being trained. Hence UNESCO separates the training of teachers from the use of computers. In my view the separation of teacher training from the use of computers seeks to ensure that teachers have sufficient time to acquire the relevant skills that are needed in the integration of ICT.

After technological adoption Yuen, Law and Wong's model conflates infusing and transforming levels by UNESCO, where both the teacher and the learner confidently explore the ICT. Thereafter Yuen, Law and Wong introduced a new stage where ICT forms the integral part of the school culture. In revisiting

UNESCO' model I found that the last stage of Yuen, Law and Wong is not considered. I therefore proposed a new model based on UNESCO's model with the additional stage where ICT will form the integral part of the school culture, i.e. innovating stage. Therefore in my view the integration of ICT should take place in five levels: emerging, applying, infusing, transforming and innovating.

In the light of the above interpretations of "integrating ICT into the curriculum", I now examine what the previous research says about the integration of ICT in as far as teachers are concerned.

**Previous Research on the |Integration of ICT into the Curriculum:**

**Perception of Teachers**

It is notable that "teachers' perception of ICT in education are not only influenced by the discourse of official document and guidelines, but also their own experiences of using ICT for personal reasons within social and professional context in which the profile of access to ICT resources is fast-changing" (Loveless 2003, p. 315). In addition to that "it is also notable that individuals' attitudes, confidence levels, cognitive and emotional styles, and social identities can influence their voluntary participation in the use of ICT" (Hennessy et al. as cited in Maholwana-Sotashe, 2007).

Perceived benefits of integrating ICT into the curriculum

Before discussing the benefits perceived by teachers in other studies, it is important to note that the benefits of integrating ICT into the curriculum only emerge where ICT is used effectively (National Council of Education Technology

as cited in Lee, 2002; Selwood & Pilkington, 2005). Becta (2005, p. 26) argues that the benefits of integrating ICT into the curriculum are achievable by teachers who are confident and competent in using ICT.

**Internet connectivity**

Lee reported that the National Council for Educational Technology (NCET) stated a number of potential benefits, amongst which is access to richer source materials (Lee, 2002). According to the studies conducted by Granger et al. (2002), Carnoy (2004) and Becta (2005), teachers are of the view that the Internet is a useful resource that can provide access to a number of materials relevant to the curriculum.

In responding to Lankshear, Peters and Knobels' concern of "recognising the way academics understand and approach the Internet" (2000, p. 20), Granger et al. mention that teachers used Internet for browsing readings, to interact with family and friends, on-the-job discussions, and collaboration with peers and /or students (2002, p. 483). Internet provides learners an opportunity to participate in electronic projects that facilitate a constructivist approach in which students work in teams on the design and building artifacts and complex systems, in a rich learning environment.

In Carnoy's (2004) study, teachers from rural areas asserted the benefit of using email for collaborative teaching:

> "ICT system has made priority of connecting rural schools to the Internet and thereby integrating them more tightly into the larger educational system, and hooking them up to the outside world.

> Many school districts and almost all universities now communicate internally and externally largely through e-mail" (p. 5).

Even in the SITES Module 1, the use of email was found to be providing teachers an opportunity to communicate with peers from other schools within and/or outside the country (Howie et al., 2005, p. 66).

Use of ICT Applications:

The teachers from Howie et al.'s (2005) study indicated having perceived the integration of ICT as providing an opportunity for using ICT applications. These include:

1. Simulations of natural or man-made systems
2. Dynamic modelling and graphical modelling of mathematical functions
3. Software for simple manipulation and statistical analysis
4. Word processing /desktop publishing
5. Spreadsheets
6. Software supporting creative works (music /art)
7. An interactive multimedia encyclopedia on CD-ROM (2005, p. 64).

Juxtaposing the opportunity of using ICT applications in the integration of ICT, Becta (2005) reported that teachers perceive subject specific software as playing an integral role in the integration of ICT in their LAs.

**Improvement of Administration and Storage Facility**

Central to the benefits of using ICT applications is the improvement of administration for both teachers and school management. For managerial purposes, teachers use word processing and spreadsheets for designing school

timetables, planning and finances. For general purposes word processing is used for organization of school records, equipment and all clerical work (Selwood & Pilkington as cited in Maholwana-Sotashe, 2007). "Some schools are using specially prepared software packages that allow teachers and the school to measure student gains on tests" (Carnoy, 2005, p. 7) and for administering and storing student personnel data. This means in some schools computers became a permanent fixture in the schools offices (Carnoy, 2005, p. 5).

**Reducing Teacher Workload**

Excessive teacher workload has been a concern in the teaching profession. The use of ICT applications for administration purposes has the possibility to reduce teacher workload (Selwood & Pilkington, 2005). However, this is only possible when teachers have access to adequate computers (Selwood & Pilkington, 2005) and are able to use ICT effectively (Becta, 2005). Effective use includes sharing responsibilities with other teachers from other schools within and outside the country. This reduces preparation time and releases time for teachers to engage with their learners (Selwood & Pilkington, 2005).

**Transforming teaching**

In the adoption of new technology, teachers view their roles as changing (Pearson & Naylor, 2006). Teachers who use ICT most frequently seem to shift from the paradigm where they act as transmitters of knowledge to a paradigm where they act as co-constructers of knowledge (Lee, 2002, p. 8) and perceive ICT as a catalyst in transforming their teaching (Dede as cited in Maholwana-Sotashe, 2007). In Mumtaz's (2000, p. 324) study it is highlighted that "teachers

perceive that their practices became more students centred; the more extensively involved teachers were in professional activities, the more likely they were to have teaching philosophies compatible with constructivist learning theory".

This means ICT can act as a catalyst that changes teaching-learning process from that of being teacher-oriented to that of learner-oriented. Learners' roles change from being passive to being active "partners in developing learning experiences and generating knowledge, and then collaborative construction of meaning is enhanced" (Dede, 2000, p. 284). Teachers extend their roles from worksheet designers to web designers (Dede, 2000).

**Development of Skills**

In addition to this, ICTs offer the potential for effective group work, encourages cooperative learning practices, develops learners' talents and skills in marketing, sales, public speaking design, administration, entrepreneurship, writing and editing (Granger et al., 2002, p. 5-6).

**Perceived Challenges of Integrating ICT |into the Curriculum**

While the effective use of ICT contributes towards a number of benefits in the integration of ICT, teachers cannot use ICT effectively if there are factors that hinder their pedagogical practices.

**Unavailable Infrastructure**

The integration of ICT depends on the availability of infrastructure. Hardware, software and buildings are the essential components of the implementation of ICT in the school curriculum. According to Granger et al.

(2002) the lack of appropriate up-to-date equipment restrains the integration of ICT into the curriculum. Williams, Coles, Wilson, Richardson and Tuson (2000) assert that "access to technology tends to override all other factors in determining use" (p. 313).

**Hardware and Software**

Veen argues that "without hardware and software there could not be any use of information technology at all" (1993, p. 1). In support of this notion Granger et al. (2002) argue that one of the factors that inhibits the integration of ICT in schools is lack of appropriate and up-to-date materials. The unavailable equipment includes the lack of software that fits the subject knowledge (e.g. History knowledge) and the lack of technical support to ensure that day-to-day practices take place without being hindered by unreliable equipment (Veen as cited in Maholwana-Sotashe, 2007).

**Buildings**

It is without doubt that in any country ICT cannot exist without buildings. The study by Becta (2005, p. 10) reveals that "buildings restrict the development of ICT, including the ability to site computers".

**The Lack of Internet Access**

Apart from subject specific software, it is Internet connectivity that has been perceived as hindering the process of ICT integration and includes where connectivity is not readily available or the Internet access is slow (Becta, 2005). Teachers who have access to ICT mentioned bandwidth as problem in their access of Internet (Becta, 2005). In the schools where there is no connectivity, the

predominant constraint is the cost of Internet connectivity (Hodgkinson-Williams, Sieborger & Terzoli, 2007).

**Lack of ICT competent teacher and training**

Often mentioned by a number of researchers, is the lack of ICT competent teachers who are able to integrate ICT comfortably with confidence (Hennessy et al., 2005; Loveless, 2003 & Lee, 2002). Incompetence seems to lead to lack of confidence. According to Somekh "teachers need to be convinced of the value of ICT because many teachers tend to perceive themselves to be technologically incompetent and often feel deskilled and demoralised when they first begin to use computers in the classroom" (as cited in Lee, 2002, p. 5). Even computer literate teachers may not be in a position to use computers in their teaching.

The major problem with using ICT in the teaching-learning process is the complexity of a key aspect of curriculum knowledge in ICT (Webb, 2004, p. 246). This means computer skills alone cannot help teachers with the integration of ICT in their teaching; further training that entails how computers can be used together with curriculum knowledge is necessary. The knowledge acquired in such training can help the teacher to select appropriate representations for particular task and to be able to identify the problem that learners have with particular software (Webb, 2002, p. 246).

**Insufficient training**

Howie et al., (2005) argue that the incompetence of teachers is due to insufficient training they receive. Even in the event of ICT competent teachers,

continuous staff development is necessary to ensure that teachers are coping with changing technologies (Howie et al., 2005). This means teachers should undergo some form of training before they are able to integrate ICT effectively in their teaching. However, there are teachers who resist change and this becomes a hindering factor in integrating ICT into teaching (Lee, 2002).

**Resistance to change and insufficient knowledge possessed by teachers**

The teachers who resist change may be technophobics (Becta, 2005) or may have a different perspective on why ICT are integrated in their teaching, or may fear the loss of authority (Granger et al., 2002). Mumtaz (2000, p. 320) referred to this phobia "avoidance" because teachers tend to "distant themselves from computers or sustain a very low level of interaction". Insufficient knowledge possessed by teachers may give rise to the reluctance of using ICT in teaching. Lee (2002, p. 5) argues that: "for teachers to rethink and restructure teaching and learning, they must first learn enough about the relevant technologies to apply in their professional work and to translate them to their students as part of the integrated learning of the subject matter". This means that teachers as the key drivers in the implementation of ICT, should be able to apply new technologies in their pedagogical practices to allow students to construct knowledge. It is argued that the resistance to change is due to insufficient knowledge possessed by teachers, e.g. teachers may lack the skills to use Internet effectively (Lee, 2002). This resistance to change does not exclude school leadership. According to NCET (as cited in Mooij & Smeets, p. 2001) the attitude of school leadership is

influential in the integration of ICT in the schools. School leaders' "commitment and decisions are expected to be relevant to the ICT innovation processes" (Mooij & Smeets, 2001, p. 266).

**The Availability and Accessibility of Unfiltered or Uncensored Information**

This is also viewed as inhibiting the integration of ICT. Because the Internet is unable to control who accesses what, when and where, it allows all kinds of information to be accessed by students as argued by Kerr:

> "The Net's beauty is that it is uncontrolled, it's information by anyone, for anyone. There is a racist stuff, bigoted, hate-group stuff, filled with paranoia; bomb recipes; hot to engage in various kinds of crimes, electronic and otherwise; scams and swindles" (as cited in Oppenheimer, 1997, p. 15)

**Technical Support**

One of the important aspects to consider in integrating ICT in schools' curricula is that computers require maintenance. This cannot be done by every teacher. Carnoy (2004) found out that "even if teachers are familiar with ICT, additional technical support is needed to make ICT a tool for curricular change in the teaching-learning process" (p. 9). He further recommends the appointment of full time technicians who will monitor and fix serious technical problems.

