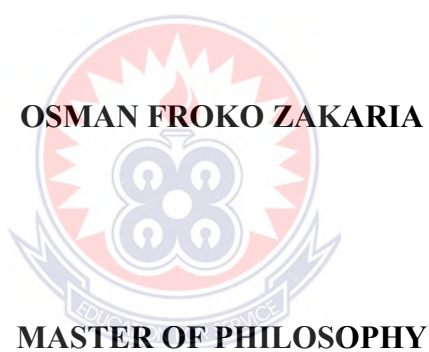


UNIVERSITY OF EDUCATION, WINNEBA

**THE STATUS OF THE INTEGRATION OF TECHNOLOGY INTO JUNIOR
HIGH SCHOOL SCIENCE TEACHING IN WA MUNICIPALITY**



2023

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**THE STATUS OF THE INTEGRATION OF TECNOLOGY INTO JUNIOR
HIGH SCHOOL SCIENCE TEACHING IN WA MUNICIPALITY**

**OSMAN FROKO ZAKARIA
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**A thesis in the Department of Science Education, Faculty of
Science Education, submitted to the School of
Graduate Studies, in partial fulfilment
of the requirements for the award of the degree of
Master of Philosophy
(Science Education)
in the University of Education, Winneba**

JANUARY, 2023

DECLARATION

Student's Declaration

I, OSMAN FROKO ZAKARIA, declare that this thesis, with the exception of quotations and references contained in published works which have all being identified and duly acknowledged, is entirely my own original work, and that it has not been submitted, either in part or whole for another degree elsewhere.

SIGNATURE:

DATE:

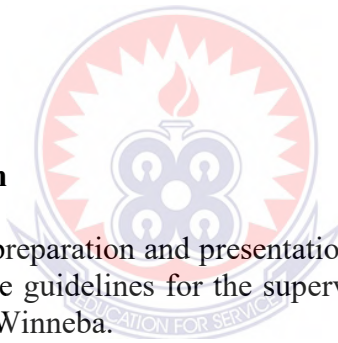
Supervisor's Declaration

I hereby declare that the preparation and presentation of this thesis was supervised by me in accordance with the guidelines for the supervision of Thesis laid down by the University of Education, Winneba.

PROF. JOHN K. EMINAH (Supervisor)

SIGNATURE:

DATE:



DEDICATION

This thesis is dedicated to my mother, Memunatu Froko who has been my support and source of encouragement and to my loving and dependable wife, Umatu-Biibi and my children, Huda Kanda, Hamdia Hena, Husni Yameogo, Hayaat Beniere and Hawa Sumcheta. I say God bless you.



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To everyone who offered me support, encouragement and assistance in the completion of this study.

I also want to express my warmest gratitude to my uncle, Abdulai Mumuni Froko, my brother, Ali Moomin (Water cool) and Aaron Donkurun my course mate for their immense contributions in diverse ways to make this work reality. I am eternally grateful.

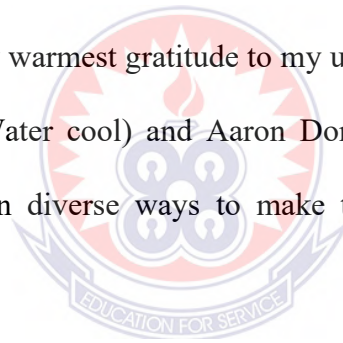


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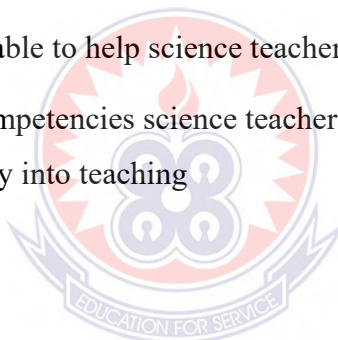
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ABSTRACT

This survey study explored the status of the integration of ICT in the teaching of integrated science in selected Junior High Schools in the Wa Municipality. The study explored the availability and use of ICT in teaching and the challenges encountered in the integration process. A Sample size of 96 respondents were purposively selected to provide information regarding their perception and views on the use of ICT to facilitate teaching of integrated science in the Wa municipality. Questionnaire and interview schedule were used to collect data for the study. The quantitative data collected were analyzed using both descriptive and inferential statistics. Even though, the Government of Ghana recognized the need for ICT in education through the implementation of policies, the state of ICT infrastructure and tools on the ground is not encouraging as access is below standard in the Wa Municipality. The study revealed that most of the schools in the Wa Municipality do not have ICT infrastructure to support the integration of technology in teaching. The study also revealed that most of the Junior High School science teachers do not possess adequate ICT competencies to integrate ICT in the teaching and learning process. However, many of the respondents were ready to integrate ICT in teaching if they are given the necessary training and ICT resources to support teaching. It is recommended that Science teachers in the Wa Municipality should be trained on how to integrate ICT in their teaching and not only on the general use of ICT tools. The stakeholders of Education in the Municipality should work towards providing a projector, laptop, standby generator and internet connectivity to every Public Junior High School in the Municipality to facilitate ICT integration in teaching at least three times a week. All public Junior High Schools should be connected to the National grid and also provided with a standby generator to power ICT equipment in the school.

CHAPTER ONE

INTRODUCTION

1.0 Overview

This chapter one presents a general overview of the study. The chapter is organized into sub-headings. The chapter explores the background to the study, rationale for the study, statement of the problem, purpose of the study, research questions, significance of the study, delimitation of the study, limitations of the study, organization of the study, as well as, the definition of terms and abbreviations.

1.1 Background to the Study

The rapid growth in Information Communication and Technologies (ICT) has brought profound changes in the twenty-first century, as well as affected the demands of modern societies. ICT has become increasingly important in our daily lives and in our educational system. Therefore, there is a growing demand on educational institutions to use ICT to teach the skills and knowledge students need for the 21st century. Realizing the effect of ICT on the workplace and everyday life, today's educational institutions try to restructure their educational curricula and classroom facilities, in order to bridge the existing technology gap in teaching and learning. This restructuring process requires effective adoption of technologies into existing environment in order to provide learners with knowledge of specific subject areas, to promote meaningful learning and to enhance professional productivity (Tomei, 2005). According to UNESCO (2006), the use of Information and Communication Technology (ICT) in and for education is rapidly expanding in many countries and is now seen worldwide as both a necessity and an opportunity for improving and enhancing the education offered to citizens across the globe. Technology is a process by which scientific knowledge and discoveries are applied and used (Robert & Manu,

2001). ICT has the potential to enable teachers and students to construct rich, multi-sensory, interactive environments with an almost unlimited teaching and learning potential (Balanskat et al., 2006). The International Conference on Teaching and Learning with Technology (2010) stressed the pivotal role that ICT can play in transforming teaching and learning. ‘The Dakar Framework for Action’ (2000), identified the use of ICT as one of the main strategies for achieving the world declaration of Education for All adopted at Jomtein in 1990 and called on all nations to harness new information and communication technologies to help achieve these goals (Rampersad, 2011).

All countries of the European Economic Union have made the integration of ICT in education a priority and have invested heavily in ICT in schools (Balanskat, et al., 2006).

The Government of Ghana in the last two decades has championed the use of ICT in education for improved education outcomes. The Education Strategic Plan (2003-2015) and (2010 -2020) of the Ghana Education Service identified the need for ICT in education. On the bases of promoting ICT in education, the Ghana government through the ministry of Education and the Ghana Education Service has introduced policies to support the integration of ICT in teaching at the basic school level. The “ICT for Accelerated Development (ICT4AD) policy (2003)”, the “ICT in Education Policy (2008)” and the “Basic school Computerization Policy (2011)” are the notable policies formulated and implemented to promote ICT integration and improve learning outcomes (Government of Ghana 2008, p.10).

The Ghana ICT for Accelerated Development (ICT4AD) Policy (2003) recognizes the importance of integration of ICT into teaching and intends to:

- Transform Ghana into an information and knowledge-driven ICT literate nation
- Introduce computers into all primary, secondary, vocational and technical school
- Put in place special schemes to enable students, teachers and educational institutions to purchase computers through attractive packages, among other strategies.

On the basis of promoting ICT in education, the Ministry of Education launched the ICT in Education Policy 2008, as a way of addressing ICT needs in education. Similarly, the Basic School Computerization policy was created in 2011 to introduce computers and e-Learning into the entire education system. Hence, in 2012, the Ministry of Education through rLG, an ICT company in Ghana introduced the “teacher laptop and ICT project” where teachers are trained in ICT and provided with laptop to aid in research, teaching and learning across a variety of subjects areas. The use of ICT for teaching and learning is important since it guarantees unrestricted access to relevant information and development in subject areas as well as the provision of efficient and effective tools to take care of students individual differences including pupil with special needs (Bede, Termit, & Fong 2015; Kwache 2007).

Currently, ICT and “e-learning” have become important concepts in Primary, Senior High Secondary, and tertiary education in Ghana. Though Ghanaians are not highly developed in technology use as compared to the advanced countries, Ghana can be counted among Nations which see the integration of technology in education as essential (Essunam & Appiah-Boateng, 2013). Learning platforms such as online educational videos, virtual classrooms, webcasting and an array of access to research,

all compiled on the internet provides convenience for both students and lectures and this, in its own way, has reinvented the way Ghanaians view education. However, the situation seems to be different in the public Junior High schools in the Wa Municipality in the Upper West Region.

1.2 Statement of the Problem

Research points to the benefits that ICT integration brings on bear to the teacher as well as the learners. Talabi (2015) noted that when lessons are presented through computers, they give learners more control over their learning environment and they get access to a wider range of materials to use. Lessons become more interactive. Both the struggling and smarter students benefit since computers facilitate self-directed learning.

Most JHS teachers in the Wa Municipality were provided with laptops in 2014 by government through the Municipal Education Office with the view of encouraging them integrate technology into teaching. Since this intervention, little or no work has been done on the status of ICT integration into teaching integrated science in Junior High Schools in the Municipality. Even though world organizations recognize the importance of integrating ICT into teaching and Ghana's ICT4AD supports ICT integration, the knowledge and practices of integrated science teachers in integrating ICT into teaching in the Wa municipality is yet unknown. It is against this background that this study was conducted to investigate the perception of teachers of the integration of technology into teaching of integrated science in Junior High Schools in the WA Municipality of the Upper West Region of Ghana.

1.3 Purpose of the Study

The purpose of the study was to explore the status of the integration of Technology into Junior High School science teaching in the Wa Municipality. It also ascertained the implementation challenges of the Ghana ICT4D program in the Wa Municipality.

1.4 Research Objectives

The research objectives were to:

1. determine how teachers in the Wa Municipality perceive ‘technology integration’ into JHS science teaching.
2. examine the factors that affect technology integration in teaching at the Wa Municipality.
3. assess whether the selected schools have basic facilities to enable teachers integrate technology into teaching.
4. explore whether the science teachers in the Wa Municipality possess adequate knowledge and competencies to integrate technology into science teaching and learning.

1.5 Research Questions

The following research questions were formulated to guide the study:

1. What are the perceptions of science teachers on the integration of technology into science teaching in Wa Municipality?
2. What factors affect the science teachers’ technology integration practices in the Wa Municipality?
3. What ICT facilities are available to help science teachers integrate technology into teaching?

4. What level of knowledge and competences do science teachers in the Wa Municipality possess to integrate technology into teaching?

1.6 Significance of the Study

It is anticipated that the findings of this study would provide adequate information to:

1. effectively implement the integration of ICT into teaching all subjects.
2. unravel the limitation that go against the implementation of ICT4AD so as to find solutions for such programs in future.
3. help the Ministry of Education (MOE) to be well prepared with the requisite facilities and to plan ahead to make the necessary training programs to prepare teachers for the integration of ICT in teaching.
4. provide the GES and other stakeholders the opportunity of adopting workable models to facilitate a successful implementation across the education system.

1.7 Delimitation of the Study

The scope of the study was on the perception of science teachers in integrating technology into teaching at JHS level and not on other aspects like perception of parents on integrating technology into teaching. The study was narrowed down in scope due to financial and time constraints. It therefore focused itself only on JHS Science and ICT teachers in the Wa Municipality. The study did not cover the whole of the Upper West Region.

