

UNIVERSITY OF EDUCATION, WINNEBA

**INVESTIGATION INTO THE ATTITUDES EXHIBITED BY SHS TWO
STUDENTS TOWARDS ICT INTEGRATION AT SALAGA SENIOR HIGH
SCHOOL**

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EDUCATION IN SCIENCE (PEDAGOGY) DEGREE.**

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DECLARATION

STUDENT'S DECLARATION

I, Abdulai Mohammed Abbah, hereby declare that this dissertation, with the exception of the quotations and references contained in published works which have all been identified and acknowledged, is entirely my own original work, and that it has been submitted either in part or whole to any institution anywhere for the award of another degree.

Signature.....

Date.....

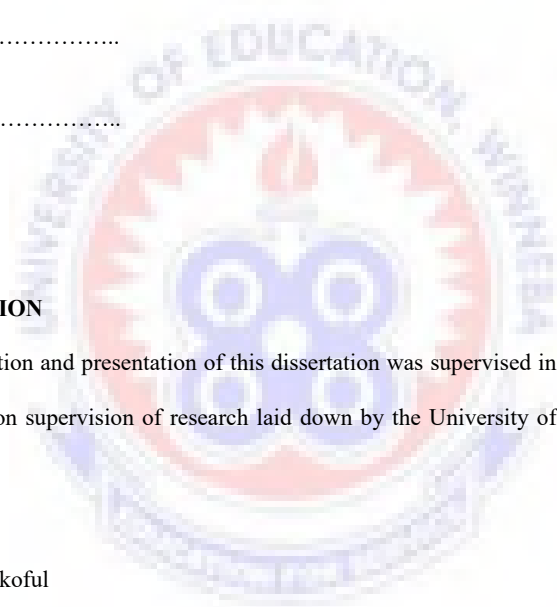
SUPERVISOR'S DECLARATION

I hereby declare that the preparation and presentation of this dissertation was supervised in accordance with the guidelines on supervision of research laid down by the University of Education, Winneba.

Name of Supervisor: Dr. Sam Arkoful

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Date.....



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DEDICATION

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ABSTRACT

The purpose of this study was to investigate the attitudes of SHS two chemistry students of Salaga Senior High School towards ICT integration in their teaching and learning. The study attempted to establish the ICT infrastructure available in schools to enable them integrate ICT in teaching and learning and the perceptions of school managers in integrating ICT in teaching and learning in the school. For this study, an exploratory approach, using descriptive survey design was used. The study was carried out in East Gonja Municipal of the Northern Region. The study targeted a population of two hundred students in Salaga Senior High School. The researcher used purposive sampling to select subjects for the survey. As such, only chemistry students in the second year were considered in the school. The instruments used in the survey were questionnaires for subject teachers, Assistant Headmasters, and students. An interview schedule for ICT coordinators was also used. Collected data was then analyzed using descriptive and inferential statistics, where frequencies, percentages, means and average means were the main techniques. Major findings were that majority of the chemistry students in Salaga Senior High School possessed generally high attitudinal acceptability level towards ICT integration in their learning and a very few of the students displaying indifference towards ICT use. Infrastructure remains a major hurdle to effective ICT integration in teaching and learning as the school lacks essential infrastructure to support ICT integration. Finally, school managers are positive about the impact of ICT in the teaching and learning of chemistry in spite of the numerous infrastructural challenges. Based on the findings, the researcher proposed that the infrastructural inadequacies should be addressed by the school in collaboration with the Municipal Education Directorate and the Municipal Assembly and also attend to the training needs of teachers in ICT integration.

CHAPTER ONE

INTRODUCTION

1.0 Overview

This chapter comprises the background to the study, statement of problem, the purpose of the study, research objectives and research questions. Significance of the study, delimitation and limitations of the study are also captured. The concluding part of the chapter presents the operational definition of terms, abbreviations and acronyms used in the study and the organisation of the study.

1.1 Background to the study

Integration of Information and Communication Technology (ICT) is high on the education reform agenda worldwide particularly in developed countries (Tilya, 2008). Often ICT is seen as an indispensable tool to fully participate in the knowledge society (Peeraer and Van Petegem, 2011).

ICT is therefore perceived to provide a window of opportunity for educational institutions and other organisation to harness to complement and support the teaching and learning process. Although a large body of research on factors determining the integration of ICT in education emerges from developed countries, recent research indicates that developing countries are finding means to participate effectively in the global information society and to address challenges regarding ICT in education (Tilya, 2008).

Attitudes toward ICT usage have been defined as a person's general evaluation or feeling towards ICT and specific computer and Internet related activities (Smith, Caputi, & Rawstone, 2000). The learner attitude toward computer measures a person's capabilities in effective learning. Garland and Noyes, (2005), indicated that in the educational context, confidence should lead to more positive attitudes toward computers and Internet, and this

will enhance learning and associated activities. Rogers, (1995), identified four main attributes of technology that affect its acceptance and subsequent adoption: relative advantage, compatibility, complexity and observability. These attributes are investigated as a predictor in determining educators' attitudes toward ICT. Adoption of ICT tools by students creates an intellectual relationship connecting the learner and such tools which helps broaden the learners' reasoning capacity. Cognitive ICT tools are built to ensure that students reason strongly on the course objective that is studied and also creating ideas that are possible as a result of such ICT tools. (Davies, 2005). In the meantime, it is this same ICT tools that showcases the current and ingenious usage of constructivist teaching and learning approaches. Desai, Hart, and Richards, (2008) stated that the large quantity of knowledge, ICT provides daily has permitted students a novel means to discover educational hidden benefits when compared to regular teaching instruments. ICT is usually seen to be a medium and an expediting factor in ensuring change in educational setting. (Desai, Hart, & Richards, 2008).

With the rapid development of modern Information Technology, computer and networking applications have been widely used in various fields. This is gradually changing people's work, study, and life, especially in education. Information and Communication Technology (ICT) henceforth is not only the backbone of the information society but also an important catalyst and tool for inducing educational innovation that changes the learning style of students. (Lower, 1992; Pelgrum, 2001).

Information and Communication Technology (ICT) is a general term that emphasizes the integration of telecommunications, computers, software and audio-visual systems to enable users to create, access, store, transmit and manipulate information. (Stevenson, 1997).

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In many developed countries, nearly all schools are equipped with the infrastructure to conduct ICT mediated teaching and learning. The developing countries, however, perceive ICT as a tool that will promote socio-economic, political and sustainable development. For instance, Ghana in 1995, became one of the countries in Sub-Saharan Africa to have access to the internet. As a result, governments have initiated a number of development policies in the area of infrastructure and training so as put Ghana in the mainstream of ICT and its application. One of such programs is the development of a national fibre optic network by the nation's electricity provider, the Volta River Authority (VRA) (Intsiful, Okyere, & Osae, 2003). In spite of these interventions ICT development is still in the infant stage in Ghana. Teaching methods are typically goal oriented and emphasise social interaction between pupils and the teacher. The learning strategies are not necessarily the same as the teaching methods used, although there is some overlap, especially when there has been effective co-operative planning or pupils have studied, for example, in small co-operative groups or made concept maps (Joyce 1996; Fairbrother, 2000; Oser & Baeriswyl, 2001). However, teaching and learning process in science is complex and therefore cannot be reduced to well designed algorithms or a string of sequences of specific teaching methods (Leach & Scott, 2001).

A study conducted by the International Institute for Communication and Development (IICD) indicated that 80 percent of its participants felt more aware and empowered by their exposure to ICT in education, and 60 percent stated that the process of teaching, as well as learning, were directly and positively affected by the use of ICT (International Institute for Communication and Development, ICTs for Education, 2007). Twenty-first century teaching and learning skills underscore the need to shift from the traditional teacher-centered pedagogy to more learner-centered methods. According to (Fensham, 2008), students low interest or attitude in science is attributed to four views, the students

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feel science teaching is predominantly trans-missive, the content of the school science has an abstractness that makes it irrelevant, learning science is relatively difficult for both successful and unsuccessful students and finally many of the students do not see the need to study science when there are more interactive, interesting and less difficult subjects to study. This development has among other things ensured the adoption of teaching alternatives including the integration of ICT in the teaching and learning of science related courses.

The effective use of modern ICT tools has the great potential to make the student as well as their teachers to become interested in the best conditions to participate in modern educational processes and to increase the quality of teaching and learning. To meet the challenges of education in the 21st century in Ghana, the Ministry of Education (Ministry of Education, 2008) formulated a draft policy titled: "ICT in Education Policy". This was a policy framework describing how ICTs should be introduced and implemented in second-cycle institutions. The policy proposed the introduction of ICT as a core subject, the introduction of ICT as an elective subject, the integration of ICTs as a teaching tool for all subject areas as well as the integration of ICTs to support educational management and administrative functions.

In furtherance to this document, the Ministry of Education conducted a research in 2009 under the theme "e-Readiness Assessment of second-cycle institutions in Ghana". The objective of this base line study was to examine and establish the extent to which ICTs are being exploited and deployed to facilitate education and training efforts within the country (MoE, 2009). The survey showed that, the level of computer literacy is low in the country and this has been identified as one of the key factors limiting the utilization of ICTs in education. Meanwhile, the internet plays a major role in the lives of young people today

as children and youngsters engage in online activities both inside and outside the classroom, (Sefton-Green, 2004).

1.2 Statement of the Problem

The impact of technology is one of the most critical issues in education (Webber, 2003). Despite interventions by the Ministry of Education (MOE) including the Ghanaian ICT policy documents like the National Development Policy Framework (Vision 2020), the information technology policy framework for Ghana, the ICT4AD policy and introducing ICT in pre-tertiary institutions policy, teachers still use the traditional pedagogical approach in their lesson delivery (Ministry of Education, 2008). An observation at Salaga Senior High School, a beneficiary of these numerous interventions, revealed stagnated performance as teachers are unwilling to implement these policies which requires them to integrate ICT and related facilities in their lessons. The development has left management sweating as efforts are being made to identify measures to address the situation. It is also feared that, the situation could be attributed to the level of acceptance from the students towards the integration of ICT in their lessons. This therefore provides a case for the investigation into the attitudes of these students towards the integration of ICT in their teaching and learning. The outcome of the study is expected to help iron out the challenges hindering the smooth usage of ICT in the teaching and learning of chemistry at Salaga Senior High School.

1.3 Purpose of the Study

The purpose of the study is to investigate into the attitudes of SHS 2 students towards ICT integration in teaching and learning of chemistry in Salaga Senior High School. The study will also identify students' views on school infrastructural support in the integration and

finally assess management's views on the integration of ICT in chemistry teaching and learning.

1.4 Objectives of the Study

The objectives of the study are:

1. To determine students' attitudes towards the use of ICT in chemistry teaching and learning.
2. To identify the school's infrastructural support in the integration of ICT.
3. To assess management's views on the integration of ICT in chemistry teaching and learning.

1.5 Research Questions

1. What attitudes do students exhibit/show towards the use of ICT in chemistry teaching and learning?
2. What ICT infrastructure do schools have in order to integrate ICT in teaching and learning?
3. What views do school managers hold about the integration of ICT in teaching and learning of chemistry?

1.6 Research Assumptions

The study will be based on the following assumptions:

Salaga Senior High School is a beneficiary of all the interventions by government to ensure ICT integration in teaching and learning and that there are certain attitudes students have in relation to ICT integration into their lessons.