**Insufficient Funding**

ICT and its components demand financial support. According to Howell, Lundall and Patrick (2000) the cost of ICTs in schools includes teacher training, additional advisory and technical staff, hardware, software, telecommunications infrastructure (e.g. phone lines) and content development. Mooij and Smeets (2001) argue that in order to achieve ICT goals the national authorities should make financial means available to schools.

**Lack of Appropriate ICT Policies:**

The effectiveness of ICT integration needs guidelines on how the process will be followed from national down to school level. The reluctance of schools in designing their own policies is the most frequently mentioned inhibiting factor around the ICT policies. Teachers argue that it is impossible to integrate ICT when the school time-table does not integrate ICT access. Hennessy et al. argue that the fact that teachers have "little say in designing and implementing development plan for using ICT within their schools" (2007, p. 157) is hindering the use of ICT in teachers' practices since they are "highly politicized and do not attend to the culture of classroom practice and the pivotal role of the teacher in effecting change" (Olson as cited in Hennessy et al., 2007, p. 157).

In response to the above "lack of appropriate ICT policies" I examine the ICT policies from developed countries to developing countries.

## ICT Policies

Worldwide countries have developed policies for ICT integration into the curriculum. In UK the integration of ICT aims at supporting innovation in schools for improving effectiveness of schools and teachers in particular, by using ICT to reduce the burdens placed on teachers and to modernise delivery (UK Connecting Schools and Networking People, 2002). The Canadian ICT policy "expects that the introduction of ICT in schools will improve the academic performance equity among students and ultimately, students' ability to use and apply technology and software in the jobs" (Corbett & Willms, 2002, p. 9).

In Africa, there are number of countries that are using computers in specific non-governmental organisation (NGO) educational projects (Hodgkinson-Williams, 2005, p. 1), however "the development of well elaborated national policies on ICT education seems to be in the making" (Howie, Muller & Paterson, 2005). In Southern African region ICT policies that seem to exist are very few, and even those that exist are vague to interpret and make little reference to how ICT implementation is to take place (Howie, Muller & Paterson, 2005, p. 4).

In Ghana, the ICT policy for all sectors of the economy including education is termed ICT4AD (ICT for Accelerated Development).

> "As part of the mission of the policy 'to transform the educational system to provide the requisite educational, and training services and environment capable of producing the right types of skills and human resources required for developing and driving Ghana's

> information and knowledge-based economy and society', the Government is committed to a comprehensive programme of rapid deployment, utilization and exploitation of ICTs within the educational system from primary schools upwards". (Republic of Ghana, 2003, p.37)

The mission statement of the ICT4AD emphasizes the utilization and exploitation of ICTs within the educational system from Primary schools through the tertiary levels. This is a clear indication that the Government of Ghana is committed to encouraging practical use of ICTs at all levels of the Ghanaian educational system to improve teaching and learning.

Additionally, one of the policy objectives of the ICT4AD is "to facilitate 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" (Republic of Ghana, 2003, p38). This policy objective indicates the government's awareness of potential of the integration of ICTs in the curriculum to improve delivery and support teaching and learning even at the primary school level.

## Summary

The integration of ICT into the curriculum is underpinned by various explicit and implicit theories. Many countries have already made attempts to integrate ICT into the curriculum. The research studies conducted in these countries have established to some extent how teachers perceived the integration of ICT into the curriculum. According to teachers' perceptions, the integration of ICT has both benefits and challenges.

Different models are proposed on how to integrate ICT into the curriculum. According to the proposed models, the integration of ICT requires not only computer literate teachers, but teachers with computer knowledge that can help them choose appropriate educational software and to be able to assist learners with the use of software without wasting teaching time. In the event of insufficient ICT knowledge, the integration of ICT poses a challenge to teachers. In addition to this, it is noted that insufficient computer hardware is one of the major stumbling blocks in integrating ICT into the curriculum.

# CHAPTER THREE

# METHODOLOGY

## Introduction

This chapter presents the design of this study as well as description of the population, sample and sampling procedure. It further describes the research instrument used for data collection. It is followed by description of the data collection procedures, data analysis plan and the validity of the study.

## Research Design

The study was to explore challenges faced by teachers in integrating ICT in teaching various subjects in Basic schools. The descriptive methodology was used. According to Leedy and Ormrod (2010, p. 182) this type of research involves "identifying characteristics of an observed phenomenon" and "examining a situation as it is". The descriptive methodology has varied approaches such as observation studies, correlation research and survey research.

Among the various approaches to descriptive methodology approaches, survey research was used in this study because it was found more suitable. Gay (1992) holds the view that descriptive survey is very useful when investigating educational problems. Osuala (1991) also points out that descriptive surveys are practical to the researcher and identify present conditions and at the same time point to the present needs. He believes that descriptive survey is regarded by

social scientists as the best especially where large populations are involved. Osuala also notes that descriptive survey is widely used in educational research since data gathered through descriptive survey present field conditions. According to Best and Khan, cited in Amadahe (2002), descriptive research concerns itself with conditions or relations that exist. These include practices, attitudes and opinions that are held. Amadahe (2002) argued that in descriptive research, there is accurate description of activities and this goes beyond mere fact-finding.

According to Leedy and Ormrod (2010, p.187), "survey research involves acquiring information about one or more groups of people – perhaps about their characteristics, opinions, attitudes or previous experiences – by asking them questions and tabulating their answers", with the ultimate goal of generalizing to a larger population.

This design was chosen because it has the merit of gathering various responses from a wide range of people. It also enables one to have a clear picture of events and people's behavior on the basis of data collected for a particular period of time. In addition, in-depth follow-up questions can be asked and items that were not clear could be explained using descriptive survey design. Furthermore, descriptive survey helps to present the true state of affairs of a given situation after data have been collected from a number of people who respond to the same set of questions about a given situation (Gay, 1992). This approach is more suitable for this research because it was intended to acquire information about teachers of Basic Schools concerning their challenges of integrating ICT

into the curriculum. The information obtained was analyzed using frequency tables.

## Population

The target population of the study was all the teachers of public Basic Schools in the Cape Coast Metropolis of approximately 1,476 teachers. They comprised both males and females, professional and non-professional teachers, holders of certificates, Diplomas, First degrees and Master's degrees, as well as working experiences of a range up to 60 years. Since the target population was very large, a sample was used for the study.

## Sample and Sampling Procedure

The sample of the study consisted of 242 teachers of public Basic Schools comprising 114 males and 128 females, all selected from 22 out of 82 public Basic schools. Again, the sample consisted of 6 Primary school teachers – 1 teacher from each of primary school classes, and 5 Junior High School teachers, from each of the 22 Basic schools selected.

The sample size was found to be appropriate on the basis of Alreck and Settle (1985) who indicated that a sample size of 10% of a population is enough to obtain adequate confidence. In addition, Nwana (1993, pp.72) supports this when he states that "… if the population … is many hundreds, a 20% sample or more will do". The sample of schools was 26.8% of the total of 82 public basic

schools and the sample of teachers was 16.4% of the population of approximately 1,476 teachers.

The sampling technique used to select the sample of 22 basic schools from the 82 public basic schools was simple random sampling, specifically, using the random numbers method. All public Basic schools were listed alphabetically and a computer program written in Python programming language was used to generate a sequence of random numbers in the range from 1 to 82 (The program code in appendix A ). The first 22 distinct numbers generated by the computer program that corresponded to 26.83% of the listed public basic schools were selected and their respective corresponding schools were listed out of the population schools. The 11 teachers (six from primary and five from Junior High School) were then selected as representative of each of the 22 schools. Table 1 shows the sample size distributed by schools.

**Table 1: Distribution of Sample by Schools**

| Name of School | Number of Teachers | Percentage (%) |
|---|---|---|
| A.M.E. Zion 'D' | 11 | 4.5 |
| Abura Ahmadiyya 'B' | 11 | 4.5 |
| Abura St. Lawrence Cath. Sch. | 11 | 4.5 |
| Amamoma Presby | 11 | 4.5 |
| Amanful Catholic | 11 | 4.5 |
| Ansapatu St. Peters Anglican | 11 | 4.5 |
| Antem M/A | 11 | 4.5 |

**Table 1: Distribution of Sample by Schools (Continued)**

| Name of School | Number of Teachers | Percentage (%) |
|---|---|---|
| Apewosika M/A | 11 | 4.5 |
| Ayifua St. Mary's Anglican Sch. | 11 | 4.5 |
| Christ Church Anglican | 11 | 4.5 |
| Ebubonko M/A | 11 | 4.5 |
| Efutu M/A | 11 | 4.5 |
| Ekon M/A | 11 | 4.5 |
| Esuekyir M/A | 11 | 4.5 |
| Imam Khomeinn | 11 | 4.5 |
| Kakumdo M/A | 11 | 4.5 |
| Kubease M/A | 11 | 4.5 |
| Kwaprow M/A | 11 | 4.5 |
| Nkanfoa Catholic Sch. | 11 | 4.5 |
| Nyinasin M/A | 11 | 4.5 |
| St. Andrews Anglican Sch. | 11 | 4.5 |
| St. Augustine's Practice | 11 | 4.5 |
| **Total** | **242** | **100** |

**Instruments**

The questionnaire was used as a means of collecting data. Questionnaire is a useful and widely used instrument for collecting survey information, providing structured and often numerical data in various scales of measurement such as

nominal and ordinal. Also, it is useful for the collection of data without the presence of the researcher, and it is often comparatively straight forward to analyze (Cohen et al., 2005). Questionnaire is a very effective instrument for acquiring factual information about practices and conditions of which the respondents are presumed to have knowledge and enquiring into the opinions and attitudes of the subject. Further, questionnaire was deemed appropriate for this study because the respondents were all literate in English language.

The questionnaire consisted of mainly closed-ended and a few open-ended questions. Closed-ended questions restrict the respondents to options given. Coding is made easier with the use of closed-ended questions. The merits of the closed-ended questions explain why they were used. A few open-ended questions were included due to the advantage of allowing respondents to provide additional information as a supplement to those solicited by the close-ended questions.

The questionnaire was developed with guidelines from my supervisor and related studies on Challenges faced by Secondary School Teachers in Integrating ICT into the Curriculum, a master's thesis submitted to the Rhodes University (Maholwana-Sotashe, 2007). Relevant information from the literature reviewed also aided in the design of the questionnaire. The questionnaire was divided into five sections.

The first section of the questionnaire centered on the demographic information about the respondents. The second section focused on the availability of ICT resources in the school. The third section tried to elicit respondents' views on the utilization of the available ICT resources of the school in teaching of

various subjects. The fourth section sought to solicit data on the skills of teachers in using ICT resources especially computers and software in general and specifically for teaching various subjects. Finally, the fifth section of the questionnaire sought for information on the challenges of integrating ICT in teaching various subjects.

**Data Collection Procedure**

Pilot-testing was carried out before the main data was collected. A pilot-test is a small scale replica and a rehearsal of the main study. Pilot-testing helps to test the effectiveness of the study organization. It also helps to test the suitability of the research methods and design. Through pilot-testing, the researcher familiarizes with the research environment. A successful pilot-testing enables the researcher to discover possible weakness, inadequacies and ambiguities in the research instruments so that they can be corrected before the actual data collection takes place. Pilot-testing though an essential element of a good study design, does not guarantee success in the main study since some problems may not become obvious until the larger scale study is conducted. It does, however, increase the likelihood of success.

The pilot-testing of the study was carried out at Nyinasin M/A Junior High School of the Cape Coast Metropolis on the 13$^{th}$ of May, 2014. The Nyinasin M/A Junior High School shares some commonalities with all the Basic schools in the Cape Coast Metropolis in terms of teacher population and qualifications, as well as infrastructural facilities, hence the selection of that school for the pilot-testing.