1.8 Limitations of the Study

Limitations are conditions beyond the control of the researcher that place restriction on the conclusion of the study and its application (Best & Kahn, 1989). One of the major limitations of the study was that the survey considered only science teachers and also basic schools in the Wa Municipality. This might not reveal a general picture

of the perception integrated science teachers in integrating technology in other Regions of Ghana. Therefore, generalizing the findings of this study must be done with caution. In order to strengthen internal validity of the study, the researcher used a variety of data collection methods including questionnaire and interviews.

However, each method may have limitations such as respondents misunderstanding of a question or failure to answer all the questions. Also, the spatial nature of locations of the basic schools made it difficult to cover all of the basic schools.

1.9 Definition of Terms and Abbreviations

ICT: Information communication technology

ICT4AD: Information communication technology for Accelerated Development

JHS: Junior high school

MMDA: Metropolitan, Municipal and District Assembly.

1.9 Organization of the Study

The study has been organized into six chapters and each chapter has sections and sub-sections.

Chapter One includes the background to the study, statement of the problem, purpose of the study, research questions, significance of the study, delimitation, limitation, organizations of the study.

Chapter Two is made up of the review of related literature. It deals with how other people perceived and expressed their thoughts about the topic under study.

Chapter Three also gives account of the methods and procedures employed by the researcher to collect data. It covers population, sampling work and administration of

instruments and data analysis.

Chapter Four describes the results of the study, showing an in-depth analysis of observations recorded.

Chapter Five deals with the discussion of the findings and analysis and Chapter six deals with the summary, conclusion drawn from the analysis and data collected and also puts forward some recommendations and suggestion.



CHAPTER TWO

LITERATURE REVIEW

2.0 Overview

A problem that is identified by an individual might have been identified by other individuals elsewhere. Based on this fact, the researcher decided to review literature written by other people concerning the topic under research. The literature was reviewed under the following headings:

The literature was reviewed under the following topics:

- Teachers' Belief about science and technology
- The concept of teaching and Teacher's knowledge
- The concept of Educational Technology
- Basic Facilities in Technology Integration
- Advantages of Technology Integration
- Barriers of Technology Integration



2.1.0 Teachers' Belief

Among the factors that influence successful integration of ICT into teaching is teacher's attitudes and beliefs towards technology (Hew & Brush, 2007). Many authors refer to teachers' beliefs as having a significant impact on the integration of ICT, as teachers' beliefs are reflected in their classroom practice (Ottenbreit-Leftwich et al, 2010). Attitude is an important concept in social judgments and behaviors and thus, is one of the most important concepts in decision making, (Venkatesh et al., 2003). Teacher attitude is one of the most critical factors that enhance or inhibit the integration of ICT into classroom instruction. However, teachers' beliefs are difficult to articulate, as they are often tacit and implicit in practice (Donnelly et al, 2011).

This section would consider teachers' beliefs about pedagogy, attitude to the use of ICT, confidence and competence in using technology, and also the relationship between these aspects. It is encouraged that teacher integrate and use ICT in ways that support their existing beliefs in terms of learner-centred or teacher-centred pedagogies (Palak & Walls, 2009; Ertmer et al, 2012). Liu (2011) suggests that while some studies find that teachers use ICT in ways that support their beliefs in terms of teacher-centred or student-centred learning, beliefs in student-centred learning are not always translated into practice. This may be due to time-constraints or external pressures such as curriculum and assessment requirements (Conlon & Simpson, 2003; Ertmer et al., 2012).

Kim et al (2013) focused on teacher beliefs in investigating why technology is integrated differently by teachers. They identified variances in how teachers view the efficacy of ICT and beliefs about student-centred or teacher-centred pedagogy in terms of what is considered to be effective teaching and the nature of knowledge and learning. Kim et al. (2013) noted that these beliefs are connected, as how teachers view the nature of knowledge and learning affects their views of what is effective teaching and how ICT is used to support this. John (2005) noted how teachers of different secondary school subjects integrate and view ICT differently based on how they view their subject. Meyer et al. (2011) found that collaborative support from other teachers can develop positive beliefs in the use of ICT to support teaching and learning. Teachers need to have a positive attitude towards ICT to make use of it in the classroom and teachers who develop their own skills often have a more positive attitude (Kreijns et al., 2013). Ertmer and Ottenbreit-Leftwich (2010) contended that teacher-level factors affecting ICT use include self-efficacy, but this takes time to develop. Teachers do not need high levels of personal ICT competence to use ICT in

the classroom but need a high-level of personal confidence to make use of it (Loveless, 2003). ICT integration is affected by second-order barriers, in particular teacher beliefs about their attitudes to ICT and skills (Mueller et al, 2008). Teachers' personal use of ICT impacts on their professional use and ICT skills often take time to develop, particularly due to the changing nature of ICT. How teachers make use of ICT themselves directly relates to how they expect students to use it, for example teachers that use ICT to create multimedia content also set this as an activity for students whereas teachers who do not themselves use ICT to create multimedia content are unlikely to expect students to do this (Hsu, 2011). Teachers who choose to develop their own ICT skills often have a positive belief in the use of ICT to support teaching and learning (Meyer et al, 2011).

Hammond et al. (2011) identified teacher-level factors affecting ICT use including subject taught, self-efficacy, and beliefs in terms of whether ICT has a positive impact on learning. Teachers who are confident in their own skills make more use of ICT and teachers who believe that ICT will have a positive impact on learning make more use of ICT. Teacher confidence and ICT competence is positively related to how they make use of ICT in the classroom (Wastiau et al., 2013). Also, teachers who are more confident in their own ICT ability are more likely to make use of ICT in student-centred ways (Wastiau et al., 2013). Kreijns et al. (2013) find that teacher confidence and competence are linked but the causal relationship is unclear. Celik and Yesilyurt (2013) consider relationships between teachers' computer anxiety, self-efficacy, attitudes towards ICT use and use of ICT to support teaching and learning. They find that low anxiety, high self-efficacy and a positive attitude to ICT use are all indicators of likelihood to use ICT within the classroom and that teachers who develop positive attitudes to ICT also increase their confidence and decrease anxiety. In summary,

developing the use of ICT to support teaching and learning across the curriculum places burdens on teachers in terms of developing required knowledge and skills. As discussed above, the SLT set out the policy and identify what makes ‘good’ teaching and learning within the school context but it is up to teachers to implement this in practice. In addition to interpreting school policy, teachers’ own assumptions, beliefs and experience affect how they view ICT and subsequently how they make use of it. This study would investigate how teachers’ beliefs affect their practice. The role of the teacher is complex and burdens are placed on teachers in developing knowledge of technology and pedagogy. Therefore, it is expected that CPD is important in developing teacher knowledge, as is described further in the next section. Various studies and media reports of education technology, such as the introduction of video and computer-based training, the micro-computer, multimedia and the World Wide Web, have identified expected benefits of technology in education (Oliver, 2006). However, there is still the need to develop an understanding of the relationship between education and ICT in terms of how and why ICT is actually used within educational settings, rather than concentrating on how it could or should be used (Selwyn, 2010).

2.2.0 The Concept of Teaching and Teachers’ Knowledge

Teaching is any situation in which one person tries to pass to another his knowledge, feeling, purpose or an action (Fleming, 1965). Also, Hunter (1984) in Beach and Reinhartz (1989) defines teaching as ‘the constant stream of professional decisions that affect the probability of learning: decisions that are made and implemented before, during and after interaction with the students’. The major goal of teaching is to bring to bear, the expected and desired behavioral change in the learner. Nacino Brown *et al* (1990) emphasized the transfer of skills, attitude and knowledge from one

person to another. Farrant (1980) defines teaching as “a process that facilitate learning”. This implies that in order for teaching to take place, there must be the learner who is ready to be trained by a qualified professional.

According to Beach and Reinhartz (1989), teaching is a complex and multidimensional activity which include: telling, explaining, defining, giving example, stressing critical attributes, modeling and demonstration. Therefore, any activity involving a learner and a trained person that goes through the above activities could be deemed as teaching. From the point of view of Beach and Reinhartz (1989), the teaching from which students learn the most is one in which the teacher does the following:

- a) Provides opportunities for students to participate actively and successfully.
- b) Evaluate and provides feedback on students’ progress during instruction.
- c) Organizes materials and students.
- d) Maximizes time for teaching.
- e) Manages student behaviors.
- f) Teaches for cognitive, effective and/ or psychomotor learning.
- g) Uses effective communication skills.

According to Prestride (2012), ICT aided teaching is the most appropriate skill required of a teacher, unfortunately, it is the least possessed by many. This may be because it is barely been part of their training course. Prestride (2012) outlined some of ICT packages required of a secondary school teacher as data processing, word processing, use of internet, use of spreadsheet, use of presentation software like PowerPoint and e-mail. The role of the teacher embraces a number of responsibilities including the design of the learning environment, managing people and resources,

mediating student learning, and improving practice. Teachers who are confident in their subject-specific curriculum knowledge are more likely to innovate within their practice (Hartnell & Young, 2009). However, developments in the use of ICT make the role of the teacher more complex and require specific skills relating to the technology and pedagogy, which take time to develop (Webb & Cox, 2004). There is a burden placed on teachers in terms of developing their knowledge, both of the technology and of appropriate pedagogy, thereby increasing teacher workload. In addition, teachers may see their role change as a result of technology integration and need support (Hennessy et al, 2010). ICT competence is defined as being able to handle a wide range of varying technologies for various purposes. Teachers make use of a range of knowledge in order to effectively do their job and the integration of technology into teaching and learning involves a knowledge base for teachers that is new and therefore needs to be developed through appropriate professional development (Mishra & Koelhar, 2006; Loveless, 2011).

Mishra and Koelhar (2006) explain this concept as the qualities of teacher knowledge required in order to integrate technology within pedagogy. For ICT to support teaching and learning, pedagogy and what teachers need to know to successfully incorporate the technology must be considered (Mishra & Koelhar, 2006). This is referred to as Technological Pedagogical Content Knowledge (TPCK). Pedagogical technological content knowledge (Mishra & Koehlar, 2006, pp10-25; Mishra & Koelhar 2006; Unwin, 2007; Voogt et al., 2013) describe this model of teacher knowledge as including content, the subject specialist knowledge; pedagogy, knowledge of techniques of teaching and learning; and pedagogical content knowledge, based on Shulman's definition (Shulman, 1986). This definition sets out the knowledge used to make the subject comprehensible to others and the

requirements for teacher knowledge. It includes an understanding of how ICT can be used to provide forms of representation not available without the technology, knowing the range of technologies available to support teaching and learning and being able to choose appropriate technologies and pedagogic strategies to use. Therefore, the rationale for CPD for teachers should focus on the technology alongside content and pedagogy, rather than see technology as a separate issue (Mishra & Koelhar, 2006; Price & Kirkwood, 2010; Chen et al, 2009). Harris et al (2009) also identify the added complexity of the rate of change of technology that makes keeping up with developments even more challenging and time consuming for teachers. Ertmer & Ottenbreit-Leftwich (2010) support this and emphasize the need for teachers to be given time to develop and establish new practices. This section has identified that the use of ICT to support teaching and learning places a burden on teachers to develop new knowledge and skills to be able to integrate ICT effectively.

2.3.0 The Concept of Educational Technology

Educational technology is the application of the principles and findings of the physical and behavioral sciences to plan, design, develop and implement educational systems (Talabi,2015). Educational technology is very systematic. It proceeds and makes progress in a step-by-step manner. It starts with behavioral objectives and ends with evaluation (Talabi, 2015). According to Yidana and Anapey (2016), educational technology is the scientific application of tools, procedures, methods and innovations to improve teaching and learning goals in schools. Educational technology is concerned with the improvement of education in every facet of society. However, there are varied opinions among educationist over the years on the scope of educational technology which has generated different meaning and terms in the field. Roblyer and Edwards (2000) conveniently traced the field of educational technology

from four major views that dominated its practice over the years. These four major views have shaped the definition and scope of educational technology. These include:

1. Technology in education as media and audio-visual communication.
2. Technology in education as vocational training.
3. Technology in education as computer and computer -based systems.
4. Technology in education as instructional systems.