1.7 Educational Significance

The study attempted to investigate the attitudes of students in Salaga Senior High School in teaching and learning of Chemistry. By doing so the findings obtained from this study may be of great usefulness and benefit to the administrators and managers of Salaga Senior High School in the management and applications of the facilities provided by government. It is also envisaged that outcomes of the study will help science teachers make use of the facilities to teach difficult concepts and by extension improve performance. Finally, according Annan, (2006) human development is a process of enlarging peoples' choices it is therefore hoped that the study would bring out suggestions and ways of inspiring teaching and learning of chemistry and also improve the choices of students in relation to chemistry and science at large.

1.8 Delimitation of the Study

This study took place in Salaga Senior High School in the East Gonja Municipality of the Northern Region of Ghana. The study targeted only one public Senior High School in the Municipality which has relatively some ICT facilities. The study dealt with SHS two students, ICT Coordinators and Chemistry Teachers and the Academics Assistant Headmasters because they are the major actors in the implementation process of the Secondary Education Implementation Project. The respondents were suitable for the study as they were involved in the day-to-day interactions in the school and hence could provide firsthand information or data.

1.9 Limitations of the study

This research work is based on the attitudes of SHS two students towards ICT integration in chemistry at Salaga Senior High School would be limited. The sample size is relatively small for the research to be generalised. The research work is also likely to be hampered by student's unavailability due to sickness, truancy and suspensions. It is also likely to face the challenge of students not responding to the questionnaire given them.

1.10 Organisation to the Study

The study was organised into five chapters. Chapter one comprised the Background to the study, problem statement, research questions, objectives of the study, purpose of the study, organization of the study, delimitation and the limitation of the study. Chapter two reviewed the related literature of the study. Chapter three presented the methodology. Thus, the study area, the research design, population, the sample size and sampling technique, source of data, instrumentation, data collection techniques and data analysis. Chapter four looked at the analysis of the data collected; thus, the result and the discussion. Finally, chapter five dealt with the summary, conclusions and recommendations.

1.11 List of Acronyms and Abbreviation

- ICT - Information and Communication Technology
- ICTs - Information and Communication Technologies
- GES - Ghana Education Service

- MOE - Ministry of Education
- ICT4AD - Information and Communication Technology for Accelerated Development
- SHS - Senior High School
- TIMMS - Trends in International Mathematics and Science Study
- IICD - International Institute for Communication and Development
- WASSCE - West African Senior School Certificate Examination
- CAL - Computer-Assisted Learning
- SEIP - Secondary Education Improvement Project
- CFSK - Computer for Schools Kenya
- CSIR - Council for Scientific and Industrial Research
- KNUST - Kwame Nkrumah University of Science and Technology
- VRA - Volta River Authority
- BOG - Board of Governors

CHAPTER TWO

LITERATURE REVIEW

2.0 Overview

The chapter presents a review of the related literature on the empirical, theoretical and conceptual issues on the attitudes of students towards ICT integration in the teaching and learning of chemistry at Salaga Senior High School in the East Gonja Municipal. Basically, the literature review will be on the following headings:

- Theories of attitudes
- History of ICT integration in Ghanaian schools
- ICT integration into teaching and learning
- Attitudes of management and Users towards ICT
- Learner ICT attitude
- Attitudes on ICT infrastructure and its support in ICT integration in Chemistry
- Policy on ICT Education in Ghana
- ICT Implementation at the School level in Ghana
- Attitudes towards computer education and computer use
- Theoretical and conceptual framework of ICT integration in chemistry.

2.1 Theories on Attitudes

Different authors have defined attitude in many ways. According to Kassin, (2008), attitudes connote relatively enduring beliefs or opinions that predispose people to act in a positive, negative, or ambivalent way to a person, object, or idea. The relatively enduring beliefs influence how people do things and the outcomes of their actions. This connotes that attitude affects people in everything they do and it reflects who they are, hence attitude is a determinant of people's behaviour (Yushua, 2006). As a psychological construct,

attitude has been theorised to comprise affective, cognitive, and behavioral components (Maio & Haddock, 2010). The cognitive aspect of attitude is what the individual thinks or believes about an object while the affective component is the feelings or emotions of the individual associated with the object. The behavioral component is the inclination to act in a certain way to the object. It is realised that people's attitudes toward others, objects or situations can be favorable, unfavorable or ambivalent. Hence, students' attitudes toward computer education could be positive, negative or ambivalent. On his part, (Otaibi, 2012) defined attitude towards the use of the internet as a number of perspectives and beliefs, positive or negative, and favorable or unfavorable feelings, which pinpoint the usefulness or avoidance of the internet. Research undertaken in the area of attitude and attitude formation shows that attitudes and beliefs are linked, and attitudes and behaviors are linked; moreover, attitudes are essentially divided into likes and dislikes (Siragusa & Dixon, 2008). With the broad expansion of ICT in education during the last decade, many research studies have explored the attitudes of users (educators and students) towards the integration of ICT in education (Mishra & Panda, 2007).

2.2 History of ICT integration in Ghana

Lave and Wenger, (1991) noted that knowledge is strongly connected with a social situation or context. The world has become a global village due to efficiency of communication and information sharing and usage. The school system which hinges on information and communication acquisition and transmission of skills and knowledge inevitably operates under this new culture of science and technology. The pervasive nature of ICT in different societies around the world has revolutionised the total existence of humanity and thus education. Ghana as a country has its own through comparatively inadequate ICT resources but has put in some efforts to fully incorporate ICT as a pre-

requisite for national development by building a strong scientific and technology literate society.

The first major investments into science and technology to make Ghana self-sufficient began with the first president of the country when he retorted to the industrialisation of the country thus the need to equip the citizenry with technological skills to push that agenda. This among other investments led to the establishment of Kwame Nkrumah University of Science and Technology (KNUST), Nuguchi Memorial Institute, the Council for Scientific and Industrial Research (CSIR) and many more to train and nurture students who have the desire to study in the sciences. These investments were deliberate efforts to get the country grow in the sciences and also to make the country self-sufficient in training and provision of medical doctors and investigative scientist in the country. It worthy to add that, in all these institutions established ICT facilities including heavy machine and gadgets were installed to make learning easy for the students. Further, the derive to fully integrate information and communication technology into the socio-economic structure of Ghana and the academic circles in schools in Ghana continued vigorously receiving several political and cabinet backing in the many policies and educational reviews in the country and many other political addendums of various governments over the last two decades. However, the culture of science and technology is yet to be an integral component of the Ghanaian society. This could be attributed to different factors stemming out of various degrees of inefficiencies in the driving force needed to catapult a rich ICT.

Some of the comprehensive programs committed to rapid deployment and utilisation spearheaded by the Ministry of Education (MOE) serving as the main engine operating through the Ghana Education Service (GES) led to initiatives that cover pre-tertiary and tertiary levels of education with mainly establishing laboratories and the provision of

computers. One of the active processes was captured in Ghana ICT Accelerated Development (ICT4AD, The Ghana ICT for Accelerated Development Policy ,2001). It is a policy in which the framework started in 2001 and the strategic educational plan drawn in 2003 with various enactment stages in 2006 and 2008. The overall vision of this policy was to ‘articulate the relevance, responsibility and effectiveness of utilizing information and communication technologies (ICTs) in the educational sector with a view of addressing current sector challenges and equipping Ghanaian learners, students and communities in meeting the national and global demand of the 21st century’. Additionally, there was a drive to make the Ghanaian society ICT compliance as a vision for Ghana in the information age. The establishment of the National ICT Science Resource Center financed by the Japanese International Cooperation Agency (JICA) and Philip Harris of UK translated into the establishment of a district science throughout the country as a way of bringing science and technology through the use of ICT to the doorstep of the Ghanaian student to transform the fortunes of Ghana through the use of information and communication technology as part of the global village. In 2008, the ICT drive in Ghana was reinforced by a revised policy through the deployment of ICT in education, the culture and practice and practice of traditional memory-based learning would be transformed to education that stimulates thinking and creativity necessary to meet the challenges of the 21st century. The benefits of the policy led to the massive distribution of government sponsored laptops manufactured locally across the country. This was aimed at readily making available ICT tools to teachers to impact positively on their teaching and learning. To the best of the knowledge of the researcher these are some of the major efforts channelled towards ICT integration in Ghana in which the school is no exception. However, comparing ICT compliance with other countries there is the need for Ghana to

improve its ICT policies significantly to impart positively in all sectors of the country especially in science education.

Computers have been used in education in many ways from the beginning of their evolution. Several ways to analyse use of computers or ICT in education have been suggested. In the 1980s use of computers was typically divided to technological and pedagogical use. ICT use was classified based on the type of interaction in two categories; a student or a computer leads the interactive learning process (Brownell, 1992).

The costs of subscription and infrastructure for ICT are high, coupled with the poor quality of service by internet providers (Sulberger, 2001). These among others are the major barriers to the use of ICT in science education. Information on classroom characteristics in the Trends in International Mathematics and Science Study (TIMSS), 2003 indicated that in Ghana, though the national curriculum contains policy statements about the use of computers in teaching, on the average, computers were not accessible to large number of pupils in schools who participated in TIMSS (Anamuah-Mensah, Mereku, & Ameyaw-Asabere, 2004). This perception provided the basis for the introduction of computers and internet usage in second cycle institutions in Ghana. Conscious efforts are therefore being made by the Ghanaian government to expand access to the use of ICT.

2.3 ICT Integration into Teaching and Learning

There have been numerous researches into the integration of ICT into learning worldwide. Specific among them is the study conducted by Kennedy, Judd, Churchward, and Grey, (2008) on 2000 Australian students. This study revealed that some students use computer for general study purposes, whilst others use computer to develop web pages but a great number of students use computer to play music every day or once a week. Further and Kvavik, (2005) conducted a study on 4374 students to investigate their use of ICT in

school. The study found that students frequently use ICT for email, instant messaging, word processing and internet surfing. Again, Zakaria, Watson and Edwards, (2010) conducted a research on Malaysian students' use of ICT in schools. The results showed that students use email to disseminate and share digital contents. In a similar study, Yukhymenko and Brown, (2009) investigated the use of ICT among 122 Ukrainian high school students. The result found that 53.3% of the students use ICT in school once a week but 33.5% indicated that they never use ICT in school. However, the study was silent on what the students use ICT for in schools. As a comparison with advanced countries, the technology use in education in developing countries is relatively limited. Though, there is much information on the availability of ICT and the way they are being implemented in advanced nations, there is little information in the literature on the use of ICT among students in schools in Africa in general, and especially Ghana (Buekes-Amiss & Chiware, 2007). In Ethiopia, Woreta, Kebede and Zegeye, (2013) surveyed the knowledge and utilisation of ICT among 1096 students. The result showed that 33% of the students use a computer once a week and almost 41% of the students interacted with a computer once in a month. Nearly half of the students (47%) never use ICT. In addition, the result revealed that most of the students (51%) use ICT for email or instant messaging. Further, in Nigeria, Tella, Adedeji., Toyobo, Adika and Adeyinka, (2007) conducted a study on the use of ICT among 700 teachers. The study found that 61% of the teachers have access to computers. However, the result did not indicate the use of ICT among students. Similarly, Sarfo and Ansong-Gyimah, (2011) did a survey on access to ICT and experiences in the use of ICT among 300 students in Ghanaian second-cycle schools. The result revealed that the students have been using mobile phones, computer or internet. In addition, the result showed that reasonably number of the students have access to computers and often use it to gain computer knowledge. However, the result was silent on the use of ICT in terms of

the type of school the students attended and the geographical location of the schools (i.e. urban, semi-urban and rural). Additionally, the study was silent on the factors relating to the use of ICT among students. Therefore, the purpose of this study is to investigate secondary school students' use of ICT in chemistry, the differences in their technology use in terms of school type and location and the factors that relate to their technology use. To achieve the research purpose, three research questions would be addressed.