The main data collection activity was carried out a week after the pilot testing – from 19th to 30th of May 2014. During the first week of the period, I travelled to all the 22 schools to distribute the questionnaire. Because schools were still having lessons, I was permitted by the respective head teachers to see a teacher or two in each school and leave the questionnaires. I took advantage to explain the purposes of the study and discussed the questionnaire with the teachers I was allowed to see and left them copies of the questionnaire to be administered to the other selected teachers. We scheduled appointments for collection of the questionnaires in the following week and also exchanged cell phone numbers to enable communication concerning completion of the questionnaires.

During the second week of the data collection period, I called the teachers who agreed to assist in administering the questionnaires to confirm the completion of the latter. When the questionnaires were completed, I travelled to the respective schools for collection and gave twelve or thirteen designer pens, one for each respondent and another for each head teacher depending on number of head teachers in a school, as a form of appreciation. I finished collection of the completed questionnaire on Friday, 30th May 2014.

**Data Analysis**

The data obtained from the completed questionnaires were grouped, coded and analyzed using frequency tables generated in Statistical Package for the

Social Sciences version 16 (SPSS V.16). The generated outputs of the data analysis are shown in the appendices.

# CHAPTER FOUR

# RESULTS AND DISCUSSION

## Overview

This chapter presents the analysis and discussion of the results obtained from the data collected in response to the research questions. The results are presented and discussed under the following topics: description of respondents, ICT resources (software, hardware, etc.) available for use in basic schools, ICT resources teachers use in teaching their respective subjects, ICT skills Basic School teachers have, factors that militate against the use of ICTs in teaching and learning of various subjects, and possible solutions to the challenges of integrating ICTs in teaching and learning of various subjects in Basic schools, as guided by the research questions of this study.

## Description of Respondents

Table 2 presents distribution of the sample of the study by gender.

**Table 2: Distribution of Respondents by Gender**

| Gender | No. of Teachers | Valid Percentage (%) |
|---|---|---|
| Male | 114 | 47.1 |
| Female | 128 | 52.9 |
| **Total** | **242** | **100** |

Among the two hundred and forty-two (242) respondents, 114 (47.1%) were males while 128 (52.9%) were females. This is an indication that the number

of males in the sample was slightly more than that of females. Specifically, the males were 14 (5.8%) more than the females.

Table 3 presents the distribution of the respondents by the grades they taught.

**Table 3: Distribution of Respondents by Grades Taught**

| Grade | No. of Teachers | Percentage (%) |
|---|---|---|
| B.S. 1 | 22 | 9.1 |
| B.S. 2 | 22 | 9.1 |
| B.S. 3 | 22 | 9.1 |
| B.S. 4 | 22 | 9.1 |
| B.S. 5 | 22 | 9.1 |
| B.S. 6 | 22 | 9.1 |
| J.H.S. | 110 | 45.5 |
| **Total** | **242** | **100** |

It is observed in Table 3 that 22 (9.1%) of the respondents taught in each of Primary School classes (One through Six) being a total of 132 (54.5%) while the remaining 110 (45.5%) taught in Junior High School. This indicates that the teachers were selected from all the Basic school classes therefore they were representative of the various categories of teachers at the Basic school level.

Table 4 presents distribution of respondents by the number of years of teaching experience.

**Table 4: Years of Teaching Experience**

| Range of Years | No. of Teachers | Percentage (%) |
|---|---|---|
| 0-5 | 86 | 35.5 |
| 6-10 | 80 | 33.1 |
| 11-15 | 42 | 17.4 |
| 16-20 | 12 | 5.0 |
| Above 20 | 22 | 9.1 |
| **Total** | **242** | **100.0** |

Table 4 indicates that out of the 242 respondents, 86 (35.5%) had taught for up to 5 years, 80 (33.1%) had teaching experience of 6 to10 years, 42 (17.4%) had 11 to 15 years of teaching experience, 12 (5%) had taught for 16-20 years and finally, 22 (9.1%) respondents had had more than twenty years of teaching experience. This is an indication that the sample was representative of teachers of all categories of working experience in terms of number of years. However, Table 4 also shows that most of the respondents had had teaching experience of up to five years, followed by those with experience from six to ten years and the least category of teachers had had teaching experience of sixteen to twenty years.

Table 5 shows distribution of respondents by highest qualifications.

**Table 5: Highest Qualification**

| Qualification | No. of Teachers | Percentage (%) |
|---|---|---|
| Certificate | 0 | 0 |
| Diploma | 114 | 47.1 |
| First Degree | 114 | 47.1 |
| Master's Degree | 10 | 4.1 |
| Missing values | 4 | 1.7 |
| **Total** | **242** | **100.0** |

It is shown in Table 5 that none of the respondents possessed a Certificate as a highest qualification. Most of the respondents (47.1%) possessed Diploma, likewise First Degree. Ten respondents representing 4.1% had Master's Degree but four (1.7%) teachers did not respond at all. Table 5 is an indication that the respondents are representative of teachers of most common qualifications at the Basic school level being Diploma, First Degree and Master's Degree.

**Analysis of Main Data**

**Research Question One:**

**What ICT Resources (software, hardware, etc.) are Available for use in Basic Schools?**

Research question one was meant to find out what ICT resources were available for use in Basic Schools. To answer this question, the respondents were asked to indicate which ICT resources were available for use in their schools in

response to item 8 on the questionnaire and their responses were summarized in Table 6.

**Table 6: Availability of ICT Resources**

| Resource | Response | No. of Teachers | Percentage (%) |
|---|---|---|---|
| Internet: | Yes | 6 | 2.6 |
| | No | 229 | 97.4 |
| | **Total** | **235** | **100** |
| Computers | Yes | 230 | 96.6 |
| | No | 8 | 3.4 |
| | **Total** | **238** | **100** |
| Television | Yes | 50 | 21 |
| | No | 188 | 79 |
| | **Total** | **238** | **100** |
| Software for Teaching | Yes | 7 | 3 |
| | No | 228 | 97 |
| | **Total** | **235** | **100** |

As shown in Table 6, out of the total of 242 respondents, seven did not respond. Only six (2.6%) responded affirmatively that they had internet access in

their schools. Surprisingly, as many as 229 (97.4%) respondents responded that internet access was not available in their school. This finding showed that most of the Basic schools did not have internet access. Though the percentages differ, this is in harmony with that of a similar study conducted in South Africa which found that only 25% of the teachers from a sample of schools confirmed availability of internet access in their schools, in other words as many as 75% confirmed their schools did not have internet access (Maholwana-Sotashe, 2007, p. 89).

Again, when asked to indicate whether computers were available in their schools, Table 6 shows that 230 (96.6%) respondents indicated that computers were available in their schools. Only eight (3.4%) teachers however responded that their schools did not have computers. This result is an indication that at the time of the study most of the Basic schools in the Cape Coast metropolis had computers. However, response to a follow up question, item 11 on the questionnaire, asked to find out about the number of computers available to a class in a lesson indicated that most of the schools had very few numbers of computers. The numbers of computers indicated ranged from one to 30 with 200 teachers indicating availability of one to 10 computers. This is a clear indication that though most of the schools had computers, their numbers were clearly insufficient as shown in appendix C (SPSS OUTPUT).

Once again, out of the total of 238 teachers who responded to the question on availability of television in schools, Table 5 shows that 50 teachers representing 21.7% of the teachers affirmed that their schools had television sets while 188 teachers representing 79% indicated that television sets were not

available in their schools. This also shows that most of the Basic schools did not have television sets that could be integrated in teaching.

Lastly, in response to the question on availability of software for teaching in the sample schools, Table 6 shows that out of 235 teachers who responded, only seven (7) representing 3% confirmed that software for teaching were available in their schools. Two hundred and twenty-eight respondents representing 97% however indicated that such software was not available in their schools. In response to a follow-up question to name, if any, available software for teaching and learning, the three percent respondents mentioned Microsoft Word, Microsoft PowerPoint and Mavis Beacon Teaching Typing. None of the respondents ever mentioned learning software in the form of tutorials, drills or even games. This is a clear indication that either most of the schools simply do not have such software or they do not know about them.

To sum up, the results in Table 6 reveal that computers are the only ICT resources that are available for use in most of the Basic Schools in the Cape Coast metropolis. Next to computers is television which is also available in some of the Basic schools.

**Research Question 2**

**What ICT resources do teachers use in teaching their respective subjects?**

The purpose of research question 2 was to find out which ICT resources teachers actually used in teaching their respective subjects. Table 7 shows the responses of teachers when asked to indicate the frequency with which they used internet (or worldwide web) in teaching their respective subjects.

**Table 7: Frequency of Internet Usage in Teaching**

| Response | No. of Teachers | Percentage (%) |
|---|---|---|
| Not at all | 202 | 86.7 |
| Rarely | 29 | 12.4 |
| Often | 2 | 0.9 |
| **Total** | **233** | **100** |

As indicated in Table 7, 202 teachers, representing 86.7% of the respondents answered that they did not use internet at all in teaching their respective subjects. Twenty-nine teachers representing 12.4% of the respondents answered that they rarely used internet in their teaching. Only two teachers representing 0.9% answered that they often used internet in teaching their respective subjects. This result is a clear indication that the internet (or worldwide web) as a tool with all its invaluable advantages for supporting teaching and learning was not being used by most teachers of public basic schools in the Cape Coast Metropolis.

Similar to the frequency of internet usage in teaching and learning at the basic school level in the Cape Coast Metropolis, Table 8 presents the frequency of computer usage in teaching various subjects.

**Table 8: Frequency of Computer Usage in Teaching**

| Response | No. of Teachers | Percentage (%) |
|---|---|---|
| Not at all | 167 | 71.1 |
| Rarely | 68 | 28.9 |
| Often | 0 | 0 |
| **Total** | **235** | **100** |

Table 8 shows that as many as 167 teachers representing 71.1% answered the question on how often they used computers in teaching their respective subjects that they did not use computers at all. 68 teachers representing 28.9% responded that they rarely used computers in teaching their respective subjects. None of the teachers showed that he or she used computer often in his or her lesson. This is a clear indication that though the government of Ghana had supplied a number of laptop computers to various schools, most of the schools did not use the computers in the teaching of various subjects other than I.C. T. as a subject. This result confirms that of a similar study conducted in South Africa which found that only 32%, 27% and 21% of three different categories of teachers respectively were more likely to use computers for teaching and learning purposes (Maholwana-Sotashe, 2007, p. 93).

Table 9 presents the responses to the item 12 of the questionnaire that probed into how often teachers used television in teaching their respective subjects.

**Table 9: Frequency of Television Usage in Teaching**

| Response | No. of Teachers | Percentage (%) |
|---|---|---|
| Not at all | 210 | 92.5 |
| Rarely | 14 | 6.2 |
| Often | 3 | 1.3 |
| **Total** | **227** | **100** |

From Table 9, as many as Two hundred and ten (210) teachers representing 92.5% responded that they did not use television at all in teaching their subjects. Only fourteen teachers representing 6.2% answered that they rarely used television in teaching their subjects while finally, three teachers representing 1.3% responded that they used television often in teaching their subjects. The results of this table are clear indication that most teachers did not use television in teaching their respective subjects.

When teachers were asked how often they used software in teaching their respective subjects, their responses were as shown in Table 10.