This section will concentrate on the aspect of technology in education as an instructional system.

2.3.1 Instructional Technology

According to Talabi (2015), Instructional technology is part of educational technology. It is the application of the theories of psychology, curriculum and innovation to design, produce and utilize hardware and software to make classroom teaching more effective. Theories are the basis of educational practice across diverse fields. Learning theories provide educators with the framework for the interpreting the conditions and observation of teaching and learning as well as a leverage between education research (Shelly et al, 2006). Consequently, in the field of educational technology, several theories guide the use, selection, design, and integration of gadgets or devices used in teaching and learning. The use of instructional visuals for teaching for instance can be explained with an information processing theory that state that as a result of the limited capacity of the human mind, visuals serve as a support to learners in learning a task. The system approach believed that both teachers and media could be part of a system for addressing teaching and learning needs of learners (Roblyer & Ewards, 2000). One way in which teachers demonstrate their ideology is through the use of ICT tools (Leidner & Javenpaar, 1995; Jeffries et al, 2007). Consideration will be made of the three dominant theories (behaviourism,

cognitivism and constructivism) guiding instructional technology in education. The discussion of pedagogy relating to the use of ICT frequently centres on constructivism and behaviourism (Jeffries et al, 2007). Jeffries et al. (2007) describe these philosophical standpoints as characterising how teachers and students interact and equate behaviourism with a teacher-centred model of teaching and learning and constructivism as a student-centred model. the use of ICT in teaching, often the use of technology reinforces behaviourist pedagogy (Attwell & Hughes, 2010). The use of ‘drill and practice’ software and the use of technology to enhance teacher presentation support behaviourist pedagogy, and so behaviourist pedagogy can be viewed as knowledge instruction and constructivist pedagogy as knowledge construction (Gibson, 2001). ICT integration aims to develop student-centred pedagogy, as this is seen as more effective in terms of how ICT can be used to support teaching and learning (Ertmer et al, 2012; Ertmer & Ottenbreit-Leftwich, 2013). However, in their studies, (Windschitl & Sahl, 2002; Lim & Barnes, 2002 & Reedy, 2008) found that ICT is used more frequently in lessons for teaching than for learning, i.e. supporting the teacher, particularly the use of ICT to enhance teacher presentations, rather than supporting the learner.

2.4.0 Technology integration in Teaching and Learning

Children are accessing myriad of educational information on their smart phones as well as watching video contents that were unthinkable few years ago. The proliferation of microcomputers in our homes and schools coupled with broadband connectivity are generating new challenges for today’s teacher. As teachers, such development present new challenges in the daily work of the teacher. There is the need to take advantage of emerging digital technologies in areas of lesson design, presentation, and evaluation in all subjects. Van et al., 2004 define ICT competence as

the ability of handling various applications on ICT for more than one purpose. According to Bordar (2010) one of the major predictors of ICT integration into teaching is competence of the teacher and this helps a lot in successful integration of ICT in teaching. Yidana et al, (2016) defined technology integration literacy as individual's capability to use different types of instructional technologies combined with a variety of teaching and learning methodologies to promote children learning experiences. ICT integration should first identify what 'good' learning is then look at how ICT can facilitate development, rather than focus on the technology (Ertmer & Ottenbreit-Leftwich, 2013). In order for ICT integration to be successful, the fit between existing practices and promoted use of the technology should be considered for both teacher and school level factors (de Koster et al, 2011; Donnelly et al, 2011). ICT integration is not a one-shot activity, it may take time before improvements, if any, are seen (Pittard, 2004; Higgins, 2003; Kanuka & Rourke, 2008).

Technology education seems to follow three stages (basic skills acquisition, personal usage and integration) of skills development (Yidana & Anapey, 2016). Currently, there is no policy document to guide teachers integrate instructional technology into the classroom in the Ghanaian context in spite of the 2007 Educational reform recommendation for ICTs use in schools. Even though pockets of teachers continue to receive ICT trainings in Subject-specific areas, educational technology is still in its infancy. As a result, professional development and training practices are still being refined. Teachers are using laptop computers to support teaching and learning. This is however, ineffective (Yidana & Anapey, 2016). Therefore, instructional technologist has recommended the following systematic approaches to integrating technology into early childhood classroom for effective instructional delivery:

- a. Consider the relative advantage: -Before teachers introduce any new technology in teaching and learning, they should determine whether it offers a relative advantage for improving learning goals. In other words, is there a need that a given technology tool can impact children learning. Identifiable needs might include but not limited to lowered student achievement, waning engagement in learning, new school or district policy, redefined set of expectation.
- b. Determine objectives and assessment: -Once a need has been identified and a given technology's relative advantage evaluated, the next step is determining the objective and appropriate assessment. This means that learning indicator and mode of lesson evaluation should be clearly indicated.
- c. Design instructional strategies: -As you move closer to integrating technology into classroom, take into consideration students' readiness levels along with their physical and affective needs. This will assist in creating appropriate student groupings and a flowing activity sequence of instruction. Drawing out an instructional step longer than is necessary can negatively affect the technology integration effort and student achievement as well.
- d. Prepare the instructional environment: -Equally important to designing mindful instructional strategies is ensuring that the learning environment is ready for new technology to be introduced. Aside from building a sound infrastructure for technology -based learning to occur, being acutely aware of the classroom layout, available materials, information dissemination to learners and parents about new technology, and preparing a backup plan for when technology issues arise ensures the most effective technology integration experience possible for everyone involved.

- e. Analyse results and make revisions: -Though this is the only step occurring after a given technology is introduced, it is nonetheless essential to the overall integration plan. Teachers at this stage look at the objectives established along with the various assessments administered and make objective conclusions about what worked and what didn't work. Key to any effective and enduring technology integration plan is allowing it to evolve over time through repeated revisions of the previous four steps.

2.4.1 Basic Facilities in Technology Integration

According to Plomp et al (2009), access to ICT infrastructure and resources in schools is a necessary condition to the integration of ICT in education. Prestride (2012) outlined some of ICT packages required of a secondary school teacher as data processing, word processing, use of internet, use of spreadsheet, use of presentation software like PowerPoint and e-mail. Instructional devices may be classified as either software or hardware. The hardware are devices such as television sets, video equipment, computer and the overhead projector which does almost all the functions of the chalkboard (Talabi, 2015). At the Junior High School level, basic teaching learning resources such as a computer, data, overhead projector, stable power supply and smart phone should lend themselves to the integration of technology in teaching integrated science.

2.5.0 Advantages of Technology Integration in Teaching

Several studies from case studies to surveys have been conducted on the importance of ICT and as why teachers use technology. To Mathayo (2016), when lessons are given through computers, they give learners more control over their learning environment and they get access to a wider range of materials to use. Lessons

become more interactive. Both the struggling and smarter students benefit since computers offer self-directed learning. Lehtinen (2010) meta-analysis of ICT based studies identified four common themes in terms of students' learning – they learn more, learn faster, gain in terms of motivation and improve social interaction – but that the inclusion of ICT does not inevitably lead to enhancements in learning. The positive motivational effects of ICT on pupils in terms of behaviour, learning and achievement are most likely when ICT is used to support both learning and teaching (Passey, et al, 2003; Holley & Dobson, 2008). Several studies have reviewed literature on ICT and learning and have concluded that it has great potential to enhance student achievement and teacher learning (Bransford et al., 2000). Wong et al., (2006) pointed out that technology could play a crucial part in supporting face-to-face teaching and learning in the classroom. Many researchers and theorists assert that the use of computers can help students to become knowledgeable, reduce the amount of direct instruction given to them, and give teachers an opportunity to help those students with particular needs. Gillespie (2006), stated that new technologies can be used to enable students to collect information and interact with resources, such as images and videos, and to encourage communication and collaboration. Osborne and Hennessy (2003) identify those new technologies may also help to increase student motivation, facilitate clearer thinking, and develop interpretation skills with data. Below are a few highlighted benefits of using ICT to support teaching and learning: -

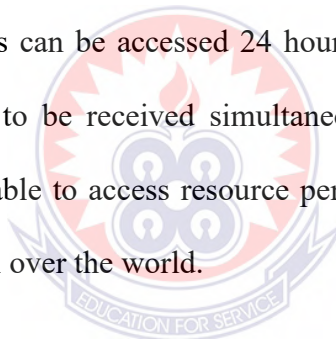
2.5.1 Individualized Interactivity

Traditional pedagogic methods focused on a passive one-way flow of information from teachers to students. According to the World Bank reports (2004) , recent trends towards a constructivist approach to teacher-student interaction suggests that learning process can be enhanced through use of technologies which adapt the presentation of

needs, preferences and requests. Due to the interactive nature of most of the ICT technologies, it is well suited for creative learning approach in which experimentation and creative thinking skills are emphasized.

2.5.2 Delivery of Educational Resources

With ICT, it is possible to provide immediate up to date resources using one or more media to large numbers of educators and learners easily and relatively cheaper. Any alterations made to resources are easily available to educators and students without incurring major additional distribution expenditures. An additional benefit is the huge resource base that resides on the World Wide Web. According to Tinio (2003) asserts that ICT has the ability to transcend time and space making possible asynchronous learning. Online materials can be accessed 24 hours a day, seven days a week. ICT has enabled instructions to be received simultaneously by multiple geographically dispersed learners to be able to access resource persons, learning resources, mentors and professionals from all over the world.



2.5.3 Access to Global Knowledge Base/Internet

One of the major and clearest benefit to education derived from ICT according to the World Bank report (2004) comes from its ability to share knowledge, experiences with an emerging networked global community. Students can actively search for their counter parts in other countries to develop joint research projects on a variety of topics e.g., environment or health issues. The same technology allows students and wider community access to both global and local cultural resources.

2.5.4 Facilitating Interaction with Resources

According to Bullock (2004) ICT provides educators with a wide range of very interesting opportunities for creating resources that allow learners high levels of interactivity. This can lead to creation of interesting and exciting interaction of learners with educational resources.

2.5.5 Simplification of Lesson Delivery

According to Plomp et al., (2007), the use of ICT such as videos, television and multimedia computer software that combine text, sound and colourful moving images can be used to provide challenging, authentic content that will engage students in the learning process. Moreover, networked computers with internet connectivity can increase learner motivation as it combines the media richness and interactivity of other.

2.6.0 Barriers that Hinder Teachers from Using ICT in the Classroom Teaching

The process of integrating ICT into teaching is a complex process and one that may not be free of a number of challenges or barriers. A barrier is any condition that makes it difficult to make progress or to achieve an objective (Schoepp, 2015). There are several factors that hinder the use of ICT into classroom instruction. Some factors are institutional (unavailability or limited access to ICT facilities), instructional and teacher's competence. Researches identify these factors as non-manipulative and manipulative factors. Non-manipulative refers to the factors, such as age, teaching experience, computer experience. Manipulative factors are availability of ICT infrastructures, support from the Municipal Education office, PTA and the availability of other external support services.

2.6.1 Limited access to ICT Facilities and Support.

Access to ICT infrastructure and resources in schools is a necessary condition to the integration of ICT in teaching and learning. Inaccessibility or unavailability of ICT, a school level barrier, has been identified as a key obstacle that hinder teachers from using ICT in teaching. Yildirim (2007) found that access to technological resources is one of the effective ways to teachers' pedagogical use of ICT in teaching. To Tondeur et al., (2008), access to hardware and software is not only important, but also the use of suitable kind of tools and programme to support teaching and learning. Lack of resources includes different factors, such as lack of access to hardware and software, poor quality hardware, inappropriate software and lack of stable electricity supply or standby generator. To Ruth (2014) ,the inadequacy of technological infrastructure, such as hardware, software, limited internet access, poor bandwidth, sporadic electricity, geographical factors, such as country size, mountains, demographic factors, such as high population, increased density, and extreme poverty, HIV/AIDS, lack of teachers' participation in curriculum development and evaluation, lack of pre-service and in-service training, teachers' brain drain to the western countries, poor teachers' welfare and morale, lack of parent and community participation in schools, poor school vision, mission and leadership affects ICT usage in the class room. Effective adoption and integration of ICT into teaching in schools depends mainly on the availability and accessibility of ICT resources such as hardware, software, etc. Obviously, if teachers cannot access ICT resources, then they will not use them. Therefore, access to computers, updated software and hardware are key elements to successful adoption and integration of technology. Several research studies indicate that lack of access to resources, including home access, is another complex barrier that discourages teachers from integrating new technologies into classrooms,

Bingimlas (2009). The inaccessibility of ICT resources is not always merely due to the non-availability of the hardware and software or other ICT materials within the school. It may be the result of one of a number of factors such as poor organisation of resources, poor quality hardware, inappropriate software, or lack of personal access for teachers. The level of access to ICT at school is defined as teachers' access to infrastructure, provision shortages and inadequacy, and teaching time using ICT.