ICT acts as a tutor where students programme the computers in order to gain more understanding.

A number of different ICT tools and applications may be integrated in teaching and learning (Yunus, Lubis, & Lin, 2009). Some of these tools and applications may be designed specifically for educational purposes and some others for more general use. The choices of resources, and the way they are used, can be linked to different learning theories which may be invoked to explain or predict learning benefits from the use of ICT (Wishart & Blease, 1999). Roblyer and Edwards, (2000) believed that the use of ICT in education has evolved from two main approaches, namely directed and constructivist instructional methods (Roblyer & Edwards, 2000). The theoretical foundations of directed instruction are based on behaviorist learning theories and information processing theory, which is a branch of cognitive psychology. The theoretical foundations of the constructivist approaches are based on the principles of learning derived from cognitive learning theory.

2.4 Attitudes of management and users towards ICT

Sarfo and Ansong-Gyimah, (2010), conducted a study to assess the perceptions of students, teachers, and educational officers in Ghana on the role of computer and the teacher in promoting the first five principles of instruction namely: Integration, Activation, Application and Demonstration. The perception of 395 participants (students, teachers,

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and education officers) in Ghana have examined the role of the computer and the teacher in promoting the first five principles of instruction for quality teaching and learning. The results of 79 respondents in the study indicated that there were perception dissimilarities among the participants on the role of a computer and a teacher in implementing the first five principles of instruction. In addition, according to the findings, there was a mismatch of participants' recommendations on training students to acquire computer skills, and training teachers to acquire skills in designing their teaching.

Stake holders' perceptions towards ICT integration in secondary school education is an important ingredient to its success. More significant is the perception of curriculum implementers, learners, school administrators and managers, towards ICT integration in teaching and learning at secondary schools. Musumba, (2007), revealed that there was a positive association between management attitude and the integration of ICTs in the teaching and learning process. Baines, (1999), pointed out some factors that conspire to create anxiety in teachers, especially when faced with changes relating to new technologies. According to these authors, teachers are aware that application of ICT solutions has led to unemployment in other professions. The authors further pointed out that teachers, were too afraid of being unemployed due to ICTs in teaching and learning. According to Weller, (2003), there are those who are resistance to change. Weller pointed out that when change is brought by technology, the technophobia will be a strong group in this resistance. What underlines much of this resistance is the fear about potential of technology to alter ones situation, status or even job.

Omwenga, (2003), agreed to this. According to him, the feeling of ICTs posing a threat to their professional roles and image makes teachers to be hesitant to integrate ICTs in teaching. Kumar, (2008) averred that managing change was one of the biggest problems,

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as teachers don't want to accept change easily. Kumar further asserted that change management issues must be addressed as new work practices and new ways of processing and performing task are introduced. Becta (2004) agreed that due to lack of technical support in schools, then it is likely that technical maintenance will not be carried out regularly, resulting to higher risks of technical breakdowns. This will result to teachers being discouraged from using ICT because of fear of equipment failure. According to the Ministry of Education Science and Technology, Government of Kenya, (2008), school administrators, teaching staff and students should be made aware of ICT integration. According to the draft, Computer for Schools Kenya (CFSK) should undertake training of trainers and educational administrators. In this study, the researchers sought to find out whether such trainings took place and if they did what impact they have on the perceptions of the teachers and school administrators and managers.

2.5 Learner ICT Attitudes

Al Mahmud, (2011), carried out research on learners' attitude towards ICT, the study was done on special universities of Bangladesh. The researcher focused at finding the attitude of learners in the special University of Bangladesh to ICT. The sample for the study was 1022 respondents in the post and graduate level during the evaluation of student's perception and attitude based on gender, age, internet connection, and years of experience and so on. The total population of learners possessed computers in their homes and also almost 81% have internet connections. The research found that close to 50% of the learners have positive attitudes regarding ICT, moreover, the study did not state a significant difference between boys and girls' learners. Even for postgraduate and graduate students, no difference was noticed regarding attitudes. The study was concerned with attitudes of learners towards ICT at a higher level of education and about 50% showed positive attitude.

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Tabar, (2014), evaluated learners' attitude in relation to technology and the relation to learners' gender, age and having PC at home and in school. The study was carried out on 350 learners 62.5% were boys and 37.5% were girls. The findings of this showed that learners use computer for several purposes, and more than average of them use the computer for transactions, game playing and communicating with colleagues on a weekly and daily basis, 35% adopt computer for getting information, 55% for presentation, and the remaining hardly adopt the computer for programming, 100% adopts computer for listening to music. The study showed that the learners use the computer for different goals as well as for academic and entertainment reasons. The study also revealed that learner's attitudes show positive attitudes regarding using ICT. The study further proved that there were no significant differences existing between students' attitudes in using computers, and having computers in the house and students age.

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Beauchamp and Thomas, (2009) conducted research on 'Pupils' attitudes towards school science as they transfer from an ICT-rich primary school to a secondary school with fewer ICT resources. They studied a group of science students from a technology-rich primary school who moved to a less ICT-oriented secondary school in rural UK. They found that the lack of ICT in the secondary school caused some frustration; however, the group remained predominantly enthusiastic about science. The students particularly enjoyed the practical aspects of science lessons, something that they had not experienced in the primary school, and which they reported compensated for the relative lack of ICT in science teaching.

Ahmad, (2012), carried out a research, on learners' attitudes in colleges of education in Jordanian institutions regarding the use of mobile phone in the institution of learning. To find out learners' attitude and also to evaluate if there is a significant difference in learners'

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attitude regarding age, gender, level of study etc. The researcher used 363 respondents from a different college of education in Jordan. The sample consisted 78.2% girls and 21.8% boys, the study showed that learners in colleges of education have positive perception towards adopting mobile phones, that is to say, that, there is no significant differences in the learners' attitude regarding the adoption of phones in institutions in Jordan between boys and girls learners. The study also showed that undergraduate students showed less positive attitudes than the postgraduate learners.

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In a study by Alkan and Erdem, (2010) on learners' attitude towards ICT focused on students' attitudes towards technologies regarding their status in acquiring learning application lessons. The study was conducted in Hacettepe university faculty of education. The samples for the study received tutor on different courses from chemistry to biology to physics and mathematics. In the study there was two status of acquiring training; the preliminary grade didn't receive training and the fifth grade received training. The study finally proved that learners had positive attitudes generally regarding technologies and further proved that the fifth-grade students interacted more positively than the preliminary students; the learners that received training showed their strong positive attitudes and displayed the difference in the perception regarding the state of adopting training lesson application. More so, no significant differences existed in the attitude between boys and girls learners and no significant difference between departments too.

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A study was done by Sarfoet, (2011) on rural and urban learners. The research focused at finding the attitude of learners in rural and urban setting to ICT. The sample for the study was 319 respondents at secondary level during the evaluation of student's perception and attitude based on gender, age soon. The total population for the study consists of 159 boys and 160 girls. The population covered 184 from urban and 140 from rural. The research

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concentrated on senior high schools in Ghana. These results showed that there was no significant difference between male and female from the geographical settings in their perception regarding ICT for advancement. More also, learners from urban areas showed positive perception than the rural learners. The study also showed that there was a similarity in their use of ICT for learning purpose. In as much as there was no significant change between rural and urban setting regarding ICT use, the attitude of urban learners differed from rural learners.

A study conducted by Duran, (2013), evaluated learners' attitudes in relation to technology and its relation to learners' gender. The study carried out on 254 learners 110 were boys and 144 were girls. The findings of this study showed that learners use the computer for several purposes, and more than average of them used the computer for transactions, game playing and communicating with colleagues on a weekly and daily basis, 73.3% adopt computer for getting information, 77.9% for social networking, 62% adopts computer for educational purpose. The study showed that the learners used the computer for different goals as well as for academic and entertainment reasons. The study also revealed that learners' attitudes show positive attitudes regarding using ICT. The study further proved that no significant differences exist between students' attitudes in using computers, having computers in the house and students age.

Lukow, (2002) carried out a study on 244 learners 32% were boys and 68% were girls. The findings of this showed that learners use the computer for several purposes, and more than average of them used the computer for transactions, game playing and communicating with colleagues. 70% didn't use a programming language and hardly produced a web page and their skills grew. Average of them used ICT for discussions and the remaining hardly adopted the computer for programming, the majority adopted the

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computer for listening to music. The study showed that the learners used the computer for different goals as well as for academic and entertainment reasons. The study also revealed those learners showed positive attitudes regarding using ICT. The study further proved that no significant differences existed between students' attitudes in using computers, and having computers in the house and students age.

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Deaney, Kenneth and Hennessy, (2003) in their study 'Pupil perspectives on the contribution of ICT to teaching and learning in secondary schools' found that students viewed ICT resources as helpful in tasks and presentations, and also useful in refining project reports and trial options. They associated ICT with change in the study environment and classroom relations; ICT applications raised interest and increased motivation on their part. Nevertheless, whilst the participants valued independent study and the challenge of ICT, they were concerned that this reshaping of learning might be displacing valuable teaching.

2.6 Attitudes on ICT infrastructure and its support in ICT integration

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According to Mumtaz, (2000), limited resources within schools are a great impediment to the take-up technology. Availability of computer laboratory, school local-area network (LAN) and internet are not exempted to the limited resources. The absence of ICT infrastructure can daunt teachers and learners from acquiring ICT skills in teaching and learning. In order to motivate teachers and learners to acquire ICT expertise and to integrate them effectively in the teaching and learning of chemistry, there is the need to ensure the existence of ICT infrastructure. Before any ICT-based program is launched, policy makers and planners must ensure the availability of appropriate rooms or buildings to house the technology, computers as well as affordable internet service for online learning, and availability of electricity and telephony (Kumar, 2008). According to

Angwin, (2011), the ambitious e- Learning goals in Africa can only be achieved with classroom technology that is intrinsically sustainable. Angwin further asserted that ICT provision must take into account of the absence of reliable power supplies. In this study the researcher seeks to find out whether schools have the required infrastructure to integrate ICT in teaching and learning. The researcher will also seek to find the reliability of the ICT infrastructure in Salaga Senior High School.

ICT infrastructure is limited and not provided to all educational institutions with the depth needed to allow optimal usage of education systems (Cecchini and Scott, 2003; Cossa and Cronje, 2004, Hinostroza, Labbe and Claro, 2005; Ward, 2003). In particular, rural areas are more affected by the lack of electricity and there are cases of low density of Internet connectivity which pose many challenges to rural areas (Howie, 2010; Brandt et. al 2004). Other challenges include the cost of ICT provision, which can be high in comparison to the costs of other equipment. In under-resourced schools the cost can even be higher due to the need for installation of electricity and landline connectivity. Provision of infrastructure competes with the provision of other basic needs, such as textbooks, furniture, teacher training, and nutritional supplements (Cawthera, 2002). Balanskat, Blamire and Kefala, (2006) argued that schools with good ICT resources achieve better results than those that are poorly equipped. However, other factors may also contribute towards ICT implementation such as professional development.