**Table 10: Frequency of Software Usage in Teaching**

| Response | No. of Teachers | Percentage (%) |
|---|---|---|
| Not at all | 180 | 83.3 |
| Rarely | 36 | 16.7 |
| Often | 0 | 0 |
| **Total** | **216** | **100** |

The data in Table 10 show that 180 teachers representing 83.3% responded that they did not use software in teaching at all. Thirty-six teachers representing 16.7% also responded that they rarely used software in teaching their respective subjects. None of the respondents affirmed using software often in teaching his or her respective subjects. Again, it could be deduced from the results of Table 10 that most of the teachers did not use software in teaching their respective subjects, and even the few who did, rarely did so.

In answering the research question 2, analyses of the results of Tables 7, 8, 9 and 10 revealed that generally speaking, teachers virtually did not use any ICT resources in teaching their respective subjects.

**Research Question 3**

**What ICT Skills do Basic School Teachers Have?**

The purpose of research question 3 was to find out the kind of skills Basic school teachers have in using ICT tools especially computers. To answer this question, teachers were asked to indicate how conversant they were with the use

of some common computer applications. Familiarity with the use of such applications would mean teachers had basic skills of using computers such as typing, drawing, navigating through documents and preparation of slides among others which would all be necessary in integrating ICT in teaching various subjects. Table 11 shows responses of teachers to item 15 of the questionnaire when asked how conversant they were with the use of Microsoft Word.

**Table 11: Familiarity with Microsoft Word**

| Response | No. of Teachers | Percentage (%) |
|---|---|---|
| Not at all | 24 | 10.4 |
| Very little | 70 | 30.4 |
| Very well | 136 | 59.1 |
| **Total** | **230** | **100** |

As shown in Table 11, only twenty-four (24) teachers representing 10.4% of the total respondents of 230 indicated that they were not conversant at all with the use of MS Word, while 70 teachers representing 30.4% responded that they were very little conversant with MS Word and 136 teachers representing 59.1% affirmed that they were very well conversant with Microsoft Word. The results of Table 11 are an indication that most of the teachers of the sample schools were somehow skilled in using Microsoft Word application. This finding is in agreement with that of Maholwana-Sotashe (2007, p. 86) who noted in a similar

study that “MS Word was the most frequently mentioned software” when teachers were asked to mention which software they used very often.

Table 12 also confirms that most of the teachers were skilled in the use of Microsoft Excel.

**Table 12: Familiarity with Microsoft Excel**

| Response | No. of Teachers | Percentage (%) |
|---|---|---|
| Not at all | 46 | 20.5 |
| Very little | 118 | 52.7 |
| Very well | 60 | 26.8 |
| **Total** | **224** | **100** |

As shown in Table 12, though 46 teachers representing 20.5% indicated that they were not at all conversant with the use of Microsoft Excel, as much as 52.7% affirmed being very little conversant and 26.8% also responded being very well conversant with the use of Microsoft Excel. In effect, as much as 79.5% had skills in using MS Excel which implies they were somehow capable of using the application in teaching if they needed.

The number of teachers who were conversant with the use of Microsoft PowerPoint reduced compared to those of Microsoft Word and Excel as revealed in Table 13.

**Table 13: Familiarity with Microsoft PowerPoint**

| Response | No. of Teachers | Percentage (%) |
|---|---|---|
| Not at all | 82 | 37.6 |
| Very little | 78 | 35.8 |
| Very well | 58 | 26.6 |
| **Total** | **218** | **100** |

As shown in Table 13, 82 respondents representing 37.6% were not conversant at all with the use of MS PowerPoint. However 78 teachers representing 35.8% responded being very little conversant while 58 representing 26.6% responded that they were very well conversant with using Microsoft PowerPoint. To sum up, Table 13 shows that many teachers were familiar with the use of Microsoft PowerPoint and that implies that about 62.4% of the teachers were capable of using the application in their lesson delivery if they wanted to, with some assistance to those with very little familiarity.

Table 14 shows teachers' responses on their familiarity with the use of Microsoft Access.

**Table 14: Familiarity with Microsoft Access**

| Response | No. of Teachers | Percentage (%) |
|---|---|---|
| Not at all | 94 | 46.5 |
| Very little | 84 | 41.6 |
| Very well | 24 | 11.9 |
| **Total** | **202** | **100** |

The results in Table 14 show that close to half of the teachers (46.5%) were not conversant at all with using Microsoft Access application while only 11.9% being very well conversant. This implies that many teachers did not have either the skills or knowledge to use the application should there be a need to use it in their teaching.

In Table 15, it is clear that most of the Basic school teachers were not familiar with the use of CorelDraw application at all.

**Table 15: Familiarity with CorelDraw**

| Response | No. of Teachers | Percentage (%) |
|---|---|---|
| Not at all | 122 | 58.1 |
| Very little | 54 | 25.7 |
| Very well | 34 | 16.2 |
| **Total** | **210** | **100** |

From Table 15, as many as 58.1% did not have the knowledge and or skills to use the application even if CorelDraw could be used to better achieve their instructional objectives, probably through designing attractive and appropriate instructional materials.

The foregoing analyses and discussion of the results in Tables 11 through 15 give a clear indication that though there were differences in the skill levels of the teachers in using those popular applications, in all, most of them had some familiarity with using applications such as Microsoft Word, Microsoft Excel and Microsoft PowerPoint all of which could be integrated in teaching various subjects at the Basic school level. Again, use of the named computer application software come with other basic ICT skills that are applicable in using other technologies and applications such as surfing the web for information, using educational software and playing educationally relevant videos all of which could be relevant skills in integrating ICT into teaching various subjects.

Once again, Table 16 provides information on the sources of training the respondent teachers indicated that they had, or otherwise, some form of training to use computers from in response to item 16 of the questionnaire.

**Table 16: Training Received to Use Computers**

| Source | Response | No. of Teachers | Percentage (%) |
|---|---|---|---|
| G.E.S | Yes | 174 | 75.7 |
| | No | 56 | 24.3 |
| | **Total** | **230** | **100** |

**Table 16: Training Received to Use Computers (Continued)**

| Source | Response | No. of Teachers | Percentage (%) |
|---|---|---|---|
| School of teaching | Yes | 50 | 25.5 |
| | No | 146 | 74.5 |
| | **Total** | **196** | **100** |
| Personal effort | Yes | 178 | 87.3 |
| | No | 26 | 12.7 |
| | **Total** | **204** | **100** |
| Family and friends | Yes | 136 | 61.8 |
| | No | 84 | 38.2 |
| | **Total** | **220** | **100** |
| University/College | Yes | 152 | 76 |
| Course | No | 48 | 24 |
| | **Total** | **200** | **100** |

As shown in Table 16, 75.7%, 87.3%, 61.8% and 76% of the respondents being majority in each case agreed to have had training from Ghana Education Service (GES), personal effort, family and friends, and University/College course respectively while only 25.5% agreed to have had training to use computers from the schools they taught. It could be deduced from Table 16 that most of the teachers had had some form of training, irrespective of the source, to use

computers in general, a clear indication of their possession of basic skills to use computers in general.

Item 17 of the questionnaire asked teachers to indicate the source of training they had had to use computers in teaching their respective subjects, if any. Their responses were summarized as shown in Table 17.

**Table 17: Training Received to Use Computers in teaching**

| Source | Response | No. of Teachers | Percentage (%) |
|---|---|---|---|
| G.E.S | Yes | 146 | 62.9 |
| | No | 86 | 37.1 |
| | **Total** | **232** | **100** |
| School of teaching | Yes | 26 | 11.6 |
| | No | 198 | 88.4 |
| | **Total** | **224** | **100** |
| Personal effort | Yes | 118 | 52.2 |
| | No | 108 | 47.8 |
| | **Total** | **226** | **100** |
| Family and friends | Yes | 72 | 31.3 |
| | No | 158 | 68.7 |
| | **Total** | **230** | **100** |

**Table 17: Training Received to Use Computers in teaching (continued)**

| Source | Response | No. of Teachers | Percentage (%) |
|---|---|---|---|
| University/College | Yes | 86 | 38.4 |
| Course | No | 138 | 61.6 |
| | **Total** | **224** | **100** |

The results in Table 17 show clearly that greater numbers of the teachers (62.9% and 52.2%) agreed that they had had training from the Ghana Education Service (GES) and through personal effort respectively to use computers in teaching their respective subjects. However, regarding the schools they taught, family and friends, and university/college courses, greater numbers of teachers (88.4%, 68.7% and 61.6% respectively) disagreed to have had any training to use computers in teaching their respective subjects. It can be concluded from the results of Table 17 that majority of the teachers had some skills and knowledge acquired from GES training and personal studies about how to use computers in teaching their respective subjects.

**Research Question 4**

**What factors militate against the use of ICTs in teaching and learning of various subjects?**

The purpose of research question 4 was to find out the possible challenges or difficulties teachers encountered that prevented them from integrating ICT in teaching their respective subjects. To answer the research question 4, teachers

were asked to state such challenges in an answer to item 18 of the questionnaire. The item 18 was an open-ended question and responses of the teachers were summarized as in Table 18.

**Table 18: Challenges in Integrating ICT in Teaching**

| Response | No. of Teachers | Percentage (%) |
|---|---|---|
| Inaccessibility of ICT resources | 6 | 2.5 |
| Insufficient ICT resources | 12 | 5.0 |
| Insufficient number of computers | 85 | 35.1 |
| Insufficient number of computers and power outages | 3 | 1.2 |
| Lack of integration skills | 8 | 3.3 |
| No ICT laboratory | 4 | 1.7 |
| No practical skills | 4 | 1.7 |
| No projector | 2 | 0.8 |
| Unavailable computers and source of electricity | 2 | 0.8 |
| Unavailable computers and power outages | 6 | 2.5 |
| Unavailable resources | 46 | 19 |
| Unavailable resources and lack of practical skills | 2 | 0.8 |
| Unavailable source of electricity | 2 | 0.8 |
| Unstable electricity | 2 | 0.8 |
| Missing values | 58 | 24 |
| **Total** | **242** | **100** |

It can be concluded from the Table 18 that inadequate and unavailable resources, lack and unstable source of electricity and lack of integration skills among others were the major challenges that prevented the teachers from teaching their respective subjects with I.C. T. tools. The challenges of Basic school teachers as found in the results of Table 18 were similar to those of Primary school teachers in the Khomas Region of Namibia. In a similar study submitted to the University of Namibia in 2012, Nuuyoma found that inability to operate ICT facilities, lack of resources, burglary, lack of motivation from the school management, lack of parental involvement and overcrowded classrooms were among the challenges teachers faced in attempts to integrate ICT in the teaching of reading and writing (Nuuyoma, 2012, ).

**Research Question 5**

**What are possible solutions to the challenges of integrating ICTs in teaching and learning of various subjects in Basic schools?**

Research question 5 sought to identify some possible solutions to the challenges Basic school teachers of the Cape Coast Metropolis encountered that prevented them from integrating ICT in teaching their respective subjects. In order to answer the research question 5, item 19 of the questionnaire asked teachers to suggest how their challenges could be addressed. In response to item 19 of the questionnaire, the teachers' suggestions were summarized as shown in Table 19.