2.6.2 Lack of I.T. Technical Support

The absence of both good technical supports in the classroom and whole-school resources, teachers cannot be expected to overcome the barriers preventing them from using ICT (Lewis, 2003). Pelgrum (2001) found that in the view of primary and secondary teachers, one of the top barriers to ICT use in education was lack of technical assistance. Technical problems were found to be a major barrier for teachers. These technical barriers included waiting for websites to open, failing to connect to the Internet, printers not printing, malfunctioning computers, and teachers having to work on old computers. "Technical barriers impeded the smooth delivery of the lesson or the natural flow of the classroom activity" (Sicilia, 2005). ICT support in schools helps teachers to use ICT in teaching without losing time through having to fix software and hardware problems. BECTA (2004) agreed that if there is an absence of technical support available in a school, then it is likely that technical maintenance will not be carried out regularly, resulting in a higher risk of technical breakdowns. Jones (2004) reported that the breakdown of a computer causes interruptions and if there is lack of technical assistance, then it is likely that the regular repairs of the computer will not be carried out resulting in teachers not using computers in teaching. The effect is that teachers will be discouraged from using computers because of fear of equipment failure since no one would give them technical support in case there is

technical problem. Furthermore, basic schools are not financially resourced to carry out such repair services which are mostly expensive even if available. Closely related to lack of technical support is lack of continuous professional development

2.6.3 Lack of Continuous Professional Development

Teachers' professional development is a key factor to successful integration of computers into classroom teaching. In their study (Bauer et al., 2005) revealed that whether beginner or experienced, ICT related training programmes develop teachers' competences in computer use, influence teachers' attitudes towards computers as well as assisting teachers reorganize the task of technology and how new technology tools are significant in teaching. Ertmer et al., (2003) indicated that beginning teachers wanted to use technology and have adequate technical skills, but teachers lacked knowledge on how to integrate technology in teaching. Clearly, it is imperative to allow teacher trainees to apply ICT in their programmes when in school in order to be able to use the technology to supplement their teaching activities. Teachers when given time to practice with the technology, learn, share and collaborate with peers, it is likely that they will integrate the technology into their teaching. Training programmes so for teachers that embraces educational practices and strategies to address beliefs, skills and knowledge improve teachers' awareness and insights in advance. Lack of effective training is the barrier most frequently referred to in literature. In order to achieve high levels of teacher competence in ICT, there is a need to provide training, and perhaps unsurprisingly, there is a great deal of literature evidence to suggest that effective training is crucial if teachers are to implement ICT effectively in their teaching Kirkwood et al., (2000). Recent research in Turkey found that the main problem with the implementation of new ICT in science was the insufficient amount of in-service training programmes for science teachers. Toprakci,

(2006) concluded that limited teacher training in the use of ICT in Turkish schools is an obstacle.

2.6.4 Teachers Instructional Method

A teacher's choice of instructional method can serve as a barrier to the integration of ICT in the teaching and learning process. Traditional pedagogic methods focus on a passive one-way flow of information from teachers to students and this does not lend support to ICT integration in lesson. ICT integration aims to develop student-centred pedagogy, as this is seen as more effective in terms of how ICT can be used to support teaching and learning (Ertmer et al, 2012; Ertmer & Ottenbreit-Leftwich, 2013). According to the World Bank reports (2004) , recent trends towards a constructivist approach to teacher-student interaction suggests that learning process can be enhanced through use of technologies which adapt the presentation of needs, preferences and requests. Due to the interactive nature of most of the ICT technologies, it is well suited for creative learning approach in which experimentation and creative thinking skills are emphasized. For technology integration to be effectively implemented in teaching and learning of integrated science at the junior high school, teachers need to unlearn old ways of teaching and relearn new pedagogies. Teachers make use of a range of knowledge in order to effectively do their job and the integration of technology into teaching and learning involves a knowledge base for teachers that is new and therefore needs to be developed through appropriate professional development (Mishra & Koelhar, 2006; Loveless, 2011). Mishra & Koelhar (2006) explain this concept as the qualities of teacher knowledge required in order to integrate technology within pedagogy. For ICT to support teaching and learning, pedagogy and what teachers need to know to successfully incorporate the technology must be considered (Mishra & Koelhar, 2006). This is referred to as Technological

Pedagogical Content Knowledge (TPCK). (Mishra & Koelhar, 2006); Unwin, 200; Voogt et al., 2013) describe this model of teacher knowledge as including content, the subject specialist knowledge; pedagogy, knowledge of techniques of teaching and learning; and pedagogical content knowledge, based on Shulman's definition (Shulman, 1986). This definition sets out the knowledge used to make the subject comprehensible to others and the requirements for teacher knowledge. It includes an understanding of how ICT can be used to provide forms of representation not available without the technology, knowing the range of technologies available to support teaching and learning and being able to choose appropriate technologies and pedagogic strategies to use.

2.6.5 Teachers' Attitude, competencies and confidence

Attitude is a predisposition to respond favorably or unfavorably to an object, person, or event (Ajzen, 1988). To successfully initiate and implement ICT in teaching depends strongly on teachers' support and attitudes. Among the factors that influence successful integration of ICT into teaching is teacher's attitudes and beliefs towards technology (Hew & Brush,; Keengwa & Onchwari, 2008). Attitudes toward ICT influence teachers' acceptance of the usefulness of technology, and also influence whether teachers integrate ICT into their classrooms. Many theorists (e.g., van Braak, 2001b; Vannata & Fordham, 2004) have maintained that teachers' attitudinal factors have a strong impact on technology integration in teaching. Attitude is an important concept in social judgments and behaviors and thus, is one of the most important concepts in decision making (Venkatesh et al., 2003). Teacher attitude is one of the most critical factors that enhance or inhibit the integration of ICT into classroom instruction. In a report by BECTA (2004) on ICT integration in education it was reported that negative attitude was a barrier towards integration of using ICT in

teaching while Rhoda and Gerald (2000) found that positive attitudes towards ICT use are widely recognized as a necessary condition for effective ICT use in teaching. Moreover Selewyn (1999), insists that integration of ICT in teaching depends to a great extent, on teachers' attitude towards their use. Myers and Halpin (2002) assert that attitude of teachers towards ICT use is a major predictor of future classroom use. Furthermore, a study by Bullock (2004) found that teacher 's perceptions are a major enabling/disabling factor in the implementation of ICT based teaching approach. Similarly, a study by Kersaint et al., (2003) found that teachers, who have positive attitude towards ICT based teaching feel more comfortable with using it and usually exploit it in their teaching. Essentially, Woodrow (1992) asserts that any successful implementation of ICT based teaching and learning approach requires the development of positive teacher's attitude toward information and communication technology.

ICT competence is defined as being able to handle a wide range of varying technologies for various purposes. According to Prestride (2012), ICT aided teaching is the most appropriate skill required of a teacher, unfortunately, it is the least possessed by many. This may be because it is barely been part of their training course. Prestride (2012) outlined some of ICT packages required of a secondary school teacher as data processing, word processing, use of internet, use of spreadsheet, use of presentation software like PowerPoint and e-mail. These ICT packages are important to teachers because they assist in creating lesson plans, analysing and setting students' tests, acquiring new knowledge and presenting lesson in a clear way among others. According to Bordbar (2005), teachers' computer competence is a major predictor of integrating ICT in teaching. A study by Peralta and Costa (2007) suggested that teachers with more experience with computers have greater confidence in their ability

to use them effectively. According to Jones (2005), teachers' competence relates directly to confidence. Teachers' confidence also relates to their perceptions of their ability to use computers in the classroom, particularly in relation to their children's perceived competence. A very significant determinant of teachers' levels of engagement in ICT is their level of confidence in using the technology. Teachers who have little or no confidence in using computers in their work will try to avoid them altogether (Dawes, 2000). According to BECTA (2004), much of the research proposes that this is a major barrier to the uptake of ICT by teachers in the classroom. Some studies have investigated the reasons for teachers' lack of confidence with the use of ICT. Beggs (2000) asserted that teachers' "fear of failure" caused a lack of confidence. On the other hand, Balanskat et al., (2006) found that limitations in teachers' ICT knowledge makes them feel anxious about using ICT in the classroom and thus not confident to use it in their teaching. Many teachers who do not consider themselves to be well skilled in using ICT feel anxious about using it in front of a class of children who perhaps know more than they do. On the other hand, teachers who confidently use technologies in their classrooms understand the usefulness of ICT. Cox et al., (1999) found that teachers who have confidence in using ICT identify those technologies as helpful in their teaching and personal work and they need to extend their use further in the future. Another barrier, which is directly related to teacher confidence, is teachers' competence in integrating ICT into pedagogical practice (BECTA, 2004). In the developing countries, research reported that teachers' lack of technological competence is a main barrier to their acceptance and adoption of ICT (Pelgrum, 2001). In Syria, for example, teachers' lack of technological competence has been cited as the main barrier (Albirini, 2006). Likewise, in Saudi Arabia, a lack of ICT skills is a serious obstacle to the integration of technologies into

science education (Al-Alwani, 2005). Muriithi (2005) has argued that in Kenya like most developing countries ICT usage is still limited to computer literacy training. Both the findings show that teachers who do not use computers in classrooms claim that “lack of ICT skills” is a constraining factor preventing teachers from using ICT for teaching. Hence, lack of teacher competence may be one of the strong barriers to the integration of technologies into education. Closely associated to teachers’ confidence is the number of years the teacher has been in the field of teaching.

2.6.6 Teaching Experience

Although some research studies have reported that teachers’ experience in teaching did not influence their use of computer technology in teaching (Neidarhauser, & Stoddart, 2001). Most research showed that teaching experience influence the successful use of ICT in classrooms (Wong et al., 2008). Effective use of computer related to technological comfort levels and the liberty to shape instruction to teacher - perceived student needs (Gorder, 2008). Also, Beak et al., (2008) claimed that experienced teachers are less ready to integrate ICT into their teaching. Similarly, in United States, the (U.S National Centre for Education Statistics, 2000) reported that teachers with less experience in teaching were more likely to integrate computers in their teaching than teachers with more experience in teaching. The reason to this disparity may be that fresh teachers are more experienced in using the technology.

2.6.7 Conceptual Framework

In light of the review of literature presented above, more research is required into the status of the integration of ICT to facilitate teaching. A provisional framework has been developed, and is now presented, that may be used as the basis for such an investigation (Figure 1). The framework indicates that both institutional and personal

factors have an influence on the use of ICT to facilitate teaching. Personal factors include teachers' attitude towards ICT use in teaching, teachers' competence and confidence, teachers' professional development, teachers' education level, Age and Gender as stimuli and barriers while Institutional factors include institutional enablers and barriers. The framework allows for the investigation of other factors that influence the adoption and integration of ICT in teaching that have not been previously identified in other contexts. Moreover, the framework indicates that lessons learnt from past experiences with the adoption and integration of ICT in teaching may impact on future activities.