When people think of sustainability of ICT, they think only of the infrastructure. However, according to Ferrao and Thompson (2012) expert and knowledge must also be sustainable.

2.7 Policy on ICT Education in Ghana

ICTs are not a panacea or cure-all gaps in education provision (Wai-Kong, 2009-2010). The right conditions need to be in place before the educational benefits of ICT can be fully

harnessed, and a systematic approach is required when integrating ICT into education system. Such a systematic approach requires a plan or a policy for it to be plausible. The government of Ghana is committed to the transformation of the agro-based economy of Ghana into an information rich and knowledge-based economy and society using the tools of Information and Communication Technology (ICT). (Draft Copy of ICT Policy, 2006). The government of Ghana has acknowledged the need for ICT training and education in schools, colleges and universities and the improvement of the education system as a whole. Government is therefore dedicated to a comprehensive programme of rapid development and utilisation of ICT within the education sector to transform the educational system, thereby improving the lives of people. Given the magnitude of the task ahead, the government enjoins both public and private sector to join hands to ensure that children receive high quality teaching and learning (Draft Copy of ICT Policy, 2006). With numerous efforts by government to ensuring performance is improved through the provision of facilities backed by policy this research will determine whether these efforts by government is implemented at the grassroots level and how the attitudes of students towards the integration of ICT in their lessons will mean to the policy.

2.8 ICT Implementation at the School Level in Ghana

This section summarises cases of ICT implementation at school level in Ghana. A study by Boateng, (2007) focused on the use of computers in Ghanaian schools, and how computers and related technology were used in a rural-based school. It addressed issues of use and non-use of computers and related technology within the critical social theory framework in order to determine the underlying social, economic, and political factors that affected the use of the technology at school. Particularly, Boateng's study examined how a rural school, Twifo Praso Secondary School, used computers and related technologies in its curriculum in compliance with national policy on ICT in Ghana, and in view of

increasing the use of ICT in the pre-tertiary school curriculum. Boateng (2007) found that although computers were available at the school, teachers were not using them. Instead, computer lessons were taught as standalone subjects without any relevance to the curriculum. This is attributed to inadequate training of teachers in the effective use and integration of computer technology in the school curriculum and lack of support from the local communities. With these findings, Boateng suggested for future research on how national educational policies aimed at integrating computers and related technologies can be effectively implemented in schools, especially in rural areas, and models on how to integrate technology in school curricula.

2.9 Attitudes towards computer education and computer use

The relevance of attitudes and beliefs for learning to use computer and other new technologies is very much appreciated (DeYoung & Spence, 2004; Saade & Galloway, 2005). Computer attitude is defined as a person's general evaluation or feelings of favour or anti-apathy towards computer technologies and specific computer related activities. (Smith, Caputi & Rawstorne, 2000). Students with positive attitudes toward ICT education have been found to perform better than those with negative attitudes toward the subject. (Nayashi, Chen, Ryan, & Wu, 2004). In a study conducted by Garland and Noyes (2005), it was found that confidence correlates positively with computer attitude. Gao, (2005) has also found that perceived usefulness of computer is positively correlated with students' attitudes toward it. The study unearthed that the learners who perceived computer education to be irrelevant were not positively predisposed toward the subject. A similar study by (Igbaria & Chakrabarti, 1990) disclosed that computer anxiety also influenced the attitudes of students toward computer education.

2.10 Theoretical Framework

An attitude refers to one's positive or negative judgment about a concrete subject. Attitudes are learnt; they are moldable and may change with experience of the stimulus objects and with social rules or institutions (Binder & Niederle, 2007).

Theoretical Framework is the theory which predicts, challenge, explain and sometimes extend existing knowledge within the limits of critical bounding assumptions. It forms the basis to hold and support a research work. Based on knowledge, environmental stressors and personality traits which are key to ICT integration in the teaching and learning of chemistry at the Senior High School level, the theoretical frame work of this study is hinged on the constructivist theory.

The constructivist theory is appropriate in supporting and explaining the concept of ICT integration in Chemistry. The potential of technology is to be optimized, educators and community members need to develop a comprehensive learning and technology plan long before technology equipment starts arriving (Valdez, 2004). The integration and attitudes towards the ICT use in pedagogy promotes active learning and allows learners to construct knowledge and skills of their own experiences. This underpins the bases of the constructivist theory which clearly defines the theory behind this research work which seeks to determine the attitudes of students towards ICT integration in chemistry teaching and learning.

2.11 Conceptual Framework of ICT Integration

The purpose of the conceptual framework is to explain the interrelationships between variables (Orodho, 2005). According to Mugenda and Mugenda, (2003), a conceptual framework shows graphical relationship between variables in the study. The use of conceptual framework in research work makes the stated objectives clear by relying on

inductive and deductive reasoning to differentiate between the dependent and independent variables. It reflects all the factors that influence each other on how outcomes based on researchers' position would be achieved. The study provides arguments to better understand students' readiness for ICT integration in their teaching and learning of chemistry and summarize findings from a body of research trends in ways that ICT can be understood and used to improve the quality of teaching and learning in the educational system in Ghana. Figure 1.0 shows the relationship between the independent dependent variables in this proposed study. In this framework, the independent variables are:

- Teachers' and learners' ICT expertise
- Perceptions of teachers, school administrators and school managers towards ICT integration
- ICT infrastructure



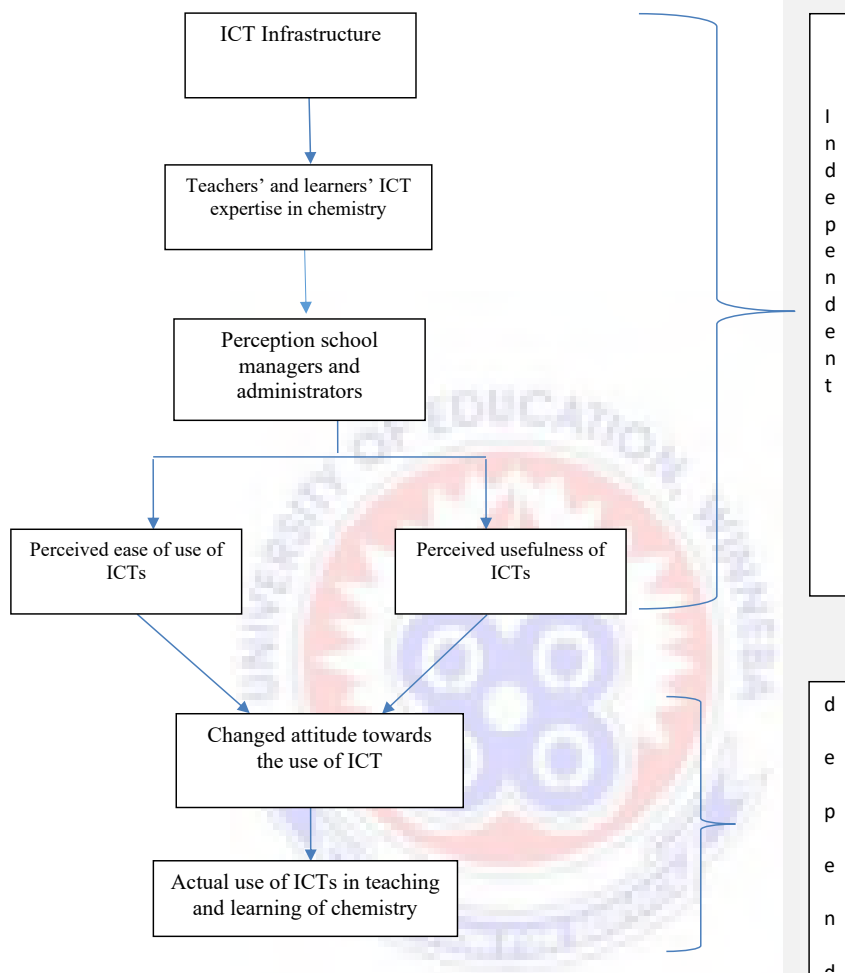


Figure 1: Conceptual framework of effective ICT integration in Secondary School Teaching and Learning

2.12 Summary

The literature reviewed has revealed that there are gaps in the implementation process, infrastructure challenges and uncertain attitudes of learners in ICT integration in science related subjects particularly chemistry in secondary schools as works are limited in this

field. Most of the studies reviewed were undertaken in countries that are developed or that started integrating ICT in their education much earlier than Ghana. A study by (Boateng, 2007) which looked at the use of computers in Ghanaian schools indicates that there is a concentration of use in urban schools while rural schools continue to lag behind. This study examined how computers and related technology were used in a rural school in the Central Region of Ghana, Twifo Praso secondary school. It addressed issues on use or non-use of computers and related technology within the critical social theory framework in order to determine the underlying social, economic, and political factors that affected the use of the technology the school. Data was collected through in-depth interviews of 16 interviewees, a teacher and student focus group, participant observations and document analysis. The possible gap could be the limitation of the study to one school. It would be interesting and revealing to replicate the research in other rural schools in similar circumstances in order to establish whether there is a pattern across the country.

CHAPTER THREE

METHODOLOGY

3.0 Overview

The chapter describes the procedure adopted in conducting the study. The chapter further provides details related to the methodology of the study. It presents the research design,

research area, location, target population, sample size and sampling technique, research instrument. The content validity, reliability of the main instrument, instrument scoring, data collection procedures and data analysis are also presented.

3.1 Research Design

This study used the descriptive survey to access information on attitudes in integrating ICT in teaching and learning of chemistry at Salaga senior high schools of East Gonja Municipal. It is also a detailed documentation of plan for the collection, measurement, and analysis of data. Research approach constitutes the blue print for the collection, measurement, and analysis of data (Saunders, Lewis, & Thornbill, 2007). The research design is used to structure the research, show how all the major parts of the research project, the samples or group, measures, treatments, and methods of assignment work together to address the central research questions. According to Saunders, (2009), a descriptive survey is that whose purpose is to produce an accurate representation of persons, events or situations. Survey research seeks to obtain information that describes existing phenomena by asking individuals about their perceptions, behaviour or values (Mugenda and Mugenda, 2003).

3.2 Research Area

The survey, whose main objective is to investigate attitudes of SHS two students towards ICT integration in their teaching and learning of chemistry at Salaga Senior High School and to also assess administrators' views on the integration of ICT in chemistry teaching and learning is to be carried out at Salaga Senior High School located in the East Gonja Municipal of the northern region of Ghana.

3.3 Target Population

According to Saunders, (2009) a population is the full set of cases from which a sample is taken. A targeted population is that population which the researcher wants to generalise the results of a study (Mugenda & Mugenda, 2003). Group of persons that possess one or more feature alike that are of a researchers' interest is known as a research group (Best & Kahn, 1993). Gay & Airasian, (2000) stated that a research group the researcher would really like to generalize to is called a target research group. The target population would be all SHS 2 students from the chemistry classes, Assistant Headmasters, Subject Teachers and ICT coordinators.

3.4 Sample and Sampling Technique

The sampling technique available to the researchers can be categorized into probability and non-probability (Cresswell, 2005). A non-probability sample technique called convenient sampling was employed to select the school used in the study. Convenient sampling was used because of the proximity of the school to the researcher which facilitated the collection of data in short time. A purposive sampling technique was used based on the objective of the study and the characteristics of the population. As a result, one hundred (100) students were selected from SHS 2 chemistry classes, two (2) Assistant Headmasters, two (2) Subject Teachers and two (2) ICT Coordinators.