**Table 19: Solutions to Challenges in Integrating ICT in Teaching**

| Response | No. of Teachers | Percentage (%) |
|---|---|---|
| Provision of more computers, posting of well-trained ICT teachers | 6 | 2.5 |
| Establishment of ICT laboratory | 10 | 4.1 |
| Involvement of skilled persons | 6 | 2.5 |
| Provision of electricity to schools | 2 | 0.8 |
| Provision of enough computers, setting up ICT laboratory | 2 | 0.8 |
| Provision of enough ICT resources | 44 | 18.2 |
| Provision of enough ICT resources and training | 2 | 0.8 |
| Provision of more computers and internet access | 6 | 2.5 |
| Provision of practical training | 4 | 1.7 |
| Provision of projectors | 4 | 1.7 |
| Provision of sufficient computers to schools | 88 | 34.4 |
| Missing values | 68 | 28.1 |
| **Total** | **242** | **100** |

As shown in Table 19, the summary of teachers' suggestions to the solutions of challenges in ICT integration included provision of sufficient computers and other ICT resources such as internet access in schools, establishment of ICT laboratories in schools, posting of well-trained ICT teachers

to schools, involvement of skilled persons, provision of electricity and provision of practical training to teachers of various schools.

# CHAPTER FIVE

# SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter 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 study investigated the challenges that militate against the successful integration of ICT in the teaching of various subjects in Basic schools of the Cape Coast Metropolis in the Central Region of Ghana. The purpose of the study was to find out ICT resources available for use in Basic schools, ICT resources teachers actually use, ICT skills teachers have, factors that militate against the use of ICT in teaching and learning of various subjects, and possible solutions to the challenges of integrating ICT in teaching and learning of various subjects in Basic schools.

To achieve the purpose of the study, the descriptive survey design was used for the study. Questionnaire was used as the main instrument for data collection to obtain information on the status quo of the phenomenon. I designed the questionnaire with the assistance of my supervisor.

The population of the study comprised all the teachers of public Basic schools in the Cape Coast Metropolis of the Central Region of Ghana. A sample

size of 242 teachers of the accessible population was selected from 22 schools out of 82 public basic schools. The random number method of the simple random sampling technique was used in the sampling procedure.

The questionnaires were administered through volunteer teachers who offered to assist in each of the selected schools. I explained the purpose of the questionnaires and how they should be answered to the volunteer teachers and a date for collection was scheduled before they were left to administer the questionnaires. The main data collection took two working weeks from 19th to 30th May, 2014 and the data obtained from the questionnaires were coded and analyzed using the SPSS version 16. Again, frequencies and percentages of the descriptive statistics method were used in the presentation and discussion of the result obtained from the questionnaires in response to the research questions.

**Key Findings**

A number of findings emerged from the study. The main ones were as follows;

1. The ICT resources available for use in Cape Coast public basic schools are mainly computers, with very few schools having television sets.
2. Computers are the main ICT resources that some teachers use in teaching their lessons.
3. Many teachers have skills in using Microsoft Word and Microsoft Excel while few have skills in using Microsoft PowerPoint. Most of the teachers

skilled in ICT usage acquired their skills through GES workshops, personal studies, family and friends, and university or college courses.

4. Inadequate and unavailable ICT resources, lack and unstable sources of electricity and lack of integration skills were mentioned as the inhibiting factors of ICT integration into the curriculum.
5. Provision of sufficient numbers of computers and other ICT resources, setting up ICT laboratories in schools, involvement of skilled persons, provision of electricity and practical training to teachers were suggested solutions to ICT integration challenges.

## Conclusions

On the basis of the key findings, it could be concluded that since teachers in the Cape Coast Metropolis Basic schools did not have requisite skills in integrating ICT in their teaching, it could be deduced that both pre-service and in-service teacher training programmes likewise lacked ICT integration components which would otherwise equip teachers to use ICT in teaching their respective subjects.

## Recommendations

Based on the findings and conclusions of the research, I recommend the following for consideration:

### Recommendations for Policy and Practice

1. The government and other stake holders of the education in Ghana should consider providing variety of Information and Communication Technologies or resources proportionally to all public basic schools to encourage more effective teaching and learning. This is necessary because different technologies are more effective in different lesson situations than others, but in the case of Cape Coast Metropolis public basic schools, it was found that computers were main ICT resources available which would not encourage diversity in ICT resource usage.
2. Teachers should find and use variety of ICT resources besides computers that can be more effective in attaining different lesson objectives and with learners of different learning styles to enhance effective teaching and learning.
3. Teachers who do not have practical skills in ICT usage should seek some training to enable them competently and confidently use them in teaching their respective subjects.
4. Teacher training programs in universities and colleges should consider including courses that involve practical methods of integrating ICT in the teaching of various subjects to equip pre-service teachers with necessary

skills to enable them effectively integrate ICT in their lessons after their training.

5. The Ghana Education Service in collaboration with the Ministry of Education should organize in-service training on strategies of integrating ICT into the curriculum as well as emerging e-learning technologies and methodologies for all teachers to equip them with relevant skills or train their representatives as facilitators to organize similar workshops in schools or circuit centers for other teachers intermittently.
6. Sources of electricity should be provided in all basic schools and their stable supply ensured to enable teachers use ICT resources whenever their lessons require them.
7. The stake holders in education such as government institutions, Non-Governmental Organizations (N.G.O.s), parent associations among others should collaborate to set up ICT laboratories and equip them with sufficient modern technologies to encourage ICT integration in all basic schools.

**Suggestions for Further Research**

Future researchers should expand the scope of a similar study to include school management and their institutional policies on ICT integration into the curriculum.

## REFERENCES


Alreck, P. L., & Settle, R. B. (1985). The survey research handbook. *Homewood, Illinois: Richard D. Irwin. Inc, 13*(1), 71-73.

Amedahe, F. K. (2002) *Fundamentals of educational research methods*. Mimeograph, UCC, Cape Coast.

Armstrong, V., Barnes, S. Sutherland, R., Curran, S. Mills, S. & Tompson, I. (2005). Collaborative research methodology for investigation teaching and learning: the use of interactive whiteboard technology. *Educational Review*, 57 (4), 457-469.

Bannon, L. (1997). *Activity theory*. Interaction Design Centre. University of Limerick.

Barak, M. (2005). From order to disorder: the role of computer-based electronics projects on fostering of higher-order cognitive skills. *Computer & Education*, 45, 231-243.

Becta (2005*). Evidence on the progress of ICT in Education*. ICT Research. Available on line: http://foi.becta.org.uk/content_files/corporate/resources/policy_and_strategy/board/0503-mar/becta_review_[2005]pdf

Bialobrzeska, M., & Cohen, S. (2005). *Managing ICTs in South African schools. A guide for school principals*. South Africa: SAIDE.

Bottino, R.M. (2004). The evolution of ICT-based learning environments: Which perspective for the school of the future? *British Journal of Education Technology*, 35 (5), 553-567.

Carnoy, M. (2004). *ICT in education: Possibilities and challenges*. Retrieved March 2014, from http://www.uoc.edu/inaugural04/dt/eng/carnoy1004.pdf

Clark, R. C., & Mayer, R.E. (2003). *e-Learning and the science of instruction*. United State of America. Preiffer.

Cohen, L., Manion, L., & Marrison, K. (2005). *Research method in education 5th edition*. New York.

Corbett, B. & Willms, D. (2002). Information and communication technology: Access and uses. *Education Quarterly Review*, 8(4) 8-15.

Corno, L. & Snow, R. E. (1986) Adapting teaching to individual differences among learners. *Handbook of research on teaching* 3(605-629)

Dede, C. (2000). Emerging influences of information technology on school curriculum. *Journal of Curriculum Studies*. 32 (2), 281 – 303.

Duffy, M. & Cunningham, D. (1996). Constructivism: Implications for Design and Delivery of Instruction. In D. H. Jonassen (Ed.). *Handbook of research for educational communication and technology*. (pp.170-195). New York: Macmillan Library Reference.

Flanagan, L. & Jacobsen, L. (2003). Technology leadership for the twenty-first century principal. *Journal of Educational Administration*. 41(2), 124-142

Gay, L. R. (1992) *Educational research: Competencies for analysis and application*. (4th ed.) New York: Merrill/Macmillan

Granger, C. A., Morbey, M. L., Lotherington, H. & Owston, R. D. (2002). Factors contributing to teachers' successful implementation of IT. *Journal of Computer Assisted Learning*. 18(4), 480-488.

Hartley, J. (2007). Teaching, learning and new technology: A review for teachers. *British Journal of Education Technology*, 38(1), 42-62.

Hawkridge, D. (1990). Keynote address: who needs computers in schools, and why? *Computer Education*, 15(1-3), 1-6.

Hennessy, S., Ruthven, K. & Brindley S. (2005). Teacher perspectives on integrating ICT into subject: Commitment, constraints, caution, and change. *Journal of Curriculum Studies*, 37 (2), 155–192.

Hinchey, P. H. (1998). *Finding freedom in the classroom: A practical introduction to critical theory*. New York: P. Lang. pp34-56

Hodgkinson- Williams, C. A. (2005). *Dust on the keyboards: Policy gaps in the integration of ICT into the South African curriculum.* Proceedings of the 8th IFIP World Conference on Computers in Education 4-7 July, University of Stellenbosch, Stellenbosch.

Hodgkinson-Williams, C. A. (2006). *Revisiting the concept of ICT' as 'tools': Exploring the epistemological and ontological underpinnings of a conceptual framework*. Paper for ITForum. 13-17 March.

Hodgkinson-Williams, C. A., Sieborge, I., & Terzoli, A. (2007) Enabling and constraining ICT practice in secondary schools: case studies in South Africa. *International Journal of Knowledge and Learning*, 3(2-3)171-190.

Howell, C. Lundall, P. & Patrick, M. (2000). *Computers in Schools: A national survey of Information Communication Technology in South African Schools*. Cape Town: Education Policy Unit, University of the Western Cape.

Howie, S. J., Muller, A., & Paterson, A. (2005). *Information and Communication Technologies in South African Secondary Schools*. HSRC Press. Cape Town. South Africa.

Jonassen, D. H., & Reeves, T. C. (1996). *Learning with technology: Using computers as cognitive tools*. In D. H. Jonassen (Ed.). Handbook of research for educational communications and technology: A project of the Association for Educational Communications and Technology. (pp.693-719). New York: Macmillan Library.

Kanuka, H., & Anderson, T (1999). Using constructivism in technology-mediated learning: Constructing order out the chaos in the literature. *International Journal of Radical Pedagogy* 1(2).

Kearsley, D., Hunter, B., & Furlong, M. (1992). *We teach with technology: New visions for education.* Wilsonville, Oregon: Franklin, Beedle & Associates.

Kennewell, S., Parkinson, J., & Tanner, H. (2000). *Developing the ICT capable school.* London: RoutedgeFalmer.

Kozulin, A. (2003*). Vygotsky's Educational theory in cultural context*. In J.S Brown, C. H., R. P. & L.A. Suchman Learning in Doing: Social, Cognitive and Computational Perspectives (pp 15-36). New York. Cambridge University.

Lagos, M. E., Nussbaum, M., & Capponi, F. (2005*). A mediation model for large group collaborative teaching*. In Fuks, H., Lukosch, S. & Salgado, A. C. (Eds). Groupware: Design, Implementation, and Use (pp. 263-270). Heidelberg Springer-Verlag Berlin

Lajoie, S. P., & Derry, S. J. (1993). *Computers as cognitive tools*. London. New Jersey.

Lankshear, C., Peters, M, & Knobel, M. (2000). Information, knowledge and learning: Some issues facing epistemology and education in a digital age. *Journal of Philosophy of Education*, 34 (1), 17-39.

Lee, K. T. (2002). Effective Teaching in the Information Era: Fostering an ICT based Integrated Learning Environment in Schools. *Asia Pacific Journal for Teacher Education & Development*, 5 (1), 21-45.