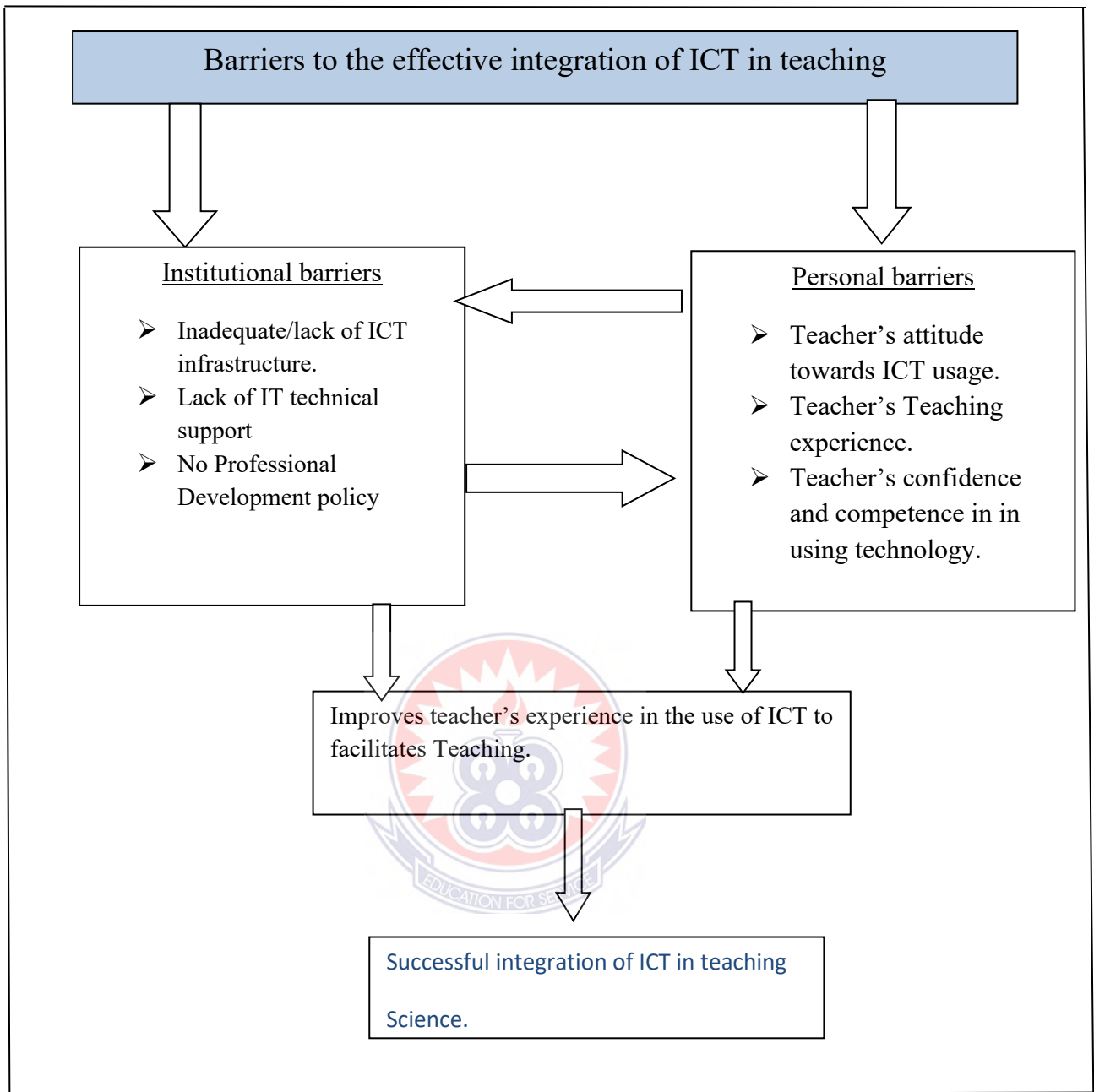


Figure 2.1: Conceptual framework for teachers' successful use of ICT to Facilitate Teaching and learning of integrated science.

Source: Researcher's Own (2022)

2.5.9 Research Gap

The literature reviews indicates that cases of ICT use in classroom teaching have been studied in Ghana and other countries. Most of these studies were conducted to assess the effectiveness of ICT usage in teaching. Very few literatures have been conducted

to assess the status of the integration or use of ICT to facilitate the teaching of science in classroom in selected junior High schools in the Wa municipality. Thus, this study intends to focus on this gap of knowledge.

2.5.10 Summary of the Literature Review

In this chapter, attempts were made to learn from the literature, theoretical and empirical knowledge for several issues concerning this study. The review of literature revealed issues like, teacher's attitudes, teacher competence and confidence, accessibility, inadequate ICT infrastructures, lack of IT technical support and lack of effective training as the barriers that hinders the use of ICT to facilitate teaching. Furthermore, the review of literature identified issues such as individual interactivity, delivery of education resources, and access to global knowledge base and facilitate interaction with education resources as the benefits of using ICT to facilitate teaching. In addition to those issues such as positive attitude towards ICT, competence in ICT use, computer self-efficacy, and teacher's working experience, professional development, accessibility, and availability of IT technical support were identified as the factors influencing the effective use of ICT to facilitate teaching of science in junior high schools. Thus, this study emanates from the thirst of the researcher to explore the status on the use of ICT to facilitate teaching and learning of science in selected junior high schools in the Wa municipality in the upper west region of Ghana.

CHAPTER THREE

METHODOLOGY

3.0 Overview

This chapter presents the research design and the presentation of the research strategy chosen for the study. The population and sampling procedures are also presented. Finally, the research instruments, validity and reliability of research instruments, data collection, data analysis procedure and ethical considerations are also presented.

3.1.0 Research Design

Bryman (2008) stated that research design provides a framework for the collection and analysis of data. Burns and Grove (2001) described the research design as a blueprint for conducting a study that maximizes control over factors that could interfere with the validity of the findings. A mixed method approach has been used with consideration of triangulation of data. As described by (Johnson et al 2007; Creswell & Plano-Clark 2011; Creswell 2013), mixed-method approaches allow for combining the strengths of qualitative and quantitative methods to develop stronger breadth and depth of understanding. Here an ‘explanatory sequential mixed-methods’ approach (Creswell & Plano-Clark, 2011; Creswell, 2013) was followed. Quantitative data was collected to identify factors and relationships, followed by the collection of qualitative data to gain further insight into these relationships and provide explanatory detail. A descriptive cross-sectional survey design was employed in this study to investigate the perception of science teachers in integrating ICT in teaching integrated science in junior high schools in the Wa municipality in the Upper West Region. Descriptive study seeks to gather information so that a description of what is going on can be made and may be designed to discover whether there is any relationship between two variables (Agyedu et al., 2007)

In this survey, questionnaire and interview were used to obtain the data for this study. The data were analyzed to arrive at the various findings after descriptive exercises were carried out on the data collected. A cross-sectional design. According to Bryman (2012), entails the collection of data on more than one case and at a single point in time in order to collect a body of quantitative or quantifiable data in connection with two or more variables which are then examined to detect patterns of association.

Surveys are structured studies that analyze, interpret and report the present state or status of an institution, organization, community or school. The purpose of this design is to obtain information that can be analyzed by extracting patterns with which comparisons can be based and sound decisions made (Opoku, 2005).

The Survey design has a lot of advantages hence the choice of this design in this study. The survey design enhanced the collection of data from a relatively large number of people or samples which represented the general population and also helped to provide useful information for the solution of local problems (Opoku, 2005). Trochim (2006) noted that a survey research design was a very valuable tool for assessing opinions and trends. The main purpose of a descriptive survey design is to obtain information from a defined set of people so as to generalize the sample results to the population. In the case of this study, descriptive survey design was deemed appropriate because Surveys provide a high level of general capability in representing a large population. Due to the usual huge number of people who answers survey attempt to produce a numerical or mathematical representation of the study that can be used as a basis for planning and decision making. Secondly, when conducting surveys, the cost incurred is for the printing of survey questionnaires. Questionnaires involve less cost in preparation and even during administration

compared to other tools. Thirdly, Surveys can be administered to the participants through a variety of ways. The questionnaires can, simply be sent via e-mail or fax, or can be administered through the Internet hence, convenient in data gathering. Furthermore, Surveys studies provide all the participants with a standardized stimulus with high reliability such that the researcher's own biases are minimized. The tools like questionnaire when used in data collection eliminates physical presence of the researcher when filling the questionnaire hence the respondent doesn't feel inferior. A questionnaire also gives the respondent time and freedom to reassess their responses by allowing the respondent to fill the questionnaire at their own convenience. The descriptive survey design was, therefore, selected because the researcher wanted to ascertain the perception, attitudes, opinions, views and feelings of teachers in integrating ICT in classroom teaching. The design was also selected due to its ability to enable the researcher to obtain and to administer the questionnaire to a large sample. However, the descriptive survey research design is not without limitations. Inappropriate wording and placement of questions within a questionnaire can bias the results. The questions must be worded and placed to unambiguously format to elicit the desired information / responses. Also, without control of independent variable variation, the researcher cannot be certain whether the relations between independent and dependent variables are causal or non-causal. Hence causality is difficult to establish because many intervening and extraneous variables are involved. Time series studies help correct this problem sometimes, but not always.

3.2 .0 Population and Sampling Procedure

The target population is all the fifteen (15) circuits which consist of seventy-six (76) public Junior High Schools with nine hundred and seventeen (917) teachers in the Wa Municipality in the Upper West Region of Ghana. There are one hundred and fifty-

four (154) science teachers in the seventy-six (76) public Junior High Schools in the municipality. Considering important factors such as finance, time and accessibility, it was practically impossible to access information from all the target population. It became appropriate therefore, to measure from a smaller group of the population in such a way that the information obtained will be representative of the total population under study. This accessible group from the population represented the sample. Purposive sampling was adopted to select ninety-six (96) science teachers from the fifteen (15) circuit for the study. A total sample size of ninety-six (96) teachers was used for the study. The ninety-six-sample size represent 62.34% of the accessible population of one hundred and fifty-four (154) science teachers in the seventy- six public junior high schools in the municipality. According to Gay and Airasian (2003), a sample size of between 10 and 20 percent of the total population is representative of the population is therefore appropriate for a descriptive survey study. Ten (10) teachers were conveniently sampled and interviewed.

3.3.0 Research Instruments

This section describes the methods of collecting data for the study. Questionnaires and Interview schedules were used as instruments for data collection.

3.3.1 Questionnaire

Questionnaires are used in connection with many modes of observation in educational research (Muijs, 2004). This is a data collection instrument mostly used in normative surveys. This is a systematically prepared form or document with a set of questions deliberately designed to elicit responses from respondents or research informants for the purpose of collecting data or information. Questionnaires serve four basic purposes: to collect the appropriate data, make data comparable and amenable to

analysis, minimizes bias in formulating and asking question, and to make questions engaging and varied. In this study a form of inquiry document, which contained a systematically compiled and well-organized series of questions intended to elicit the information which would provide insight into the nature of the problem under study. The main sections on the Questionnaire were on the benefits of integrating ICT in teaching, barriers of integrating ICT in teaching and ways we can improve the integration of ICT in teaching. The questionnaires were distributed to teachers. Closed and open-end questions were prepared to guide the researcher so as to enable the respondents to provide exact responses as per the research study. The questionnaire items are located in Appendix

3.3.2 Interview

Interview is a method of collecting data which involves formal form face-to-face conversation between the researcher and a respondent (Kothari, 2004). Interviews become necessary when researchers feel the need to meet face-to-face with individuals to interact and generate ideas in a discourse that borders on mutual interest. It is an interaction in which oral questions are posed by the interviewer to elicit oral responses from the interviewees. In this study interview schedules were adopted to help the researcher to gather relevant information from the teachers on their experience about the use of ICT in teaching. Both structured and non-structured interview were adopted during gathering of data from respondents.

3.4 Reliability and Validity of the Main Instrument

Reliability and Validity are very important components in research instrumentation since they ensure and guarantee the credibility of research findings (Lecompte & Preissle, 1993; Seale, 1999; Silverman, 2001). Also, Aikenhead and Ryan (1992)

indicate that the quality of a research instrument or a scientific measurement is determined by both its validity and reliability.

Reliability of the main instrument

Reliability refers to that quality of measurement method that suggests that the same data would have been collected each time in a repeated observation of the same phenomenon (Babbie, 2005). The reliability of the data collected can be assessed if the items are examined to show internal reliability/consistency which may be pegged by the use of Cronbach's alpha, which is dependent on the number of samples and the maturity of the respondents. However, repeated measurements of the same quantity with the same instrument seldom give exactly the same value. This is partly because of the error inherent in the scientific instruments itself during scientific measurements (Aikenhead, 2003). According to Crawley and Koballa (1994), people make evaluative judgments about a wide variety of targets and rely on these judgments in deciding among several possible courses of action in the future. With this view, the reliability of the questionnaire was determined using Cronbach's alpha of 0.73. This showed that the reliability of the questionnaire was quite high.