3.5 Research Instrument

The study was conducted sequentially using qualitative face-to-face interviews and quantitative self-administered questionnaire. According to Plano-Clark, (2007), interviews provide in-depth information pertaining to participants' experiences and viewpoints of a particular topic. The emphasis with respect to the interview is to look at people's words to see if any pattern emerges. The quantitative data was transcribed to

reveal the patterns in the responses. A questionnaire is a research instrument defined by Vaus (2002) as “all techniques of data collection in which person is asked to respond to the same set of questions in a predetermined order”. The questionnaires were main instrument used to collect data from the sample. The design of a questionnaire is critical to ensure that the correct research questions are addressed and that accurate and appropriate data are collected. The questionnaire was constructed into two parts in which one part was made up of research variables and other sections containing 30 questions match and the whole research questions in the study. This was in a bid to introduce soundness and consistency to the study and to discuss on the vibrant subject matters intended for examination all through the research. The questionnaire used a 5-point level evaluation scale for the second section: namely strongly disagreed, disagreed, neutral, agreed strongly, disagreed, which is a Likert Scale to calculate the level of replies from the participants.

Interview questions were one of the tools that were employed to elicit responses needed for the investigation in this study. Such responses enabled the qualitative and descriptive analysis of outcomes in the study. Interview questions for this study was freshly built from researches and surveys related to this study, seven (7) interview questions were built for the purpose of validating the other responses received from the questionnaire of this study. The interview schedule was administered to the ICT Coordinators. The distribution of the research instrument to the respondents is found in Table 1.

Table 1: Distribution of Research Instrument

Respondents	By mode of	
	Questionnaire	Interview Protocol
Assist H/M	2	
ICT Coordinator		2
Subject Masters	2	

3.6 The Data Collection Procedure

The data was collected by administering the questionnaires as well as the interview schedule for the respondents. The questionnaires were administered and the respondents filled them in the presence of the researcher and sufficient time was allotted to the respondents to fill out the questionnaire. The interview schedule was open-ended and unstructured.

3.7 Data Analysis Procedure

Data analysis is the process of breaking down data; clarify the nature of the component parts and their relationship (Saunders, 2009). The use of questionnaires required both qualitative and quantitative approaches of analysing the data. Quantitative analysis was used to show the whole investigation of the entire information, by finding the frequencies, percentages, mean and average mean. Analysis was done with Microsoft Office Excel and Statistical Packages for Social Science (SPSS) version 16.0. Qualitative data collected from the unstructured interviews were analysed by describing sequentially the concurrent responses from the research respondents and the results grouped into categories.

3.8 Reliability

Reliability refers to the extent to which data collection techniques or analysis procedures will yield consistent findings (Saunders, 2009). It is the degree which a test consistently measures whatever it measures (Gay & Airasian, 2000). The reliability of the study focused on the degree to which empirical indicators of theoretical concept were stable or consistent across two or more attempts to measure the theoretical concepts.

3.9 Validity

According to Orodho, (2005), validity refers to the degree to which the sample of the test represents the content that the test is designed to measure. Validity finds whether the instrument that is the questionnaire content is measuring what they are invented to measure. It also measures the extent to which data obtained from an instrument expressively and accurately reflects or represents a theoretical idea. Considering this study, validity was established by seeking opinion of experts and users in the field targeted. The supervisor of this study was one of the experts whose opinion and modification to the instruments to be employed improved the validity. Validity was also achieved by the use of questionnaire as instrument and further reusing of interview questions to validate responses of the sample groups. Further validity was made by ensuring that respondent to interview questions was made on purposive selections, as to obtain purposeful responses that would be valid for the investigation onwards.

3.10 Ethical Considerations

Ethical considerations are considered one of the most important aspects of research. I ensured the following ethical considerations as captured by Bryman and Bell, (2007) as the most important principles related to ethical consideration in dissertations:

- The researcher prioritised the respect for the dignity of the research participants.
- The researcher obtained full consent of participants prior to the study.
- The researcher ensured the protection of the privacy of research participants.
- Anonymity of individuals and organisations participating in the research was ensured.



CHAPTER FOUR

RESULTS AND DISCUSSION

4.0 Overview

This research section presents data collected, analysis and discussion of findings that were gathered from data collected. The study centered on students, teachers and school administrators in Salaga Senior High School. Out of the one hundred and four questionnaires administered, all were returned which represents 100% of the total number of questionnaires that went out. None was rejected and the results from the findings were

analysed in harmony with the research questions by organising and presenting the data using descriptive statistics and tables.

Table 2: Targeted Respondents

Category of respondents	Administered	Returned	Return Rate
Students	100	100	100%
Chemistry Teachers	2	2	100%
Assistant Headmasters	2	2	100%
Total	104	104	100%

4.1 Presentation of Data Results.

Research Question 1: What attitudes do students show towards the use of ICT in chemistry teaching and learning?

This research question sought to find out the attitudes of students towards ICT use in their teaching and learning of chemistry in Salaga Senior High School. The students responded to questionnaire items to ascertain the kinds of attitudes, whether positive or negative towards ICT in their school. These included the importance they attach to ICT, ICT enjoyment, ICT anxiety and the overall attitudes exhibited by the students. Again, it was to find out the effect ICT has on their chemistry lessons and finally to ascertain their general feelings in relation to ICT use by displaying their frequency and percentage levels of attitudes regarding these personal responses. These attitudes of personal responses are expressed in Table 3.

Table 3: The level of attitudes in relation to ICT use by students.

		Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree		Mean
		N	%	N	%	N	%	N	%	N	%	
Q1	ICT helps me to gain knowledge related to chemistry	13	13.0	9	9.0	4	4.0	51	51.0	23	23.0	3.62
Q2	ICT helps me to develop skills related to chemistry	8	8.0	9	9.0	9	9.0	55	55.0	19	19.0	3.68

Q3	ICT helps me to do my academic homework faster	10	10.0	7	7.0	8	8.0	56	56.0	19	19.0	3.67
Q4	ICT helps me enjoy my chemistry lessons	6	6.0	15	15.0	5	5.0	58	58.0	16	16.0	3.63
Q5	I use ICT when I want to know more about a topic	6	6.0	9	9.0	4	4.0	57	57.0	24	24.0	3.84
Q6	ICT allows me to exchange ideas with my teacher	7	7.0	10	10.0	5	5.0	49	49.0	29	29.0	3.83
Q7	ICT allows me to exchange ideas with my colleagues	5	5.0	15	15.0	8	8.0	42	42.0	30	30.0	3.77
Q8	ICT makes it easier for me to pass the course	4	4.0	17	17.0	5	5.0	48	48.0	26	26.0	3.75
Q9	ICT helps me to follow the course	10	10.0	16	16.0	5	5.0	44	44.0	25	25.0	3.58
Q10	ICT allows me to apply the acquired Knowledge	7	7.0	13	13.0	8	8.0	47	47.0	25	25.0	3.70
Q11	ICT facilitates my self-assessment Processes	5	5.0	14	14.0	8	8.0	45	45.0	28	28.0	3.77
Q12	I like teachers to use ICT in chemistry	4	4.0	13	13.0	5	5.0	46	46.0	32	32.0	3.89
Q13	ICT helps the teacher to guide the working methodology	8	8.0	10	10.0	3	3.0	50	50.0	29	29.0	3.82
Q14	ICT allows me to plan my work	6	6.0	12	12.0	10	10.0	43	43.0	29	29.0	3.77
Q15	ICT allows me to better evaluate my progress in the subject	5	5.0	14	14.0	3	3.0	45	45.0	33	33.0	3.87
Q16	ICT enhances the pace of work	9	9.0	18	18.0	9	9.0	36	36.0	28	28.0	3.56
Q17	ICT facilitates the presentation of content	6	6.0	11	11.0	6	6.0	42	42.0	36	36.0	3.83
Q18	ICT facilitates the identify my learning mistakes	4	4.0	8	8.0	10	10.0	42	42.0	36	36.0	3.98
Q19	ICT helps me to receive assistance from the teacher	4	4.0	13	13.0	8	8.0	49	49.0	25	25.0	3.79
Q20	ICT facilitates the integration of knowledge from different sources	3	3.0	9	9.0	7	7.0	47	47.0	34	34.0	4.00
Q21	ICT helps me to resolve my doubts	1	1.0	19	19.0	13	13.0	46	46.0	21	21.0	3.67
Q22	ICT allows me to better communicate with my teacher	6	6.0	6	6.0	5	5.0	52	52.0	31	31.0	3.96
Q23	ICT allows me to express my emotions more freely	8	8.0	13	13.0	7	7.0	35	35.0	37	37.0	3.80
Q24	ICT enables the teacher to pay more attention to us	13	13.0	20	20.0	6	6.0	35	35.0	26	26.0	3.41
Q25	ICT helps me to explain my problems to the teacher	7	7.0	17	17.0	11	11.0	43	43.0	22	22.0	3.56

Q26	ICT helps to generate a pleasant atmosphere in the classroom	11	11.0	22	22.0	7	7.0	39	39.0	21	21.0	3.37
Q27	ICT helps me to ask others questions	7	7.0	11	11.0	5	5.0	53	53.0	24	24.0	3.76
Q28	ICT facilitates my social relationship with the group	7	7.0	13	13.0	5	5.0	51	51.0	24	24.0	3.72
Q29	ICT allows me to publicly show what I do for the subjects	6	6.0	10	10.0	9	9.0	47	47.0	28	28.0	3.81
Q30	ICT helps to show my strength in chemistry	7	7.0	8	8.0	7	7.0	51	51.0	27	27.0	3.83
<i>%-100, n-100, Average mean=3.741</i>												

Table 3 displays the general level of SHS two students' attitudes towards ICT in the teaching and learning of chemistry. From the general observation in the table above, it can be deduced that over 74% of the sample response are within the range of agreed and strongly agreed. This appears to show a very high satisfactoriness of attitudinal level of students towards ICT use. It can also be deduced from the table that 7% of the respondents are totally oblivious as to the impact of ICT towards their entire learning processes. 19% of the respondents from the table fall in the range of strongly disagree and disagree on the positive attitude or impact of ICT towards their entire teaching and learning process.

Table 3 shows the average mean value of 3.741. It can further be deduced from the table that 40% of the mean values (the bolded mean values) are slightly below the average mean value which statistically implies that, ICT tools appears less helpful to student respondents on question items relating to those mean values. That is **Q1, Q2, Q3, Q4, Q9, Q10, Q16, Q21, Q24, Q25, Q26 and Q28** respectively. Cases involving questions such as "ICT helps me gain knowledge related to chemistry, ICT helps me to develop skills related to chemistry, ICT helps me to do my academic homework faster, ICT facilitates my social relationship with the group, ICT helps to follow the course etc.". The rest of the mean score values (unbolded mean) above the average mean which represents 60% of the mean appears to show that the SHS 2 chemistry students of Salaga Senior High School are highly

and positively motivated and displayed great reception attitudinally and behaviorally to ICT usage and its integration in their entire and general learning processes.

Research Question 2: What ICT infrastructure does the school have in order to integrate ICT in teaching and learning?