Leedy, P. D., & Ormrod, J. E. (2010*) Practical research planning and design* (9th ed.) New Jersey: Pearson Education Inc.

Lim, C. P. (2002). A theoretical framework for the study of ICT in schools: A proposal. *British Journal of Educational Technology*, 33 (4), 411-421.

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

Magliaro, S., Lockee, B., & Burton, K. (2005). Direct instruction revisited: A key model for instructional technology. *Educational Technology Research & Development*, 53 (4) 41-52.

Maholwana-Sotashe, N. L. (2007) *Challenges faced by secondary school teachers in integrating ICT into the curriculum: A multiple case study in the Grahams town Circuit.* Unpublished master's thesis, Rhodes University, South Africa.

McCormick, R. & Scrimshaw, P. (2001) Information and communications technology, knowledge and pedagogy. *Education, Communication & Information*, 1 (1), 37-57

McGhee, R., & Kozma, R. (2003) New teacher and student roles in the technology-supported classroom. *SRI International*, USA. Retrieved March 14, 2014 from http://islandora.mlml.calstate.edu/islandora/object/islandora%3A7179/datastream/OBJ/download/teacherstudentroles.pdf

Ministry of education (2009) *ICT in education policy.* Retrieved January 3, 2014 from http://www.moe.gov.gh/docs/ICT%20in%20Education%20policy_NOV%202008.pdf

Mooij, T., & Smeets, E. (2001). Modelling and supporting ICT implementation in secondary schools. *Computers & Education*, 36 (3), 265-282.

Mumtaz, S. (2000). Factors affecting teachers' use of information and communications technology: A review of the literature. *Journal of Information Technology for Teacher Education*, 9 (3), 319-341.

Nwana, O. C. (1993) *Introduction to educational research for student teachers.* Ibadan: Heinemann. Education Books Ltd.

Opoku R. A. (2004) *Ghana and ICT: Strides, challenges and the way forward.* Retrieved February 16, 2014 from http://www.ghanaweb.com/GhanaHomePage/features/artikel.php?ID=54098

Oppenheimer, T. (1997). The Computer Delusion. *The Atlantic Monthly Company*, 280 (1), 45-62.

Orlich, D. C. (2000). Education reform and limits to student achievement. *Phi Delta Kappan*, 81 (6), 468-477

Osuala, E. C. (1991). *Introduction to research methodology*. Onitsha: Africana Feb Publishers Limited. p. 175-179

Ozman H. & Craver S. (1986) *Philosophical foundations of education*. (3rd ed.). Columbus: Merrill.

Palincsar, A. S. (1998). Social constructivist perspective on teaching and learning. *Annual Reviews of Psychology*, (49), 345-375.

Papert, S. (1980). *Mindstorms: Children computers and powerful ideas*. Brighton, Sussex: Harvester Press.

Pearson, M., & Naylor, S. (2006). Changing contexts: Teacher professional development and ICT pedagogy. *Education Information Technology*, (11), 283–291.

Ravenscroft, D. (2001). Designing E-learning interactions in the 21st century: Revisiting and rethinking the role of theory. *European Journal of Education*, 36 (2), 133-156.

Reeves, T. C., & Hedberg, J. G. (2003). *Interactive learning systems evaluation*. Englewood Cliffs, New Jersey: Educational Technology Publications.

Republic of Ghana (2003). *The Ghana ICT for accelerated development (ICT4AD) policy*. Retrieved January 3, 2014, from http://www.nita.gov.gh/system/files/nita_resource/Ghana_ICT4AD_Policy.pdf

Romiszowski, A. J., & Mason, R. (1996). *Computer-mediated communication*. In D. H. Jonassen (Ed). Handbook of Research for Educational Communications and Technology (pp.438- 456) London: Prentice Hall International.

Schunk, D. H. (2004). *Learning theories: an educational perspective.* Greensboro. The University of North Carolina.

Selwood, I., & Pilkington, R. (2005). Teacher workload: Using ICT to release time to teach. *Educational Review*, 57 (2), 163-174.

Shelly, G. B., Cashman, T. J., Gunter, R. E. & Gunter, G. A. (2002). *Integrating Technology in the Classroom*. 2nd Edition. Boston, MA: Course Technology Thomson Learning.

Sherin, B., Reiser, B. J. & Eldelson, D. (2004). Scaffolding analysis: Extending the scaffolding metaphor to learning artifacts. *The Journal of the Learning Sciences,* 13 (3), 387- 421.

Taylor, R. P., (1980). *The computer in the school: Tutor, tool, tutee*. New York. Teacher College Press.

Tudge, J., & Rogoff, B. (1989). *Peer influences on cognitive development: Piagetian and Vygotskian perpectives*. In M.H. Bornstein & J.S.Bruner (Eds). Interaction in human development (pp. 17-40). Hillsdale, New Jersey: Lawrence Erbaum Associates, Publishers.

UNESCO (2003). *Building capacity of teacher/facilitators in technology-pedagogy integration for improved learning and teaching*, (2003). Final report. Bangkok: UNESCO

Webb, M., & Cox, M. (2004). A review of pedagogy related to information and communications technology. *Technology, Pedagogy and Education*, 13 (3), 235 -286.

Williams, D., Coles, L., Wilson, K., Richardson, A., & Tuson, J. (2000). Teachers and ICT: current use and future needs. *British Journal of Educational Technology*, 3 (4), 307-320.

Yuen, A. H. K., Law, N., Wong, K. C. (2003). ICT implementation and school leadership case studies of ICT integration in the teaching and learning. *Journal of Administration*, 41 (2), 158 - 170.

# APPENDICES

# APPENDIX A

## PYTHON CODE FOR RANDOM NUMBER GENERATION

```
import random
firstnum=raw_input('Enter first integer number: ');
secnum=raw_input('Enter second integer number: ');
num1=int(firstnum)
num2=int(secnum)
i=num1
def myNum(a,b):
        num=random.randint(a,b);
        print num;
while i <= num2:
        myNum(num1, num2)
        i+=1
```

APPENDIX B

QUESTIONNAIRE FOR TEACHERS

CHALLENGES OF INTEGRATING INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) IN BASIC SCHOOLS OF CAPE COAST METROPOLIS

**Questionnaire: Teacher's views**

The purpose of this research is purely academic, and utmost confidentiality is assured. I must be most grateful if you could kindly respond to these questions as honestly as possible. For confidentiality sake, please DO NOT write your name on the questionnaire.

**A. <u>Demographic data</u>**

1. Name of school.....……...

2. Grade(s) taught.....……...

3a. Are you a subject teacher? Yes [ ] No [ ]

3b. If yes, please specify subject(s)…….……..……..

4a. Years of teaching experience (*Please tick)*

0-5 [ ] 6-10 [ ] 11-15 [ ] 16-20 [ ] Above 20 [ ]

5. Highest qualification (*Please tick*)

Certificate [ ] Diploma [ ] First Degree [ ] Master's Degree [ ]

Other (*specify*) …….

6. Gender (*Please tick*) Male [ ] Female [ ]

7. How many learners do you teach in a period? ……

**B. <u>Availability of Resources</u>**

8. Which of these ICT resources are available in your school? (*Please tick*)

Internet access [ ]

Computers [ ]

Television [ ]

Software for teaching [ ]

9. What other ICT resources are available in your school? *(Please specify)*……

……

10. If there are any software for teaching in your school, please name them

……..

……..

11. If there are computers, how many does your class have access to in a period/lesson? ……

**C. <u>Resource Utilization</u>**

12. How often do you use ICT resources in **teaching your subject(s)**?

(*Please tick below*)

| **ICT RESOURCE** | **FREQUENCY OF USAGE IN TEACHING** | | | | |
|---|---|---|---|---|---|
| | Not at all | Rarely | Often | Most Often | Always |
| Internet | | | | | |
| Computer | | | | | |
| Television | | | | | |
| Software | | | | | |
| Other (*specify*) | | | | | |
| | | | | | |
| | | | | | |

13. If you don't use any/ some of the ICT resources in teaching, why?

……..…….

……

**D. <u>ICT Skills</u>**

14. How often do you use computers for other purposes?

Not at all [ ] Sometimes [ ] Frequently [ ]

15. If you use computers, which software are you conversant with? (*Please tick*)

| | **Not at all** | **Very little** | **Very Well** |
|---|---|---|---|
| Microsoft Word | | | |
| Microsoft Excel | | | |
| Microsoft PowerPoint | | | |
| Microsoft Access | | | |
| CorelDraw | | | |

Other (*specify*)

……..……

16. What training have you received to use computers? (*Please tick*)

| | **Yes** | **No** |
|---|---|---|
| None at all | | |
| Some training arranged by the Ghana Education Service | | |
| Some training arranged by the school | | |
| Through my own studies | | |
| From family and friends | | |
| Course in University/Collage program | | |

Other (*Specify*) …….

…….

17. What specific training have you received to use computers **in teaching your subject**? (*Please tick*)

| | **Yes** | **No** |
|---|---|---|
| None at all | | |
| Some training arranged by the Ghana Education Service | | |
| Some training arranged by the school | | |
| Through my own studies | | |
| From family and friends | | |
| Course in University/Collage program | | |

*Please specify title of training (if any)*

……..

**E. <u>Integration Challenges</u>**

18. What challenges or difficulties have you encountered in the process of integrating ICT in your teaching?.....

……

…….....

19. How can these challenges or difficulties be addressed?.....

……

……

20. Is there a computer specialist in your school? Yes [ ] No [ ]

21. To what extent does he/she support you in using computers in your subject area?

Not at all [ ] To some extent [ ] To a great extent [ ]

22. What level of interest do your learners show in using computers?

No interest [ ] Some interest [ ] A great deal of interest [ ]

23. Which grade/level do you find most eager to use computers?

(Please specify)……..

24. Which gender do you find more cooperative when using computers?

Boys [ ] Girls [ ]

APPENDIX C

SPSS OUTPUT

# Frequency Tables

**Name of school**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | A.M.E. ZION D | 11 | 4.5 | 4.5 | 4.5 |
| | Abura Ahmadiyya 'B' | 11 | 4.5 | 4.5 | 9.1 |
| | Abura St. Lawrence Cath. Sch. | 11 | 4.5 | 4.5 | 13.6 |
| | Amamoma Presby | 11 | 4.5 | 4.5 | 18.2 |
| | Amanful Catholic | 11 | 4.5 | 4.5 | 22.7 |
| | Ansapatu St. Peters Anglican | 11 | 4.5 | 4.5 | 27.3 |
| | Antem M/A | 11 | 4.5 | 4.5 | 31.8 |
| | Apewosika M/A | 11 | 4.5 | 4.5 | 36.4 |
| | Ayifua St Mary's Anglican Sch | 11 | 4.5 | 4.5 | 40.9 |
| | Christ Church Anglican | 11 | 4.5 | 4.5 | 45.5 |
| | Ebubonko M/A | 11 | 4.5 | 4.5 | 50.0 |
| | Efutu M/A Basic | 11 | 4.5 | 4.5 | 54.5 |
| | Ekon M/A Basic Sch. | 11 | 4.5 | 4.5 | 59.1 |
| | Esuekyir M/A Basic | 11 | 4.5 | 4.5 | 63.6 |
| | Imam Khomeinn | 11 | 4.5 | 4.5 | 68.2 |
| | Kakumdo M/A | 11 | 4.5 | 4.5 | 72.7 |
| | Kubease M/A Basic Sch | 11 | 4.5 | 4.5 | 77.3 |
| | Kwaprow M/A Basic | 11 | 4.5 | 4.5 | 81.8 |
| | Nkanfoa Catholic Sch. | 11 | 4.5 | 4.5 | 86.4 |
| | Nyinasin M/A Basic | 11 | 4.5 | 4.5 | 90.9 |
| | St. Andrews Anglican Sch. | 11 | 4.5 | 4.5 | 95.5 |
| | St. Augustines Practice | 11 | 4.5 | 4.5 | 100.0 |
| | Total | 242 | 100.0 | 100.0 | |