Validity of the Main Instrument.

Validity, on the other hand, describes a measure that accurately reflects the concept it is intended to measure. (Babbie, 2005). Creating the right instrument for measurement as well as the right manifest/observable measures of the latent concept is crucial at this stage. Validity is an important aspect of an effective research. If research tools aren't valid, it may affect the effectiveness of a research. Therefore, validity of data collecting tool is very important for both quantitative and qualitative research (Cohen, 2007). According to Kombo and Tromp (2006), data collection tools validation

involves determining the quality of data collecting tools or procedures that is able to measure what it is supposed to be measured. To attain validity the instruments were sent to the supervisor during proposal writing for suggestions, recommendations and advice. The instruments were presented to experts in the area of study. The experts in the area of study helped in improving the instruments. The experts' feedback in form of recommendations to the researcher, were incorporated in the final instruments. Not only that the researcher conducted a pilot test of the instruments in Wa west District before using them in the study. The purpose of piloting the instruments was to test the appropriateness of the items to the respondents in order to improve the instruments and enhance the validity of the instruments. The researcher made use of the supervising experts to ensure proper guidance was given on the piloting of the instruments. Denscombe (1998) comments that there is no research tool that is adequate in itself in collecting and validation of data. The study used more than one research instrument with expectation that one tool could complement the other. Professional comments of seasoned Science Education Lecturers from the Department of Science Education –UEW was drawn to validate the instruments for content and face validity of the two instruments used in the study.

3.5 Data Collection Procedure

The sources of data for this study were ninety-six (96) conveniently selected basic school science teachers from fifteen circuits in the Wa Municipality. Data collection for this study was done in two phases. Questionnaire and interview were employed to obtain primary data.

Kothari (2004) defined primary data as data which are collected freshly and for the first time and which happen to be original in character. The researcher administered

all the research instrument to the research subjects by himself. This was done after an initial familiarization visit was made to the selected schools to interact with the teachers. The respondents were informed about the purpose of the study and were assured that confidentiality would be maintained for any information they volunteered during data collection. The questionnaire was administered to the research subjects and they were given enough time to complete them. The questionnaire can be found in appendix A.

In phase two, some respondents were selected for follow up interview based on initial analysis of questionnaire data. Respondents were identified based on a pre-selected criterion of gender, attitude to ICT integration and ICT competence. According to Stake (2005), this method of sampling is appropriate in investigating the case by selecting information rich respondents to develop a better understanding. Sample sizes of sixteen (16) respondents were purposively selected based on their response to the questionnaire and interviewed. All sixteen (16) except one research subject were successfully interviewed. That research subject had obtained permission to attend a funeral in one of the nearby villages called Bulenga. The interviews were conducted with each research subject individually. The interviews were semi-structured and the content gave a further illumination on the barriers to technology integration. Semi-structured interviews allow the researcher to combine elements from informal and standardized interview structures with the aim of mitigating the weaknesses inherent in both (Bogdan & Biklen, 1992; Patton, 1980). Informed consent was sought from all research subjects to be interviewed as well as permission for audio recordings. The audio recordings were played back to the participants to check for accuracy. A copy of the recording and the interview transcript was given to each participant for validation purposes. A sample of the interview transcript is in the Appendix.

3.6 Data Analysis Techniques

Data analysis refers to the examination of data (Kombo et al., 2006). Data analysis involves uncovering, extracting important variables, detecting any variances and testing any underlying assumptions. Data gathered in this study were both quantitative and qualitative. Primary data collected from the field was edited first to eliminate the misplaced responses given during the collection of the data. The responses were then coded for analysis. Coding was done to summarize the responses given by the respondents for analysis. The coded items were analysed with the aid of a computer using Statistical Package for Social Sciences (SPSS) version 20 as a tool for analysis. Data collected through Interviews were analysed by using themes approach. The responses information was first read by the researcher. Secondly, the data were placed in sub themes of the study based on the objectives of the study. i.e. all responses about barriers were grouped together. Third step was to reread the common patterns in each category, and decide which to take and which to leave out. Fourth, was to write narrates in each category using quotes from interviewees. The fifth step was to interpret narrates from respondents to gain meaning out of it. All categories of data were led by the research questions.

3.7 Ethical Issue

Ethical consideration is an import factor to observe for any researcher (Cohen et al., 2007). Ethical principles in conducting research include acquiring clearance and the informed consent of the respondents as well as maintaining confidentiality. The ethical issues associated with the study were discussed with the research subjects. They were assured of their anonymity and their right to withdraw from the study should they be offended or feel threatened in any way at any stage.

3.8 Chapter Summary

In this chapter the area of the study has been identified. The reasons for adopting descriptive survey research design have been discussed. The chapter outlines the procedures adopted for sample selection and research instruments used for the study. The instruments used were questionnaires and interviews. In addition, the chapter has discussed the validation of the instruments used as well as the data analysis approach. The next chapter gives a presentation of the data collected



CHAPTER FOUR

RESULTS

4.0 Overview

This chapter deals with the results of the study. Data were collected using questionnaires and Interviews to solicit information from ninety-six (96) teacher's respondents out of the one hundred and fifty-four (154) teachers targeted as respondents from fifteen (15) circuits in the Wa municipality. This gave a response rate of 62.34%. The findings of the study are presented as per the objectives of the study in the following sections. The data from the questionnaires were statistically analysed by using a computer programme known as SPSS version 20. The findings are discussed according to the sections of the questionnaire.

4.1 General Information on the Respondents

This section, presents information on respondents' gender, years of service as a teacher and highest level of education. The respondents were first asked to indicate their gender. From the response, 75% of the respondents are male while 25% are female as shown in Table 1.

Table 1: Gender of respondents

Gender	Frequency	Percentage (%)
Male	72	75.00
Female	24	25.00
Total	96	100.00

Source: Field Data (2022)

From the findings of the study, it is clear that most of the respondents interviewed were male teachers. The findings also showed that the information collected was not biased in terms of gender composition thus the data collected was perceived to reflect ideas from the mixed gender composition.

Age of the Teachers

To establish the ages of teachers, they were asked to indicate their ages. Their age distribution is represented in Table 2.

Table 2: Age of the Teachers

Age Range(years)	Frequency	Percentage (%)
18-30	46	48
31-40	34	35
41-50	14	15
Above 51	02	02
Total	96	100

The results in Table 2 indicate that 48% of the teachers were age brackets 18-30 years respectively. Thirty-five (35%) were in the age bracket 31- 40 years, 15% were in the age bracket of 41-50 years. Only 2% of the respondents were in the age bracket above 50 years. Majority of the teachers were therefore below 40 years.

Respondents teaching experience

In finding out the teaching experience of the teachers, the researcher grouped the respondents in groups of five years serving as teachers. The results are that 38% have served for a period of 5 years, 47% have served between 6-10 years, 10% of the sample served for a period of between 11-15 years while 5% of respondents served above fifteen (15) years in the teaching field (Table 3).

Table 3: Respondents Teaching Experience

Age Range	Frequency	Percentage (%)
1-5years	36	38
6-10 years	45	47
11- 15 years	10	10
Above 15 years	5	5
Total	96	100

From the findings of the study, it can be said that most of the teachers had taught for at least a year, hence, they were perceived to be well informed about the use of ICT in teaching. According to Dudzinski et al., (2000), teaching experience is developed over time and that teachers who have taught for a long duration are knowledgeable on teaching issues. This is because they are perceived to have the ability to relate prior knowledge to new experiences. Focusing on teacher experience, Clotfelter et al., (2006), found that teachers with more experience are more effective than those with less experience. The researcher therefore considered the information given by the respondents to be reliable because most of the teachers had taught for a long period of time, and therefore, were considered to have information on their experiences on the use of ICT to facilitate teaching and learning of science in schools.

Teachers Possess Electronic Gadgets-Computers, Tablets or Smartphones.

On finding out if teachers own computers or other electronic gadgets for their own use. The study found that 86 teachers in a group of 96 own a computer or an electronic gadget be it a laptop or a desktop as against 10 respondents who do not own any of the fore-mentioned gadgets.

Table 4: Teachers Possess Electronic Gadgets-Computers, Tablets, Smartphone etc.

COMPUTER POSSESSION	Frequency	Percentage (%)
Own a computer	86	91
Don't own a computer	10	9
Total	96	100

Source: Field data (2022)

As indicated in Table 4, 91% of the sample population own a computer, it can be concluded that most of the teachers know how to use at least one of the gadgets.

Level of ICT Use

In finding out the level of technology expertise of the teachers, it was found that 35 out of 96 respondents i.e., 36% of the sample population were very comfortable working with ICT devices i.e., computer, tablets and smartphones, 45 out of 96 respondents i.e., 47% of the sample population were fairly comfortable using ICT devices and 16 out of 96 respondents i.e., 19% of the population were uncomfortable using ICT devices (Table5).

Table 5: Level of ICT use Comfortability

Comfortability in ICT devices	Frequency	Percentage (%)
Very comfortable	35	36
Fairly comfortable	45	47
Uncomfortable	16	17
Total	96	100

Source: Field data (2022)

From the findings as shown in table 5, that 83% of the population are comfortable using ICT devices and are also aware of the use of ICT to facilitate teaching.

Respondents' qualification

Teachers were further asked to indicate their highest level of education as indicated in Table 6. The study found out that 1% of the respondents are postgraduates, 80.2% of the respondents had bachelor's degree and it was also found that 18.8% of the respondents are diploma qualifications holders. Table 6 presents the qualification of respondents in the study.

Table 6: Qualification of respondents

Teachers Qualification	Frequency	Percentage (%)
Postgraduate	1	1.0
First Degree	77	80.2
Diploma	18	18.8
Total	96	100

From the findings of the study, it can be concluded that majority of the respondents are degree graduates, and, therefore are qualified to teach at the Junior High Schools.

4.7 Presentation of Quantitative Data

4.7.10 What are the perceptions of science teachers on the integration of technology into science teaching in Wa Municipality?

Table 7: Perceptions of science teachers on the integration of technology in Teaching science.

		Strongly disagree/disagree	Undecided	Strongly Agree/Agree
1	Technology integration is learning about computers.	58(60.4%)	4(4.2%)	34(35.4%)
2	Technology integration is using computers and other tools in teaching.	6(6.3%)	0(0%)	90(93.7%)
3	Technology integration is using electronic tools and methods in teaching	12(12.5)	8(8.3)	76 (79.2)
4	Educational technology integration can improve the quality of teaching and learning that take place in schools.	32(33.3)	0(0)	64(66.7)
5	Educational technology resources are important learning tools.	4(4.2)	2(2.1)	90(93.7)
6	Students who have access to technological resources are more likely to do better than those who do not	6(6.3)	2(2.1)	88(91.7)
7	Educational technology resources should be available in each school.	2(2.1)	0(0)	94(97.9)
8	Educational technology tools should be available in each classroom.	2(2.1)	2(2.1)	92(95.8)
9	Access to computers should be limited to the school library for research.	72(75.1)	4(4.2)	20(20.9)
10	Having computers in my class is a waste	88(91.6)	4(4.2)	4(4.2)
11	If I integrate technology in my teaching, I will not have enough time to cover all the topics in the syllabus.	74(77.1)	10(10.4)	12(12.5)

4.7.1.1 Technology Integration is learning about computer

From Table 7, majority of the respondents 58 representing 60.4% disagree or strongly disagree with this statement indicating an understanding of technology integration.

Thirty-four (34) respondents representing 34.4% agree with this statement indicating some misconception about technology integration in teaching. Some four (4) respondents representing 4.2%.

4.7.1.2 Technology integration is using computers and other tools in teaching

On the above statement, ninety respondents representing (93.7%) of respondents strongly agree or agree with the statement while six (6) respondents representing 6.3% strongly disagree with the statement. Below is a graphical presentation.