ICT infrastructures in schools are vital to ensure that ICT and its' resources are integrated into teaching and learning to improve on teachers' performances, knowledge dissemination and students' reception and comprehension in chemistry. Also, infrastructure provision in senior high schools includes both physical and administrative structures to harness ICT integration within the curricula. Again, infrastructure provision should lay the essential related background resources that influence students behaviorally and attitudinally and also addresses critical issues regarding ICT integration in education. With regards to this study, some relevant factors viewed by the researcher as important infrastructural provisions needed in senior high schools to promote the smooth integration of ICT in teaching and learning were assessed through questionnaire administered to teachers and school managers (Assistant Headmasters). This was aimed at ascertaining the infrastructure present in the school to promote ICT integration into the teaching and learning of chemistry. The questionnaire items (Appendix D) found out;

- ICT laboratories in the school
- ICT policy in the school
- Alternative source of electrical power in the school
- Wi-Fi internet facility in school
- Adequacy of computers and other accessories
- Training of teachers in ICT integration

Table 4 presents the data on the availability of ICT laboratories in the school

Table 4: The availability of ICT laboratories

Response	Frequency	Percentage (%)
Yes	4	100
No	0	0
Total	4	100.0

Table 4 showed that 100% of the respondents did indicate that the school has a computer laboratory. The overwhelming response to the availability of ICT laboratories in the school could be attributed to the application of ICT in schools which is perceived as a means of transforming teaching and learning processes by the government. Parthemore, (2003) points out that many secondary schools in Ghana can now boast of computer labs through which students are gaining basic computer literacy. The availability of ICT laboratory is a major step in achieving effective ICT integration but of course other important facilities are also required to put the existing ICT lab into use. One this important provision is the existence of a workable ICT policy and Table 5 presents information on its availability in the school.

Table 5: The availability of ICT policy

Response	Frequency	Percentage (%)
Yes	0	0
No	4	100
Total	4	100.0

The result of Table 5 indicates that, the school has no ICT policy framework in place. The Government of Ghana in its committed effort to pursuing and achieving an ICT for Accelerated Development (ICT4AD, The Ghana ICT for Accelerated Development Policy, 2003), it has a national policy which outlines the plans and strategies for the development of Ghana's information society and seeks to provide a framework and plans

as to how ICTs can be used to facilitate the goal of transforming Ghana into an information and knowledge-driven ICT literate nation. Every school therefore should develop an elaborate ICT policy that spells out among other things, the accessibility and usage of ICT equipment. It is in such a policy that security of software, hardware and any other digital materials in the school will be spelt out. It is in such a policy that maintenance plan of the ICT equipment will be highlighted. The policy will also spell out on the mode or method of how all teachers and all learners will be accessing the ICT facilities such as computer laboratories, and other facilities such as laptops, printers, LCD projectors etc. The absence of the policy document therefore allows for uncoordinated usage of the ICT tools which does not promote smooth ICT integration in the teaching and learning processes. For proper usage of ICT tools alternative source of power becomes essential. Table 6 presents the responses on the availability of alternative power source in the school.

Table 6: The availability of an alternative source of electrical power

Response	Frequency	Percentage (%)
Yes	4	100
No	0	0
Total	4	100.0

Table 6 revealed that the school has alternative source of electrical power which means whenever there is general power outage teachers and students could still access their ICT tools during lessons. The availability of an alternative source of power meant that teachers and students were able to access their ICT tools whenever there was general power outage. It is important to note that, electrical power is very key to the effective use of ICT tools because most of them are electronic and would require electrical current to operate. Table 7 presents the responses on the availability of internet facility in the school.

Table 7: The availability of internet facility

Response	Frequency	Percentage (%)
Yes	0	0
No	4	100
Total	4	100.0

The results from Table 7 revealed that there was no internet facility in the school to help students access the internet in their teaching and learning processes. This means integrating ICT into the teaching and learning process in the school posed a problem because internet facilities to help access information or lessons were not available. The summary of responses in relation to the provision of incentives to motivate teachers integrates ICT in teaching and learning is presented in Table 8.

Table 8: Provision of incentives to motivate teachers integrate ICT in teaching and learning.

Response	Frequency	Percentage (%)
Yes	0	0
No	4	100
Total	4	100.0

It is observed from Table 8 that teachers are not given incentive packages to motivate them to integrate ICT in their lessons in the school. Ekukinami, (2002) posited that teachers were not extrinsically motivated to utilise and integrate ICT resources due to the lack of incentives and non-availability of ICT materials in our educational institutions. This development poses a threat to effective ICT integration in the teaching and learning process as teachers feel reluctant and would rather stick to the traditional and conventional teaching methods. Table 9 and figure 2 present responses on the training of teachers in ICT integration.

Table 9: Training of teachers in ICT integration

Response	Frequency	Percentage (%)
Yes	2	33.3
No	4	66.7
Total	6	100.0

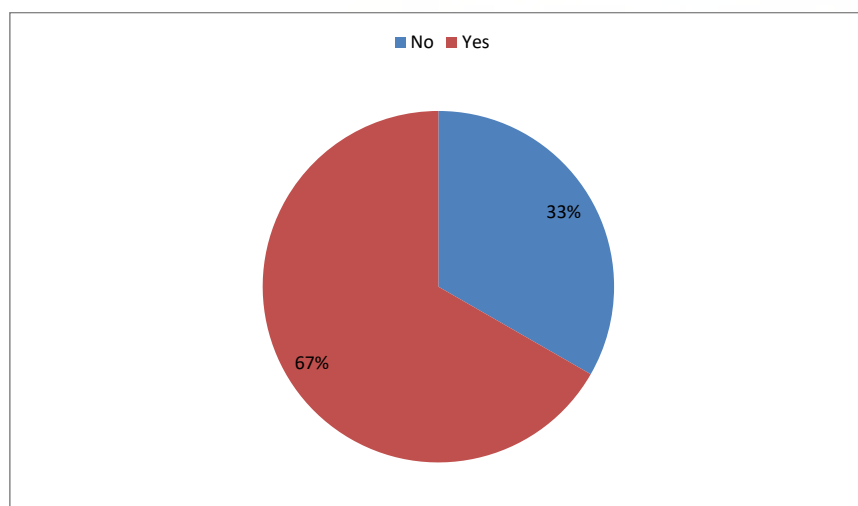
**Figure 2: Training of Teacher in ICT integration**

Table 9 and figure 2 shows that 66.7% of the respondents did not receive any form of ICT training while 33.3% of the teachers indicated they have received and can use any form of ICT tools very efficiently. According to Ukwungwu, (2004) the integration of ICT into the curriculum demands the availability of friendly and well trained teachers and these friendly ICT trained teachers with proficiency in computer operations. Ukwungwu further stressed that, most developing countries of the world have fallen behind in science education delivery due to the lack adequate training of personnels and so their inability to utilise ICT resource. This therefore makes room for the conventional and traditional

teaching approach in most secondary schools. Table 10 and figure 3 present the responses solicited from school managers on the adequacy of computers and other ICT resources.

Table 10: Adequacy of computers and other accessories

Response	Frequency	Percentage (%)
Yes	43	41
No	63	59
Total	106	100.0

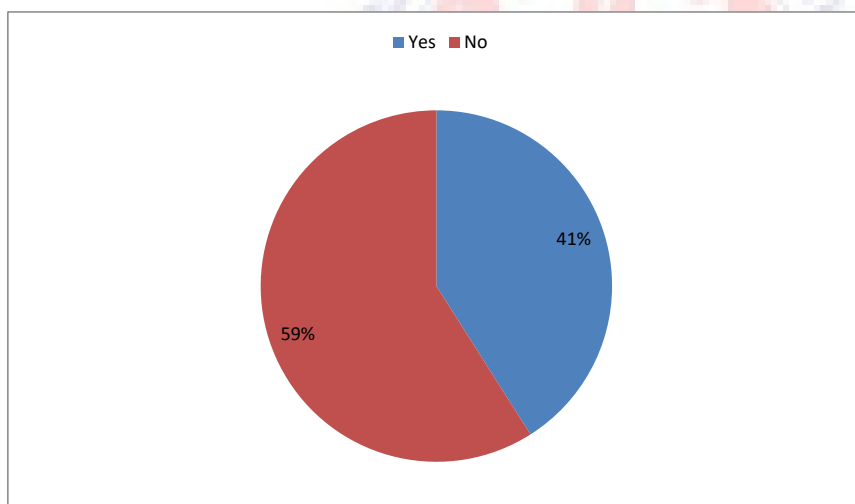


Figure 3: Adequacy of computers and other accessories

From Table 10 and figure 3 it was deduced that, 41% of the respondents which includes students, teachers and school managers think the quantity of computers and its accessories is enough to cater for the needs of students and teachers whereas 59% of the respondents think the computers are not adequate enough for use by students and teachers. This implies

that computers available to students are not enough, some students may have access to computers while others may not, and hence it impedes the smooth ICT integration in the teaching and learning.

Research Question 3: What views do school administrators and managers hold about the integration of ICT in teaching and learning of chemistry?

All schools in Ghana are managed by a group of people referred to as the Board of Governors (B.O.G). They are sometimes called school managers and they among other responsibilities manage the finances and general activities of the school. The Headmaster and the Assistants who are members of the B.O.G perform these responsibilities on behalf of the board and report to them. The researcher therefore used Assistant Headmasters who are representatives of the Board of Governors to solicit for responses in relation to the views show towards ICT integration in the teaching and learning process. In order for teachers and students to effectively make use of ICT tools in their teaching and learning, ICT facilities must be at their disposal. Apart from the ICT tools, conducive infrastructure is also necessary in achieving effective ICT integration in the teaching and learning process. School administrators including the Assistant Headmasters have the responsibility of not only supervising but also the provision of these facilities. The indicators in determining the views school managers hold about ICT integration included questionnaire items which requested to know whether ICT adds value to teaching and learning, whether it will cause the school extra budget to sustain it in future, whether the equipment supplied by government is enough, whether it will improve performance in chemistry etc. Table 11 summarises responses on the values ICT adds to teaching and learning.

Table 11: ICT adds value to teaching and learning.

Response	Frequency	Percentage (%)
Strongly agree	2	100
Total	2	100.0

Table 11 showed the respondents indication of whether ICT adds value to teaching and learning. From Table 11, all respondents (100%) strongly agreed that ICT adds value to teaching and learning in chemistry. Adding value in this light implies the improvement in the academic outcomes and performance in general. School managers strongly agreeing means they hold a positive perception to ICT integration and would support any attempt to ensure ICT integration in the school. Data on the sustainability of ICT use in the school is presented in Table 12 below.

Table 12: Sustainability of ICT use in schools.

Response	Frequency	Percentage (%)
Agree	2	100
Total	2	100.0

From Table 12, 100% of the respondents agreed that ICT will cause the school extra budget in order to sustain it in the future. Without finances schools will not be able to cater for the cost of paying for internet connectivity, service ICT equipment and even replace consumables like printer papers, printer cartridges. These expenses that are likely to be incurred in the use of ICT tools according to the respondents will cause the school extra budget to sustain in the future. This assertion is a view administrators have in relation to

the cost commitments and implications that comes with ICT integration in the teaching and learning process. Table 13 presents the responses on the adequacy of equipment supplied by government.

Table 13: Equipment supplied by government is not enough for the school

Response	Frequency	Percentage (%)
Agree	2	100
Total	2	100.0

The questionnaire item (as found in Appendix D) requested to know from school managers whether the equipment supplied by the government is enough for the whole school. From Table 13, 100% of the school managers indicated that, the equipment is not adequate to make up for the numbers in the school. This further implies that computers and accessories meant for learning by students is not enough and that some students may have access to these ICT tools while others may not, hence it impedes teaching and learning. Inadequate number of computers and other ICT tools coupled with increasing number of students as a result of the free senior high school whose primary goal is to get all students enrolled into SHS has the tendency of hindering a successful implementation of ICT integration in most Ghanaian schools. Table 14 summarises the data on ICT apparatus storage in the school.