**Grades Taught**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | B.S. 1 | 22 | 9.1 | 9.1 | 9.1 |
| | B.S. 2 | 22 | 9.1 | 9.1 | 18.2 |
| | B.S. 3 | 22 | 9.1 | 9.1 | 27.3 |
| | B.S. 4 | 22 | 9.1 | 9.1 | 36.4 |
| | B.S. 5 | 22 | 9.1 | 9.1 | 45.5 |
| | B.S. 6 | 22 | 9.1 | 9.1 | 54.5 |
| | J.H.S. | 110 | 45.5 | 45.5 | 100.0 |
| | Total | 242 | 100.0 | 100.0 | |

**Years of Teaching Experience**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 0-5 | 86 | 35.5 | 35.5 | 35.5 |
| | 6-10 | 80 | 33.1 | 33.1 | 68.6 |
| | 11-15 | 42 | 17.4 | 17.4 | 86.0 |
| | 16-20 | 12 | 5.0 | 5.0 | 90.9 |
| | Above 20 | 22 | 9.1 | 9.1 | 100.0 |
| | Total | 242 | 100.0 | 100.0 | |

**Highest Qualification**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Diploma | 114 | 47.1 | 47.9 | 47.9 |
| | First Degree | 114 | 47.1 | 47.9 | 95.8 |
| | Masters Degree | 10 | 4.1 | 4.2 | 100.0 |
| | Total | 238 | 98.3 | 100.0 | |
| Missing | System | 4 | 1.7 | | |
| Total | | 242 | 100.0 | | |

**Gender**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Male | 114 | 47.1 | 47.1 | 47.1 |
| | Female | 128 | 52.9 | 52.9 | 100.0 |
| | Total | 242 | 100.0 | 100.0 | |

**Availability of internet**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Yes | 6 | 2.5 | 2.6 | 2.6 |
| | No | 229 | 94.6 | 97.4 | 100.0 |
| | Total | 235 | 97.1 | 100.0 | |
| Missing | System | 7 | 2.9 | | |
| Total | | 242 | 100.0 | | |

**Availability of computers**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Yes | 230 | 95.0 | 96.6 | 96.6 |
| | No | 8 | 3.3 | 3.4 | 100.0 |
| | Total | 238 | 98.3 | 100.0 | |
| Missing | System | 4 | 1.7 | | |
| Total | | 242 | 100.0 | | |

**Availability of television**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Yes | 50 | 20.7 | 21.0 | 21.0 |
| | No | 188 | 77.7 | 79.0 | 100.0 |
| | Total | 238 | 98.3 | 100.0 | |
| Missing | System | 4 | 1.7 | | |

**Availability of television**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Yes | 50 | 20.7 | 21.0 | 21.0 |
| | No | 188 | 77.7 | 79.0 | 100.0 |
| | Total | 238 | 98.3 | 100.0 | |
| Missing | System | 4 | 1.7 | | |
| Total | | 242 | 100.0 | | |

**Availability of software for teaching**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Yes | 7 | 2.9 | 3.0 | 3.0 |
| | No | 228 | 94.2 | 97.0 | 100.0 |
| | Total | 235 | 97.1 | 100.0 | |
| Missing | System | 7 | 2.9 | | |
| Total | | 242 | 100.0 | | |

**Number of Computers accessible to a class in lesson**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 0 | 34 | 14.0 | 14.0 | 14.0 |
| | 1 | 80 | 33.1 | 33.1 | 47.1 |
| | 10 | 22 | 9.1 | 9.1 | 56.2 |
| | 2 | 6 | 2.5 | 2.5 | 58.7 |
| | 20 | 4 | 1.7 | 1.7 | 60.3 |
| | 25 | 2 | .8 | .8 | 61.2 |
| | 3 | 6 | 2.5 | 2.5 | 63.6 |
| | 30 | 2 | .8 | .8 | 64.5 |
| | 4 | 14 | 5.8 | 5.8 | 70.2 |
| | 5 | 18 | 7.4 | 7.4 | 77.7 |
| | 6 | 38 | 15.7 | 15.7 | 93.4 |
| | 7 | 12 | 5.0 | 5.0 | 98.3 |
| | 8 | 4 | 1.7 | 1.7 | 100.0 |

**Number of Computers accessible to a class in lesson**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 0 | 34 | 14.0 | 14.0 | 14.0 |
| | 1 | 80 | 33.1 | 33.1 | 47.1 |
| | 10 | 22 | 9.1 | 9.1 | 56.2 |
| | 2 | 6 | 2.5 | 2.5 | 58.7 |
| | 20 | 4 | 1.7 | 1.7 | 60.3 |
| | 25 | 2 | .8 | .8 | 61.2 |
| | 3 | 6 | 2.5 | 2.5 | 63.6 |
| | 30 | 2 | .8 | .8 | 64.5 |
| | 4 | 14 | 5.8 | 5.8 | 70.2 |
| | 5 | 18 | 7.4 | 7.4 | 77.7 |
| | 6 | 38 | 15.7 | 15.7 | 93.4 |
| | 7 | 12 | 5.0 | 5.0 | 98.3 |
| | 8 | 4 | 1.7 | 1.7 | 100.0 |
| | Total | 242 | 100.0 | 100.0 | |

**Frequency of Internet Usage in Teaching**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Not at all | 202 | 83.5 | 86.7 | 86.7 |
| | Rarely | 29 | 12.0 | 12.4 | 99.1 |
| | Often | 2 | .8 | .9 | 100.0 |
| | Total | 233 | 96.3 | 100.0 | |
| Missing | System | 9 | 3.7 | | |
| Total | | 242 | 100.0 | | |

**Frequency of Computer usage in Teaching**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Not at all | 167 | 69.0 | 71.1 | 71.1 |
| | Rarely | 68 | 28.1 | 28.9 | 100.0 |
| | Total | 235 | 97.1 | 100.0 | |
| Missing | System | 7 | 2.9 | | |
| Total | | 242 | 100.0 | | |

**Frequency of Television usage in Teaching**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Not at all | 210 | 86.8 | 92.5 | 92.5 |
| | Rarely | 14 | 5.8 | 6.2 | 98.7 |
| | Often | 3 | 1.2 | 1.3 | 100.0 |
| | Total | 227 | 93.8 | 100.0 | |
| Missing | System | 15 | 6.2 | | |
| Total | | 242 | 100.0 | | |

**Frequency of Software usage in Teaching**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Not at all | 180 | 74.4 | 83.3 | 83.3 |
| | Rarely | 36 | 14.9 | 16.7 | 100.0 |
| | Total | 216 | 89.3 | 100.0 | |
| Missing | System | 26 | 10.7 | | |
| Total | | 242 | 100.0 | | |

**Use of other ICT resources for teaching.**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Not at all | 28 | 11.6 | 100.0 | 100.0 |
| Missing | System | 214 | 88.4 | | |
| Total | | 242 | 100.0 | | |

**If you don't use any/some of the ICT resources in teaching, why?**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | | 110 | 45.5 | 45.5 | 45.5 |
| | inadequate | 20 | 8.3 | 8.3 | 53.7 |
| | lack of expertise | 2 | .8 | .8 | 54.5 |
| | no ICT lab | 6 | 2.5 | 2.5 | 57.0 |
| | unavailable | 100 | 41.3 | 41.3 | 98.3 |
| | unavailable, insufficient knowledge | 2 | .8 | .8 | 99.2 |
| | unavailable, no source of electricity in classrooms | 2 | .8 | .8 | 100.0 |
| | Total | 242 | 100.0 | 100.0 | |

**How often do you use computers for other purposes?**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Not at all | 40 | 16.5 | 18.5 | 18.5 |
| | Sometimes | 132 | 54.5 | 61.1 | 79.6 |
| | Frequently | 44 | 18.2 | 20.4 | 100.0 |
| | Total | 216 | 89.3 | 100.0 | |
| Missing | System | 26 | 10.7 | | |
| Total | | 242 | 100.0 | | |

**Conversant with Microsoft Word**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Not at all | 24 | 9.9 | 10.4 | 10.4 |
| | Very little | 70 | 28.9 | 30.4 | 40.9 |
| | Very well | 136 | 56.2 | 59.1 | 100.0 |
| | Total | 230 | 95.0 | 100.0 | |
| Missing | System | 12 | 5.0 | | |
| Total | | 242 | 100.0 | | |

**Conversant with Microsoft Excel**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Not at all | 46 | 19.0 | 20.5 | 20.5 |
| | Very little | 118 | 48.8 | 52.7 | 73.2 |
| | Very well | 60 | 24.8 | 26.8 | 100.0 |
| | Total | 224 | 92.6 | 100.0 | |
| Missing | System | 18 | 7.4 | | |
| Total | | 242 | 100.0 | | |

**Conversant with Microsoft Powerpoint**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Not at all | 82 | 33.9 | 37.6 | 37.6 |
| | Very little | 78 | 32.2 | 35.8 | 73.4 |
| | Very well | 58 | 24.0 | 26.6 | 100.0 |
| | Total | 218 | 90.1 | 100.0 | |
| Missing | System | 24 | 9.9 | | |
| Total | | 242 | 100.0 | | |

**Conversant with Microsoft Access**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Not at all | 94 | 38.8 | 46.5 | 46.5 |
| | Very little | 84 | 34.7 | 41.6 | 88.1 |
| | Very well | 24 | 9.9 | 11.9 | 100.0 |
| | Total | 202 | 83.5 | 100.0 | |
| Missing | System | 40 | 16.5 | | |
| Total | | 242 | 100.0 | | |

**Conversant with CorelDraw**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Not at all | 122 | 50.4 | 58.1 | 58.1 |
| | Very little | 54 | 22.3 | 25.7 | 83.8 |
| | Very well | 34 | 14.0 | 16.2 | 100.0 |
| | Total | 210 | 86.8 | 100.0 | |
| Missing | System | 32 | 13.2 | | |
| Total | | 242 | 100.0 | | |

**Received computer training from G.E.S**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Agree | 174 | 71.9 | 75.7 | 75.7 |
| | Disagree | 56 | 23.1 | 24.3 | 100.0 |
| | Total | 230 | 95.0 | 100.0 | |
| Missing | System | 12 | 5.0 | | |
| Total | | 242 | 100.0 | | |

**Received computer training from school you teach**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Agree | 50 | 20.7 | 25.5 | 25.5 |
| | Disagree | 146 | 60.3 | 74.5 | 100.0 |
| | Total | 196 | 81.0 | 100.0 | |
| Missing | System | 46 | 19.0 | | |
| Total | | 242 | 100.0 | | |

**Received computer training from personal effort**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Agree | 178 | 73.6 | 87.3 | 87.3 |
| | Disagree | 26 | 10.7 | 12.7 | 100.0 |
| | Total | 204 | 84.3 | 100.0 | |
| Missing | System | 38 | 15.7 | | |
| Total | | 242 | 100.0 | | |