4.7.1.3 Educational technology integration can improve the quality of teaching and learning that take place in the classroom

Majority of the respondents constituting 66.7% of the population agree/strongly agree with this statement while thirty-two (32) respondents representing 33.3% disagree/strongly disagree with the statement as indicated in Table 7.

4.7.1.4 Educational technology tools should be available in each classroom

With the above statement majority of respondents agree/strongly agree with this statement which constitute 95.8% of respondents while 2.1% of respondents disagree or strongly disagree with the statement with 2.1% of respondent undecided.

4.7.1.5 If I integrate technology in my teaching, I will not have enough time to cover all the topics in the syllabus.

Seventy-four respondents representing 77.1% disagree/strongly disagree with this statement. Meanwhile, ten respondents representing 10.4% were undecided while twelve respondents representing 12.5% agree or strongly agree with the statement.

Generally, there was a positive perception of teachers concerning the usefulness of technology integration in teaching and learning, especially in the teaching and learning of Integrated Science at the Junior High School level.

4.7.2.0 What factors affect science teacher's technology integration practice?

Table 8: Factors affecting science teacher's technology integration practice

	STATEMENT	Strongly Disagree/ Disagree	Undecided	Strongly Agree/Agree
12	My school administration supports activities geared towards technology integration.	38(39.6%)	8(8.3 %)	50(52.1%)
13	My school administration /municipality encourage and support teaching with technology.	30(31.3%)	6(6.3%)	60(62.6%)
14	There are enough educational technology tools in my school.	76(79.2%)	6(6.3%)	14(14.5%)
15	If I encounter problems when using technology, there is IT technician or someone to provide technical assistance.	42(43.8%)	6(6.3%)	48(50.0%)
16	Funds are made available for purchase of educational technology tools for my school.	74(77.1%)	6(6.3%)	16(16.7%)
17	Colleague teachers in my school encourage me to use educational technology in my teaching.	40(41.7%)	12(12%)	44(45.8%)
18	There are professional development sessions for teachers to develop their ICT competencies	54(56.3%)	8(8.3%)	34(35.4%)
19	My school is connected to the national grid.	62(64.6%)	0(0%)	34(35.4%)
20	My school has a constant power supply.	70(72.9%)	2(2.1%)	24(25.0%)
21	My school has a /thinking of having a standby generator to use in case of power failure.	74(77.1%)	8(8.3%)	14(14.6%)

4.7.2.1 There are Enough Educational Technology Tools in my School

Majority of the respondents disagree/strongly disagree with this statement with a percentage of 79.2% indicating the level of lack of educational technology tools the basic schools. While 6.3 % of respondents were undecided, 14.5 % of respondents agree/strongly agree with the statement.

4.7.2.2 Funds are made available for purchase of educational technology tools for my school.

Majority of the respondents representing 77.1% of the sample population strongly disagree or disagree with this statement. Sixteen respondents representing 16.6% of respondents strongly agree or agree with the statement while 6.2% were undecided.

4.7.2.3 Colleague teachers in my school encourage me to use educational technology in my teaching.

From table 8, majority of respondents representing 45.8% of the sample population strongly agree or agree with this statement. Forty (40) respondents representing 41.7% of respondents strongly agree or agree with the statement while 12.5% were undecided.

4.7.2.4 There are professional development sessions for teachers to develop their ICT competencies.

Majority of respondents representing 56.3% of the sample population strongly disagree or disagree with this statement. Thirty-four respondents representing 35.4% of respondents strongly agree or agree with the statement while 8.3% were undecided.

4.7.2.5 My school is connected to the national grid

From Table 8, majority of respondents representing 64.6% of the sample population strongly disagree or disagree with this statement. Thirty-four (34) respondents representing 35.4% of respondents strongly agree or agree with the statement while 00.0% was undecided.

4.7.2.6 My school has a constant power supply

Majority of respondents representing 56.3% of the sample population strongly disagree or disagree with this statement. Thirty-four respondents representing 35.4% of respondents strongly agree or agree with the statement while 8.3% were undecided.

4.7.2.7 My school has a /thinking of having a standby generator to use in case Of power failure.

From Table 8, majority of the respondents representing 77.1 % of the sample population strongly disagree or disagree with this statement. Fourteen (14) respondents representing 14.6% of respondents strongly agree or agree with the statement while eight (8) respondents representing 8.3% were undecided.

4.7.3.0 What ICT facilities are available to help science teachers integrate Technology into teaching?

Table 9: ICT facilities available to help science teachers in teaching

	Statement	Strongly Disagree/Disagree	Undecided	Strongly Agree/Agree
22	If I want to teach a computer-based lesson, computers are available for use	50(52.1)	0(0)	46(47.9)
23	My students have access to computers to complete course assignments.	70(72.9)	2(2.1)	24(25.1)
24	Pupils have computers at home	84(87.6)	4(4.2)	8(8.4)
25	My school has internet connectivity for use by teachers	90(93.7)	0(0)	6(6.3)
26	My school has internet connectivity for pupils.	92(95.8)	0(0)	4(4.2)
27	My school has various educational software for use by teachers.	80(83.4)	2(2.1)	14(14.6)
28	Only ICT teachers are allowed to use the computers.	60(62.5)	6(6.3)	30(31.3)
29	My school has an ICT laboratory	60(62.5)	0(0)	36(37.5)
30	Computers are locked up in computer laboratory	54(56.3)	2(2.1)	40(41.7)
31	My school has a projector for use during lesson delivery	78(81.2)	4(4.2)	14(14.6)

Source: Field Data (2022)

4.7.3.1 If I want to teach a computer-based lesson, computers are available for use.

With this statement, 50 respondents representing 52.1% strongly disagree/disagree while 46 respondents representing 47.9% strongly agree/Agree with the statement.

4.7.3.2 My students have access to computers to complete course assignments.

Majority of respondents disagree with this statement making 72.9% while 8.4% strongly Agree/Agree with the statement. Meanwhile 2.1% of the respondents Undecided.

4.7.3.3 My school has internet connectivity for use by teachers

On finding out if respondents have internet connectivity in their schools. Results from Table 4.6 indicates majority of respondents constituting 93.7% strongly disagree/disagree with the statement. A little as 6.3% strongly agree/agree with the statement.

4.7.3.4 My school has various educational software for use by teachers

Majority of respondents disagree with the statement which represent 83.4% of the sample population. While 2.1% of respondents were undecided, 14.6% of respondent strongly agree or agree with the statement.

4.7.3.5 My school has an ICT laboratory

Respondents largely disagree or strongly with this statement with a percentage of 62.5% of respondents. However, thirty -six (36) respondents representing 37.5% of the sample population agree or strongly agree with the statement.

4.7.3.6 My school has a projector for use during lesson delivery

Seventy-eight (78) respondents representing 81.2% of the sample population strongly/ disagree or disagree with this statement. However, fourteen (14) respondents representing 14.6% agree or strongly agree with the statement that their schools have projectors for use during lessons. Furthermore, 4.2% of the respondents were undecided.

4.7.4.0 What level of knowledge and competencies do the science teachers possess to integrate technology into teaching?

Table 10: Knowledge and competencies science teachers possess to integrate Technology into teaching.

	Statement	Strongly Disagree/Disagree	Undecided	Strongly Agree/Agree
32	I have a need to use educational technology in my instructional activities	8(8.3%)	4(4.2%)	84(87.5%)
33	There are opportunities at my school/Municipality for the professional development of teachers interested in using educational technology in their class.	76(79.2%)	6(6.3%)	14(14.6%)
34	Workshops are organized by my school/municipality on how to use educational technology in my class	72(75.0%)	10(10.4%)	14(14.6%)
35	Training is focused on integrating technology in classroom teaching rather than teaching basic ICT skills	46(47.9%)	16(16.7%)	34(35.4%)
36	I have knowledge in basic ICT skills	12(12.5%)	2(2.1%)	82(85.5%)
37	I have knowledge in how to integrate technology in teaching.	14(14.6%)	6(6.3%)	76(79.2%)
38	I have sufficient knowledge about the different types of software to use in my science lessons.	38(39.6%)	4(4.2%)	54(56.3%)
39	I feel prepared to teach using educational technology resources	14(14.6%)	10(10.4%)	72(75.0%)
40	When a computer develops a technical problem, I can fix it.	64(66.7%)	2(2.1%)	30(31.2%)
41	When a computer develops a technical fault, there is a resource person/IT technician to fix it.	76(79.2%)	0(0)	20(20.8%)

4.7.4.1 I have a need to use educational technology in my instructional activities.

Majority of respondents from table 4.10 strongly agree or agree with this statement which constitute 87.5% while 4.2% of respondents were undecided 8.4% of respondents strongly disagree or disagree with the statement.

4.7.4.2 There are opportunities at my school/Municipality for the professional Development of teachers interested in using educational technology in Their class.

From Table 10. Majority of the respondents strongly disagree or disagree with this statement representing 79.2% while 14.6% of respondent strongly agree or agree with the statement. However, 6.3% of respondents were undecided.

4.7.4.3 Workshops are organized by my school/municipality on how to use educational technology in my class.

From Table 10, majority of the respondents representing 75% strongly disagree or disagree with this statement while 14.6% of respondents either strongly agree or agree with the statement. The remaining respondents which constitute 10.4% were undecided about the statement.

4.7.4.4 Training is focused on integrating technology in classroom teaching rather than teaching basic ICT skills

From Table 10, forty-six (46) respondents representing 47.9% disagree with this statement while thirty-four (34) respondents representing 35.4% either strongly agree or agree with the statement. Sixteen (16) respondents representing 16.7% were undecided.

4.7.4.5 I have knowledge in basic ICT skills

From Table 4.10, majority of respondents 85.5% strongly agree or agree with this statement. Twelve (12) respondents representing 12.4% of respondents strongly disagree or disagree with the statement while 2.1% of respondents were undecided.

4.7.4.5 I have sufficient knowledge about the different types of software to use in my science lessons

Majority of respondents who constitute 56.3% of respondents strongly agree or agree to this statement while 39.60% of the respondents strongly disagree or disagree with the statement. The remaining 4.1% of the respondents were undecided.

4.7.4.6 When a computer develops a technical problem, I can fix it.

From Table 10, majority of respondents strongly disagree or disagree with this statement and it constitute 66.7% while 31.2% of respondents strongly agree or agree. However, two (2) respondents representing 2.1% were undecided.

4.7.4.7 When a computer develops a technical fault, there is a resource person Or IT technician to fix it.

From Table 10, seventy-six (76) respondents who constitute 79.2% of the sample population strongly disagree or disagree with the statement. Forty respondents representing 20.8% strongly agree or agree with the statement while zero (0) were undecided. This clearly indicate that majority of the schools do not have stand by qualified IT personnel to assist the few teachers integrating ICT in teaching to fix their ICT tools when they develop a fault. The few respondents that answered in the affirmative indicated that their friends are the ones that help them out.

4.3 Presentation of Open-Ended Interview Questionnaires

The data obtained through face-to-face interview with the respondents are presented according to the order of the objective of the study.

Question 1: What are the benefits of integrating ICTs in teaching integrate Science?

From the interviews organized and held between the respondents and the researcher, it was observed that most of the respondents enumerated the advantages of using ICT in the classroom environment as:- ICTs widens access to education resources, facilitates and makes the teaching process easier, ICTs arouses learners enthusiasm towards the subject matter, through use of ICTs learning becomes personalized, using ICT enhances students understanding of the subject matter, ICTs use in the classroom promotes collaborative work among students , the use of ICT in classroom makes learners more engaged and the lesson iterative,

A comment from teacher(A) is presented:

“Through the integration of ICT in lessons, learners take control of the lesson and a teacher is there as a facilitator, use of ICT in classrooms is more of learner centered method of teaching”

Response from teacher (B) on the advantages of ICT integration in the classroom: -

“Through the use of ICT, access to education has been expanded without boundaries, students can learn and get access to educational resources anywhere and at any time, there are varieties of educational materials on the internet such as google classroom, virtual forums, audio books,

electronic books, electronic libraries that are accessible any time.”