Table 14: ICT apparatus should/are in the computer laboratory permanently.

Response	Frequency	Percentage (%)
Agree	2	100
Total	2	100.0

Table 14 showed that, 100% of school managers agreed that ICT apparatus should and are in the computer laboratory permanently and ready to be used by teachers and students.

This questionnaire sought to know what school managers think about access to these ICT apparatus/tools locally. In every organised school setting school managers supervise and ensure proper use and maintenance of computer tools as a result some even go to the extent of not only taking delivery of these ICT tools but also keep them in their offices and provides them for use when the need arises and also ensure that they are returned after use. The researcher therefore sought to determine school managers' views on where these tools should be kept and the results above indicates that they would prefer the tools be kept permanently in the laboratory for easy access. School managers' responses on ICT making teachers delegate work to students is presented in Table 15.

Table 15: ICTs will make teachers delegate work to students.

Response	Frequency	Percentage (%)
Strongly disagree	2	100
Total	2	100.0

The questionnaire item sought to know what views school administrators have in relation to the attitude teachers will attach to their lesson when ICT tools are integrated in their lessons. There is the tendency of teachers pushing and delegating some responsibilities to students which might affect them in the long run. From table 15 above, 100% of the respondents disagreed that ICTs make teachers delegate work to students. The results above indicate that, school administrators do not harbour the worry that teachers will relax on their pedagogical responsibility because they have ICT tools at their disposal and burden students by delegating work meant for them. Table 16 presents data on whether students will use ICT tools inappropriately on left alone in the computer lab.

Table 16: Students, if left alone in the computer lab, might browse pornographic sites.

Response	Frequency	Percentage (%)
Agree	2	100
Total	2	100.0

Most school administrators are concerned about the misuse of the ICT tools provided to bring about effective ICT integration in the teaching and learning process. The questionnaire item sought to know the view school administrators have when students are left alone in the computer laboratory with the view of them visiting pornographic sites. From Table 16, 100% of the respondents agree that students when left alone in the computer lab might spend time browsing pornographic sites. The results further imply that, school administrators do not support the idea of allowing the students to work on their own. Data on the effect of frequent power disruption is presented in Table 17.

Table 17: Frequent power disruptions affect ICT integration.

Response	Frequency	Percentage (%)
Strongly Agree	1	50
Agree	1	50
Total	2	100.0

Electrical power is an essential indicator or determinant of effective ICT integration. School managers have in recent times installed standby generators and solar panels to ensure that frequent power outages do not affect lessons especially those ones involving

the use of ICT tools. From Table 17, 50% of the respondents agree and 50% strongly agree that frequent power disruptions affect ICT integration. Table 18 presents data on how frequent teachers use the computer laboratory to teach their subjects.

Table 18: Teachers frequently used the laboratory to teach their subjects.

Response	Frequency	Percentage (%)
Disagree	2	100
Total	2	100.0

Table 18 shows that, 100% of the respondents disagreed that teacher in the school frequently use the laboratory to teach their subjects. As a result of inadequate ICT tools coupled with the lack of commitment by teachers and the growing student numbers, the researcher sought to know from school managers whether teachers use the computer laboratory frequently to teach their subject. Table 19 presents responses on whether the Head teacher should keep the key to the computer lab.

Table 19: The Head teacher should keep the key to the computer lab.

Response	Frequency	Percentage (%)
Disagree	2	100
Total	2	100.0

Commented [WU58]: Can you delete this?

For accessibility reasons, the researcher sought know the views of school managers in the relation to the head teacher keeping the key to the computer laboratory. 100% of the respondents as shown in Table 19 disagreed with the questionnaire item (as found in Appendix D). Table 19 summarises data on whether ICT made teachers lazy.

Table 20: ICTs will make teachers lazy.

Response	Frequency	Percentage (%)
Disagree	2	100
Total	2	100.0

The researcher in an attempt to ascertain the attitudes teachers are likely to exhibit when ICT is integrated into teaching and learning asked respondents whether ICTs will make teachers lazy. From Table 20 above, 100% of the respondents disagree ICTs will make teachers lazy. The researcher sought to know the impact of ICT integration in chemistry to performance and the responses were captured in Table 21 below.

Table 21: ICT integration in chemistry lessons will improve performance.

Response	Frequency	Percentage (%)
Strongly agree	2	100
Total	2	100.0

Finally, the researcher sought to know the impact ICT integration will have on academic outcomes and general student performance in chemistry in Salaga Senior High School. 100% of the respondents according to Table 21 strongly agreed that performance will improve in chemistry as a result of ICT integration in teaching and learning in the school.

4.3 Results of Interview

In an attempt to obtain a broader and diverse views on the integration of ICT in the teaching and learning of chemistry interviews were used as one of the data gathering

instrument to check consistency and confirm the responses of the respondents (ICT Coordinators).

In respect questionnaire item 1 (as found in Appendix E), which sought to know the state of ICT in Salaga Senior High School, the respondents were of the opinion that the school is not equipped with required ICT tools and had no adequate infrastructure or access to internet resources to facilitate ICT integration.

A summary of these perceptions was captured below:

Respondent I who is an ICT Coordinator in the school had this to say;

“The school does not have internet services or Wi-Fi facility to be used for research. The school lacks adequate infrastructure to support ICT integration. Computers and ICT tools in the school are inadequate compared to the number of students and students”.

(Respondent I, Age: 45)

Respondent II who is also an ICT Coordinator made this comment;

“The school lack internet access. The science laboratories and classrooms are not equipped with gadgets to support ICT integration. The state of ICT in Salaga Senior High for me is one that needs serious attention if indeed school managers are committed to integrating ICT in teaching and learning”.

(Respondent II, Age: 28)

Considering the interview schedule item 2 (as found in Appendix E), on the personal assessment of ICT usage, all respondents were of the opinion that the ICT educational tools are helpful in the running of the day-to-day teaching and learning activities and makes learning simple and understandable.

A summary of these perceptions was captured in the following

Respondent I

“I boldly commend ICT educational tools of being assistive to my success. Without ICT my studies would have been boring”

(Respondent I, Age: 45)

Respondent II

“ICT use in teaching and learning simplifies the pedagogical approach and open the minds of learner to the digital world.

(Respondent II, Age: 28)

Subsequently, ICT coordinators indicated that, access to ICT tools is free as the keys and other accessories are readily available for usage even though they are inadequate. The summary is captured below:

Respondent I

“The ICT tools are accessible in spite of the limited numbers and are made available to teachers and students frequently whenever the need be.”

(Respondent I, Age: 45)

Respondent II

“ICT tools in this school are free to access and on frequent bases when they are not in use by others.”

(Respondent II, Age: 28)

The ICT coordinators further responded to the interview item regarding the nature of infrastructure in the school and how it can help in ICT integration. ICT coordinators had this to say:

Respondent I

“The computer laboratory though present is not fully equipped. The school does not have a reliable alternative power supply and in my opinion the infrastructure present cannot effectively promote ICT integration in teaching and learning.”

(Respondent I, Age: 45)

Respondent II

“The infrastructural deficit in the school makes it difficult for effective ICT integration. Some of the notable infrastructural challenges that has the tendency of making ICT integration unachievable ranges from the lack of adequate training of personnel, computer laboratory not fully equipped and unstable power supply.”

(Respondent II, Age: 28)

Additionally, the interview response to the research question on how knowledgeable teachers and students were in the integration of ICT into lessons showed a lack of in-service training, lack of ICT integration in the training of teachers and the inadequate ICT teachers in the school. Respondents asserted to having the following basic knowledge in ICT and computer use.

Respondents I

“Computer use makes teaching and learning exciting and also reduces workload. It also motivates and stimulates students’ interest. Unfortunately, the lack of adequate in-service training on the part of teachers is hampering smooth integration into teaching and learning.”

(Respondent I, Age: 45)

Respondent II

“ICT tools bridge the gap between the teachers and students and also reduces the stress teachers go through in their teaching process. It also encourages collaborations.”

(Respondent II, Age: 28)

4.4 Discussion

The purpose of the study was to investigate the attitudes exhibited by students towards ICT integration in Salaga Senior High School.

Structured interviews were employed to compliment the data gathered by the questionnaires. Considering the state of ICT in the teaching and learning of chemistry in Salaga Senior High School. It was observed that the state of ICT is not encouraging. The issues identified by the ICT coordinators include lack internet facility, inadequate ICT tools and the absence of an ICT policy framework among others, teething infrastructural deficit.

Hope, (1997) stated that for technology to be exploited in an environment, it must first exist. ICT coordinators responses on the state of ICT in Salaga Senior High showed that, the computers and other ICT tools were inadequate. The large number of students and teachers compared to the small number of available ICT resources limited teachers and students access to ICT and further hampered effective integration.

Teachers and students also had no internet facilities; therefore, work practices and assignments involving the use of the internet could not be accomplished.

Finally, the researcher sought to know how knowledgeable teachers and students were concerned about integration of ICT in the school. Pelgrum (2001), stated that the success of educational innovations depends largely on the skills and knowledge of the teachers. ICT coordinators think teachers to a larger extent have knowledge and appreciate the impact of ICT integration in their lessons but still require more training.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION, RECOMMENDATIONS AND SUGGESTIONS FOR FURTHER STUDIES

5.0 Overview

This chapter summarises the details obtained in the study. The chapter is grouped into three parts. The first part of the chapter summarises the findings, the second part outlines the conclusions drawn from the research and the third part makes recommendations on measures to address the relevant factors to ensure successful integration of ICT in chemistry at Salaga Senior High School. One hundred (100) chemistry students were the participants used in this study.

5.1 Summary

The objectives of the study were to determine the attitudes chemistry students exhibit towards ICT integration in teaching and learning, to identify the school's infrastructural support in the integration of ICT and finally, to assess managements' view on the integration of ICT in chemistry teaching and learning.

The research study answered the following questions:

1. What attitudes do students exhibit towards the use of ICT in chemistry teaching and learning?
2. What ICT infrastructure do schools have in order to integrate ICT in teaching and learning?
3. What views do school managers hold about the integration of ICT in teaching and learning of chemistry?

The researcher issued questionnaires for the students, subject teachers and the Assistant Headmasters. The researcher also interviewed the ICT coordinators as means of validating the data collected. The data collected was coded and then analysed using SPSS version 16.0. Frequencies, percentages, mean values and average mean values were used to analyse the data.

5.2 Findings

Findings from this investigation showed that majority of the chemistry possessed generally high attitudinal acceptability level towards ICT use and integration for learning purposes. A very small percentage of students displaying indifference towards ICT use was also observed.

The findings further showed that the students are highly and positively motivated and also have high receptive attitude towards ICT and its importance and acceptability to their entire general academic purposes.

On infrastructure, the researcher found that the school lacks the most essential facilities for integrating internet ICTs in teaching and learning. Internet connectivity was a major hindrance as the school did not prioritise connecting internet in the computer laboratory. Another infrastructural provision absent in the school is the ICT policy framework which is expected to direct the usage and management of ICT in the school. The school does not also have an alternative power supply as such lessons are interrupted when there is power outage.