**Received computer training from family and friends**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Agree | 136 | 56.2 | 61.8 | 61.8 |
| | Disagree | 84 | 34.7 | 38.2 | 100.0 |
| | Total | 220 | 90.9 | 100.0 | |
| Missing | System | 22 | 9.1 | | |

**Received computer training from family and friends**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Agree | 136 | 56.2 | 61.8 | 61.8 |
| | Disagree | 84 | 34.7 | 38.2 | 100.0 |
| | Total | 220 | 90.9 | 100.0 | |
| Missing | System | 22 | 9.1 | | |
| Total | | 242 | 100.0 | | |

**Received computer trainig from University/College course**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Agree | 152 | 62.8 | 76.0 | 76.0 |
| | Disagree | 48 | 19.8 | 24.0 | 100.0 |
| | Total | 200 | 82.6 | 100.0 | |
| Missing | System | 42 | 17.4 | | |
| Total | | 242 | 100.0 | | |

**Received training to use computers in teaching from GES**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Agree | 146 | 60.3 | 62.9 | 62.9 |
| | Disagree | 86 | 35.5 | 37.1 | 100.0 |
| | Total | 232 | 95.9 | 100.0 | |
| Missing | System | 10 | 4.1 | | |
| Total | | 242 | 100.0 | | |

**Received training to use computers in teaching from school you teach.**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Agree | 26 | 10.7 | 11.6 | 11.6 |
| | Disagree | 198 | 81.8 | 88.4 | 100.0 |
| | Total | 224 | 92.6 | 100.0 | |
| Missing | System | 18 | 7.4 | | |
| Total | | 242 | 100.0 | | |

**Received training to use computers in teaching from personal effort.**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Agree | 118 | 48.8 | 52.2 | 52.2 |
| | Disagree | 108 | 44.6 | 47.8 | 100.0 |
| | Total | 226 | 93.4 | 100.0 | |
| Missing | System | 16 | 6.6 | | |
| Total | | 242 | 100.0 | | |

**Received training to use computers in teaching from family and friends**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Agree | 72 | 29.8 | 31.3 | 31.3 |
| | Disagree | 158 | 65.3 | 68.7 | 100.0 |
| | Total | 230 | 95.0 | 100.0 | |
| Missing | System | 12 | 5.0 | | |
| Total | | 242 | 100.0 | | |

**Received training to use computers in teaching from University or College course.**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Agree | 86 | 35.5 | 38.4 | 38.4 |
| | Disagree | 138 | 57.0 | 61.6 | 100.0 |
| | Total | 224 | 92.6 | 100.0 | |
| Missing | System | 18 | 7.4 | | |
| Total | | 242 | 100.0 | | |

**Title of training on computer usage in teaching**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | | 202 | 83.5 | 83.5 | 83.5 |
| | Autocad | 4 | 1.7 | 1.7 | 85.1 |
| | Introduction to ICT | 2 | .8 | .8 | 86.0 |
| | Multimedia in Education | 6 | 2.5 | 2.5 | 88.4 |
| | RLG Training | 28 | 11.6 | 11.6 | 100.0 |
| | Total | 242 | 100.0 | 100.0 | |

**What challenges or difficulties have you encountered in the process of integrating ICT in your teaching?**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | | 58 | 24.0 | 24.0 | 24.0 |
| | inaccess to ICT resources | 6 | 2.5 | 2.5 | 26.4 |
| | Insufficient ICT resources | 12 | 5.0 | 5.0 | 31.4 |
| | Insufficient number of computers | 85 | 35.1 | 35.1 | 66.5 |
| | insufficient number of computers and power outages | 3 | 1.2 | 1.2 | 67.8 |
| | lack of integration skills | 8 | 3.3 | 3.3 | 71.1 |
| | no ICT lab | 4 | 1.7 | 1.7 | 72.7 |
| | no practical skills | 4 | 1.7 | 1.7 | 74.4 |
| | no projector | 2 | .8 | .8 | 75.2 |
| | unavailable computers and source of electricity | 2 | .8 | .8 | 76.0 |
| | unavailable computers, power outages | 6 | 2.5 | 2.5 | 78.5 |
| | Unavailable resources | 46 | 19.0 | 19.0 | 97.5 |
| | unavailable resources and lack of pracical skills | 2 | .8 | .8 | 98.3 |
| | unavailable source of electricity | 2 | .8 | .8 | 99.2 |
| | unstable electricity | 2 | .8 | .8 | 100.0 |
| | Total | 242 | 100.0 | 100.0 | |

**How can these challenges or difficulties be addressed?**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | | 68 | 28.1 | 28.1 | 28.1 |
| | Provision of more computers, posting of well trained ICT teachers | 6 | 2.5 | 2.5 | 30.6 |
| | Establishment of ICT laboratory | 10 | 4.1 | 4.1 | 34.7 |
| | involvement of skilled persons | 6 | 2.5 | 2.5 | 37.2 |
| | Provision of electricity to schools | 2 | .8 | .8 | 38.0 |
| | Provision of enough computers, setting up ICT laboratory | 2 | .8 | .8 | 38.8 |
| | Provision of enough ICT resources | 44 | 18.2 | 18.2 | 57.0 |
| | Provision of ICT resources and training | 2 | .8 | .8 | 57.9 |
| | Provision of more computers and internet access | 6 | 2.5 | 2.5 | 60.3 |
| | Provision of practical training | 4 | 1.7 | 1.7 | 62.0 |
| | Provision of projectors | 4 | 1.7 | 1.7 | 63.6 |
| | Provision of sufficient computers to schools | 88 | 36.4 | 36.4 | 100.0 |
| | Total | 242 | 100.0 | 100.0 | |

**Is there a computer specialist in your school?**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Yes | 106 | 43.8 | 50.0 | 50.0 |
| | No | 106 | 43.8 | 50.0 | 100.0 |
| | Total | 212 | 87.6 | 100.0 | |
| Missing | System | 30 | 12.4 | | |
| Total | | 242 | 100.0 | | |

**To what extent does he/she support you in using computers in your subject area?**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Not at all | 106 | 43.8 | 50.0 | 50.0 |
| | To some extent | 78 | 32.2 | 36.8 | 86.8 |
| | To a great extent | 28 | 11.6 | 13.2 | 100.0 |
| | Total | 212 | 87.6 | 100.0 | |
| Missing | System | 30 | 12.4 | | |
| Total | | 242 | 100.0 | | |

**What level of interest do your learners show in using computers?**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | No interest | 2 | .8 | .9 | .9 |
| | Some interest | 78 | 32.2 | 35.1 | 36.0 |
| | Agreat deal of interest | 142 | 58.7 | 64.0 | 100.0 |
| | Total | 222 | 91.7 | 100.0 | |
| Missing | System | 20 | 8.3 | | |
| Total | | 242 | 100.0 | | |

**What grade/level do you find most eager to use computers?**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | | 80 | 33.1 | 33.1 | 33.1 |
| | All the levels | 21 | 8.7 | 8.7 | 41.7 |
| | J.H.S. | 39 | 16.1 | 16.1 | 57.9 |
| | Lower primary | 40 | 16.5 | 16.5 | 74.4 |
| | Primary | 22 | 9.1 | 9.1 | 83.5 |
| | Upper primary | 40 | 16.5 | 16.5 | 100.0 |
| | Total | 242 | 100.0 | 100.0 | |

**Which gender do you find more cooperative when using computers?**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Boys | 164 | 67.8 | 86.3 | 86.3 |
| | Girls | 26 | 10.7 | 13.7 | 100.0 |
| | Total | 190 | 78.5 | 100.0 | |
| Missing | System | 52 | 21.5 | | |
| Total | | 242 | 100.0 | | |

**How many learners do you teach in a period?**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | | 10 | 4.1 | 4.1 | 4.1 |
| | 18 | 4 | 1.7 | 1.7 | 5.8 |
| | 26 | 2 | .8 | .8 | 6.6 |
| | 27 | 2 | .8 | .8 | 7.4 |
| | 28 | 6 | 2.5 | 2.5 | 9.9 |
| | 30 | 20 | 8.3 | 8.3 | 18.2 |
| | 31 | 10 | 4.1 | 4.1 | 22.3 |
| | 32 | 10 | 4.1 | 4.1 | 26.4 |
| | 33 | 10 | 4.1 | 4.1 | 30.6 |
| | 34 | 18 | 7.4 | 7.4 | 38.0 |
| | 35 | 16 | 6.6 | 6.6 | 44.6 |
| | 37 | 24 | 9.9 | 9.9 | 54.5 |
| | 39 | 6 | 2.5 | 2.5 | 57.0 |
| | 40 | 16 | 6.6 | 6.6 | 63.6 |
| | 41 | 2 | .8 | .8 | 64.5 |
| | 42 | 16 | 6.6 | 6.6 | 71.1 |
| | 43 | 2 | .8 | .8 | 71.9 |
| | 44 | 4 | 1.7 | 1.7 | 73.6 |
| | 45 | 16 | 6.6 | 6.6 | 80.2 |
| | 46 | 8 | 3.3 | 3.3 | 83.5 |
| | 48 | 4 | 1.7 | 1.7 | 85.1 |
| | 50 | 4 | 1.7 | 1.7 | 86.8 |
| | 52 | 4 | 1.7 | 1.7 | 88.4 |
| | 54 | 6 | 2.5 | 2.5 | 90.9 |
| | 55 | 6 | 2.5 | 2.5 | 93.4 |
| | 57 | 2 | .8 | .8 | 94.2 |
| | 58 | 6 | 2.5 | 2.5 | 96.7 |
| | 65 | 8 | 3.3 | 3.3 | 100.0 |

**How many learners do you teach in a period?**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | | 10 | 4.1 | 4.1 | 4.1 |
| | 18 | 4 | 1.7 | 1.7 | 5.8 |
| | 26 | 2 | .8 | .8 | 6.6 |
| | 27 | 2 | .8 | .8 | 7.4 |
| | 28 | 6 | 2.5 | 2.5 | 9.9 |
| | 30 | 20 | 8.3 | 8.3 | 18.2 |
| | 31 | 10 | 4.1 | 4.1 | 22.3 |
| | 32 | 10 | 4.1 | 4.1 | 26.4 |
| | 33 | 10 | 4.1 | 4.1 | 30.6 |
| | 34 | 18 | 7.4 | 7.4 | 38.0 |
| | 35 | 16 | 6.6 | 6.6 | 44.6 |
| | 37 | 24 | 9.9 | 9.9 | 54.5 |
| | 39 | 6 | 2.5 | 2.5 | 57.0 |
| | 40 | 16 | 6.6 | 6.6 | 63.6 |
| | 41 | 2 | .8 | .8 | 64.5 |
| | 42 | 16 | 6.6 | 6.6 | 71.1 |
| | 43 | 2 | .8 | .8 | 71.9 |
| | 44 | 4 | 1.7 | 1.7 | 73.6 |
| | 45 | 16 | 6.6 | 6.6 | 80.2 |
| | 46 | 8 | 3.3 | 3.3 | 83.5 |
| | 48 | 4 | 1.7 | 1.7 | 85.1 |
| | 50 | 4 | 1.7 | 1.7 | 86.8 |
| | 52 | 4 | 1.7 | 1.7 | 88.4 |
| | 54 | 6 | 2.5 | 2.5 | 90.9 |
| | 55 | 6 | 2.5 | 2.5 | 93.4 |
| | 57 | 2 | .8 | .8 | 94.2 |
| | 58 | 6 | 2.5 | 2.5 | 96.7 |
| | 65 | 8 | 3.3 | 3.3 | 100.0 |
| | Total | 242 | 100.0 | 100.0 | |