Computers and other accessories are also inadequate in the school and so cannot cater for the growing number of students and teachers. Finally, teachers in the school have not received ICT training to enable them integrate ICT in their teaching and learning process.

On the part of school managers, the findings revealed their readiness to embrace ICT integration in the teaching and learning of chemistry. They indicated to allow easy access to ICTs tools as they supported the idea of keeping them permanently in the ICT lab. The school managers admitted the lacks an ICT policy document and also recognise that teachers haven't been given any ICT training to promote ICT integration but remain positive that with these facilities in place ICT integration will improve performance in chemistry in Salaga Senior High School.

5.3 Conclusions

The following conclusions were drawn based on the findings of this study:

- Majority of the chemistry students in Salaga Senior High School possessed generally high attitudinal acceptability level towards ICT for their learning purposes with a very few of the students displaying indifference towards ICT use. This provides a blueprint for school managers in identifying the exact barriers to ICT integration and how to address them.
- Infrastructure remains a major deterrent to effective ICT integration in teaching and learning in Salaga Senior High School. The findings revealed the school lacks essential infrastructure to support ICT integration. These include; inadequate computers, the absence of Wi-Fi facility, the absence of an alternative power supply and finally the lack of an ICT policy document.
- Finally, managers of the school are positive about the impact of ICT in the teaching and learning of chemistry in spite of the numerous infrastructural deficits.

5.4 Recommendations

The following recommendations are made based on the findings of this study:

1. Infrastructural inadequacies and deficiencies in the research area should be addressed by the school in collaboration with the municipal education directorate and the municipal assembly.
2. The training needs of teachers in ICT at Salaga Senior High School should also be addressed through school based in-service training.
3. School managers must go beyond the positivity about the impact of ICT on performance by dedicating time and resources to ensure effective ICT integration.

5.5 Suggestions for further studies

Based on the findings of this study the following suggestions are listed for further research.

1. A study on the ICT training needs of science teachers in Salaga Senior High School should be undertaken
2. Conducting a study on school-based factors that influence ICT integration in teaching and learning in second cycle institutions.

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APPENDIX A

Background and Demographic Characteristics of the Research Subjects

Gender of Students

Sex	Frequency	Percentage (%)
Male	69	69
Female	31	31
Total	100	100.0

Ages of the students

Age Group	Frequency	Percentage (%)
Below 17 years	32	32.0
18-20 years	61	61.0
Above 20 years	7	7.0
Total	100	100.0

The demographic data on teachers for the research study

Sex Distribution of teachers

Sex	Teachers	Percentage (%)
Male	4	67
Female	2	33
Total	6	100.0

Background data on the ages of the teacher respondents

Age Group	Frequency	Percentage (%)
Below 30 years	0	0
31-40 years	3	50
41-50 years	2	33
Above 51 years	1	17
Total	6	100.0

Years of teaching experience teachers

Years of Teaching	Frequency	Percentage (%)
0-5 years	0	0
6-10 years	2	33.3
11-15 years	3	50
16-20 years	1	16.7
Total	6	100.0



APPENDIX B**QUESTIONNAIRE FOR STUDENTS**

You are kindly requested to give appropriate information to the statements provide below by either ticking in the parentheses () or by giving further information in the spaces provide. Your response shall be treated with utmost confidentiality. You are therefore not required to indicate your name anywhere in the questionnaire.

Section A: Demographic Details

1) What is your gender?

a) Male ()

b) Female ()

2) What is your age bracket?

a) 15 – 18 years []

b) 19 -25 years []

c) 26 – 30 years []

d) Over 30 years []

3) Is there a computer laboratory in your school?

a) Yes ()

b) No ()



S/N	ITEMS	STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE
1	ICT helps me to gain knowledge related to chemistry					
2	ICT helps me to develop skills related to chemistry					
3	ICT helps me to do my academic homework faster					
4	ICT helps me enjoy my chemistry lessons					
5	I use ICT when I want to know more about a topic					
6	ICT allows me to exchange ideas with my teacher					

7	ICT allows me to exchange ideas with my colleagues					
8	ICT makes it easier for me to pass the course					
9	ICT helps me to follow the course					
10	ICT allows me to apply the acquired Knowledge					
11	ICT facilitates my self-assessment Processes					
12	I like teachers to use ICT in chemistry					
13	ICT helps the teacher to guide the working methodology					
14	ICT allows me to plan my work					
15	ICT allows me to better evaluate my progress in the subject					
16	ICT enhances the pace of work					
17	ICT facilitates the presentation of content					
18	ICT facilitates the identify my learning mistakes					
19	ICT helps me to receive assistance from the teacher					
20	ICT facilitates the integration of knowledge from different sources					
21	ICT helps me to resolve my doubts					
22	ICT allows me to better communicate with my teacher					
23	ICT allows me to express my emotions more freely					
24	ICT enables the teacher to pay more attention to us					
25	ICT helps me to explain my problems to the teacher					
26	ICT helps to generate a pleasant					

	atmosphere in the classroom						
27	ICT helps me to ask others questions						
28	ICT facilitates my social relationship with the group						
29	ICT allows me to publicly show what I do for the subjects						
30	ICT helps to show my strength in chemistry						

THANK YOU!!!!!!



APPENDIX C

QUESTIONNAIRE FOR SUBJECT TEACHER

You are kindly requested to give appropriate information to the statements provided below by either ticking in the parentheses () or by giving further information in the spaces provided. Your response shall be treated with utmost confidentiality. You are therefore not required to indicate your name anywhere in the questionnaire.

Section A: Demographic Details

This section seeks information about you and your school

Name of School _____

Subject Taught _____

Academic level

Diploma []

Degree []

Master's Degree []

Doctorate Degree []

Any other (please specify) _____

Guidelines

The questionnaire has 19 items. Please tick in the appropriate bracket to show your level of agreement or disagreement with the statements.

1. Your gender is

a) Male []

b) Female []

2. What is your age bracket?

a) 21 – 30 years []

b) 31 -40 years []

c) 41 – 50 years []

d) Over 51 years []

3. Please indicate your teaching experience

a) 0 to 5 years []

b) 6 to 10 years []

c) 11 to 15 years []

d) 16 to 20 years []

e) Over 20 years []

4. Our school has enough ICT materials available for both teachers and students to use

Yes []

No []

5. What is your highest professional qualification?

a) Masters in Education []

b) Bachelors of Education []

c) Post Graduate Diploma in Education []

d) Diploma in Education []

e) Any other (please specify) _____

6. Teachers have efficient and regular access to ICT facilities to help in their work.

Yes []

No []

S/N	ITEMS	STRONGLY DISAGREE	DISAGREE	NEVER	AGREE	STRONGLY AGREE
7	The school is structurally adapted and positioned to facilitate the integration of ICT into teaching and learning of chemistry.					
8	The school administrators or managers have positive attitude towards the integration of ICT in teaching and learning chemistry.					
9	The use of ICT in my school stimulates creativity, increases motivation and collaboration for teaching and learning of chemistry.					
10	ICT use in pedagogy develops the students' learning skills considered essential in the modern working environment.					
11	Adequate in-service training are organized by my school					

	for teachers to enhance their ICT application in teaching.					
12	The use of ICT in teaching does not reduce teachers and students work load.					
13	Finance does not prevent the use of ICT in teaching and learning.					
14	Educational materials can be prepared and distributed to students through the use of ICT resources.					
15	There is adequate telecommunication infrastructure and internet service to support teaching and learning.					
16	The current school curriculum and educational system is not information and communication technology-driven.					
17	Considering the partial success of traditional teaching methods in the past, ICT inclusion in the teaching and learning process is not important to the student.					
18	Assignments and work practices given to students involve the use of computers.					

APPENDIX D

QUESTIONNAIRE FOR ASSISTANT HEADMASTERS

You are kindly requested to give appropriate information to the statements provided below by either ticking in the parentheses () or by giving further information in the spaces provided. Your response shall be treated with utmost confidentiality. You are therefore not required to indicate your name anywhere in the questionnaire.

Section A: Demographic Details

Guidelines

The questionnaire has 19 items. Please tick in the appropriate bracket to show your level of agreement or disagreement with the statements.

1. What is your age bracket?

- a) 21 – 30 years []
- b) 31 -40 years []
- c) 41 – 50 years []
- d) Over 51 years []

The school infrastructural provisions

5. Do you have a computer laboratory?

- a) Yes ()
- b) No ()

6. Have teachers in your school been trained in ICT integration in teaching and learning?

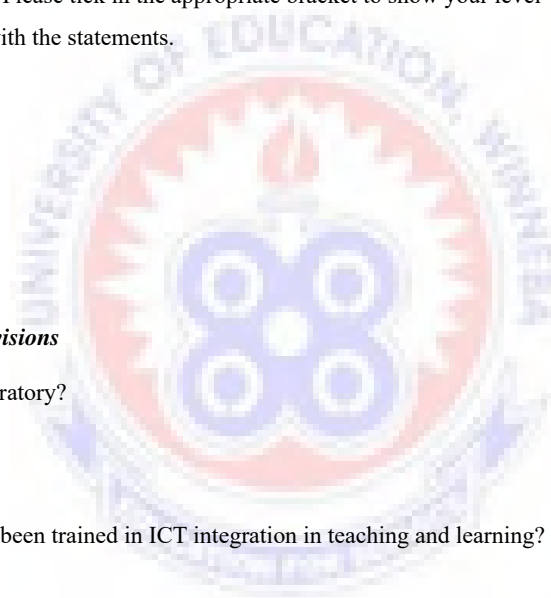
- a) Yes ()
- b) No ()

7. Does your school have an ICT policy?

- a) Yes ()
- b) No ()

8. Does the school have alternative source of electrical power?

- a) Yes ()
- b) No ()



9. Does the school have a Wi-Fi internet facility?

a) Yes ()

b) No ()

10. Are the teachers given incentives to motivate the use of ICT in teaching and learning?

a) Yes ()

b) No ()

Rank the following opinions about ICT integration in teaching and learning in your school in order of merit by ticking in the required column. The rating scale is 1 = strongly agree, 2 = agree, 3 = disagree, 4 = strongly disagree

Opinion	1	2	3	4
It adds value to teaching and learning				
It will cause the school extra budget to sustain it in the feature				
The equipment supplied by the government is not enough for the whole school				
All the ICT apparatus should and are in the computer laboratory permanently and ready to be used by teachers				
ICTs will make teachers delegate work to students				
Students, if left alone in the computer lab, might browse to pornographic sites				
Frequent power disruptions affect ICT integration				
Teachers in the school frequently use the laboratory to teach their subjects				
The head teacher should keep the key to the computer lab				
ICT s will make teachers lazy				
ICT integration chemistry lessons will improve performance				

THANK YOU FOR YOUR TIME!

APPENDIX E
INTERVIEW GUIDE

In your own opinion:

1. What is the state of ICT in your school?
2. Generally, it is perceived that ICT tools are useful when it comes to carrying out academic tasks and for learning purpose. On a personal assessment what is your view on ICT usage?
3. Your access towards ICT tools within and outside the school appears to be limited or free? If limited, could it be based on lack of competence, availability, nor exposure to such tools by the authorities? If free, how frequent is your access to such tools?
4. What in your view is the nature of ICT infrastructure in your school and how it can help in the integration of ICT?
5. How knowledgeable are teachers and students in ICT integration in your school?

THANK YOU FOR YOUR TIME!