A female science teacher (teacher C) has this to say: -

“ICT have made education resources easily accessible; you just need a computer or a smartphone connected to the internet, I use ICT occasionally when I face challenges explaining a concept. I would visit u-tube to search the concept such as rotation of the earth, laws of magnetism and basic electronics. There are a series of short videos on these concepts which I watch and choose one that is suitable for my class and I will use it to teach. I find it easier and interesting to use ICT in teaching integrated science”

Another respondent (teacher D) had the following to say on the benefit of using ICT to facilitate teaching:

“The integration of ICT to facilitate teaching has a great potential to improve students learning outcomes. There are a host of ICT tools which when well used in classroom they can turn a classroom into a place where students want to be, mobile phones, tablets and mobile applications such as google classroom, which is available in Google Play for free for android users, they can be downloaded and installed by the students in their phones or their parents’ phones and use while away from school”

Moreover, another respondent (teacher E) said this in response to the merits of using ICT to facilitate teaching and learning of integrated science: -

“By integrating ICT in a classroom, learning becomes interesting where learners are fully engaged within the lesson, with ICT learning of difficult concepts becomes simplified and interesting. With a subjects like integrated science with some challenging concepts such as basic electronics. A teacher may decide to use a

simulation software or short video clips to demonstrate a difficult concept to students, through the help of internet. at times you need to modify the video especially where the language has foreign accent and substitute it with our language. Integrating ICT simplifies my work and arouses students' morale and interest towards topics of discussion. ICT also can be used for preparation and planning, keeping students' records and attendance monitoring. ICT is a potential tool for modern teaching and learning though it seems to be embraced by only a few teachers."

An elderly respondent (teacher F) said:

"New technologies can be used to enable students to collect information and interact with resources, such as images and videos, and to encourage communication and collaboration. The young teachers should embrace it, they have enough time left in service and they are active. I would have loved to use it but I am using a "yam phone" hahahahaha with a broad smile "

Question 2: What are the barriers that hinder the integration of ICTs to facilitate teaching and learning of integrated science?

Respondents responded verbally by enumerating the common barriers that hinders the use of ICT to facilitate teaching and learning. The barriers listed includes, inaccessibility and unavailability of ICTs resources, inadequacy of ICTs resources in schools, lack of training on the use of ICT affects its effective use in teaching, some teachers have negative attitude towards the use of ICTs in teaching, the unavailability of IT technical support staff. Respondents gave their views on the barriers of integrating ICT in facilitating teaching here are their views:

TEACHER(G) response: -

“As for me, everything boils down to Lack of ICT knowledge”, I have no enough skills or competence to integrate ICT tools in my lesson at all”

A female respondent (teacher (H) said that:

“Integrating ICT in my lesson becomes hard because I am not knowledgeable on working with a computer, I find it hard to use it in class. In few occasions with the help of my students who are knowledgeable with ICT we have used videos and simulations from www.youtube.com to explain concepts like machines and respiratory system. I will give it a try”

Another respondent (teacher “I”) said that:

“The use of ICT in teaching and learning is beneficial to both the teacher and the learner. As a teacher I can use website such as You Tube and Google to search for relevant materials for my lesson and use them to teach the students, everyone would like to integrated ICT in his/her lesson, the main challenge we face at our school is that we have only one classroom with about 7 computers and unreliable electricity”

Another respondent (teacher “J”) commenting on the barrier of ICT he said

“I think there should be a program of providing basic ICT training to teachers not only on how to use them but also on how to integrate ICT in their teaching subjects. I really need to know how to use ICT to teach integrated and I believe if I have proper training on how to use internet and computer, I will be able to search relevant materials for my students”

Responding to the interview another teacher(teacher K) alleged that: -

“Not all teachers are capable of using ICT teach oooh, some of us don’t know how to use one and they are not even available at our working environment, I have never thought that ICT can be used in classrooms also”

A comment from another teacher: -

“It would have been good if every teacher at my school had a personal computer that is connected to the internet so they can use for lesson preparation and teaching, but we are a government school we depend everything from the Ministry of Education budget, teachers as educators are supposed to be ahead with the changing technology and adopt innovative teaching through using ICT in classrooms”

Another teacher described: -

“There is no standby generator in this school to help when there is light out”

Furthermore, one respondent says: -

“One of the barriers that hinder us to use ICT in teaching is lack of access to ICT facilities and infrastructures, most of schools especially government school either have inadequate ICT infrastructures or don’t have at all, Ministry of education should ensure that these infrastructures are available and train teachers to use them in classrooms.

Question 3: What are the factors determining the use of ICT to facilitate teaching and learning?

In an interview conducted by the researcher respondents gave their views on what are the factors determining the use of ICT to facilitate teaching here under are their views,

In responding to the interview, a respondent said:

“How do I use ICT to facilitate teaching and learning because when I don’t know how to use ICT. My knowledge regarding using ICT is very basic to the extent that I lack confidence to use it in front of the students, but I believe that through ICT my job as a teacher will be simplified and entertaining to my class, I think the municipal Education office should organize seminars, workshops and short courses on how to integrate ICT in teaching processes, it is very important to introduce teachers and other education stakeholders to seminars and workshops on technology-based teaching and learning”

Moreover, the following is a comment from another respondent:

A comment from a teacher:

“The capitation grant can be used to purchase not only computer and internet but the school could purchase a TV set and a DVD player and Multimedia CDs which are recorded with different subject topics this can be used as supplementary materials for both teachers and students, which can also be used in classrooms.”

Another teacher form said:

“Majority of us learnt to use ICT especially computers by our own, we search on the internet for references that matches our lesson and correlate with our lessons, this consumes lots of times since I have to find free time to do so, I would advise provision revisit the curriculum and introduce usage of ICT in teaching, we are in the 21st century and to achieve the Millennium Development Goals I think the use of ICT in education should be a number one priority. Allocate more funds on ICT projects, train teachers in uses and integration of ICT in teaching and learning and provide in-

service trainings, seminars and workshops on the use of ICT in education.”

4.4 Chapter Summary

This chapter deals with the presentation and analysis of data for the study. The findings of the study are presented as per objectives of the study in the following sections. The findings are presented according to the sections of the questionnaire.



CHAPTER FIVE

DISCUSSION OF THE FINDINGS

5.0 Overview

This chapter presents discussion of the findings of the study. The research questions lead the discussion to be organised under the following broad themes:

- i. The barriers hindering the use of ICT to facilitate teaching in basic schools
- ii. The benefits of using ICT to facilitate teaching in secondary schools.
- iii. The factors determining the use of ICT to facilitate teaching in basic schools.

5.1 The Barriers That Hinder the Use of ICT to Facilitate Teaching and Learning in the Wa municipality

This section discusses the barriers that have been identified as the barrier to the use of ICT in teaching processes in basic schools.

5.1.1 Teacher Competence and Confidence

In the study 85% of the respondents agreed that lack of training on the use of ICT in teaching is a barrier in integrating ICT in teaching. This study matches with the study done by Newhouse (2002), which reveals that many teachers lack the knowledge and skills to use computers and are not enthusiastic about the changes and integration of supplementary learning associated with bringing computers into their teaching practices. Another study by Pelgrum (2001), found that teachers' lack of technological competence is a main barrier to their acceptance and adoption of ICT. Mukama and Anderson (2008) in their study reports that, using ICT to train teachers is most necessary as it leads teachers to change attitudes, be more technologically skilled, motivated to use the same technologies after training and enhance collaboration. The study concludes little or lack of professional training on how to use ICT in teaching is

a major barrier, for successful integration of ICT in teaching an emphasis should be put in providing pedagogical training on using ICT as across the curriculum is important. Therefore, teachers need knowledge of appropriate ICT integration approaches and ICT skills to successfully incorporate the ICT tools into their lessons. Training teachers on ICT related skills within the context of classroom objectives and activities ensures development of skills in integrated use of ICT in teaching.

5.1.2 Teachers Attitude towards the Use of ICT to Facilitate Teaching.

A lot of research on the attitude of both students and teachers towards the use of ICT in teaching and learning had been done with outcome being either positive or negative. For instance, BECTA (2004) reported that negative attitude was a barrier towards integration of ICT in teaching and learning while, Rhoda and Gerald (2000) found that positive attitudes towards ICT use are widely recognized as a necessary condition for effective ICT use in teaching and learning. Similarly, Kubiak et al., (2009) in their study identified that attitude towards ICT determines its adoption in teaching. According to Jones (2001), the attitudes of teachers towards technology greatly influence their adoption and integration of computers into their teaching. The study shows that teachers prefer to use the traditional method for teaching in their classroom because of their lack of motivation, acceptance and readiness towards the ICT integration and adoption in teaching. From the results, this study found that 88% of the respondents agreed that their negative attitude towards the use of ICT to facilitate teaching hinders them to use ICT in classroom teaching. According to Gomes (2005), much research into the barriers to the integration of ICTs into education found that teacher attitudes and an inherent resistance to change was a significant barrier. To successfully initiate and implement educational technology in schools depends strongly on the teachers' support and attitudes. It is believed that if

teachers perceived technology programmes as neither fulfilling their needs nor their students' needs, it is likely that they will not integrate the technology into their teaching. In the study by Selewyn (1999), integration of ICT in education environment depends, to a great extent, on teachers and student attitude towards their use. If teachers' attitudes are positive toward the use of educational technology, then they can easily provide useful insight about the adoption and integration of ICTs into teaching processes. From interviews some teachers who resist to use ICT in teaching believe that ICT have no benefits for themselves and their learners they give excuses such as they feel shy to learn use ICT, they are too old to learn how to use ICT and some don't see the logic of learning while they know they won't use because facilities are not available. An interview results with teachers both who are computer literate and other with limited computer skills revealed that teachers are more sensitive about their ability to use computer and intention to use computer than their perceptions of the usefulness of computer. It therefore appears that teachers' attitude may influence adoption of ICT in teaching process. The study reveals that positive attitude towards computers, computer experience, and personal entrepreneurship of the teacher educator have a direct positive influence on the innovative use of ICT by the teacher. The study is in line with another study by Schiller (2003) which reveals that personal characteristics such as educational level, age, gender, educational experience, and experience with the computer for educational purpose and attitude towards computers can influence the adoption of a technology in teaching. It is undeniable that teacher attitude is one of the most critical factors that enhance or inhibit the integration of ICT into classroom instruction. Teacher attitude and competence ensure ICT implementation and guarantee further ICT innovation. The attitudes of teachers towards technology greatly influence their adoption and integration ICT into their

teaching process, therefore an understanding of personal characteristics that influence teachers' adoption and integration of ICT into teaching is relevant. To successfully integrate ICT in teaching processes teachers are argued to change their attitude towards ICT specially to develop a positive attitude. It is advisable to adopt more appropriate measures to help both teachers and students further improve on their attitude towards ICT use in teaching and learning.

5.1.3 Limited Access to ICT Facilities.

The study results show that 100% of the respondents agreed that unavailability and inaccessibility of ICT facilities and resources hinders the use of ICT to facilitate teaching. The study results indicate that accessibility and availability of ICT resources plays a huge role in determining the use ICT to facilitate teaching. To supplement these results an interview was conducted to the selected sample and the respondents gave their views regarding the barriers that hinders the use of ICT to facilitate teaching and learning most respondents argued that they do not use ICT because they do not have access to ICT resources and some schools don't have facilities such as power, computer laboratory, internet access, and electronic projectors. The study by Eze and Olusola (2013) revealed that in Botswana, lack of electricity in rural schools and high cost of computers is a stumbling block to the integration of ICT in teaching, internet is impossible where there are no telephones and electricity. Effective application of ICT into classroom heavily relies on the availability of technological resources, qualified and confident teacher and other internal and external factors that directly or indirectly affect teachers' welfare and morale. The study further show that teachers have a positive perception on the use of ICT, but the availability and accessibility of ICT resources such as hardware, software and communication infrastructure are limited. If there are some ICT resources in a school, they are only

limited to office use. Integrating ICT to teaching learning is not an option to the government and school owners, efforts should be made to ensure ICT infrastructures are available in all schools and are used as we are preparing a child to live in a 21st century.

5.1.4 Lack of Technical Support

The study shows that 80% of the respondents indicated that they lack technical support on ICT issues hence they are intimidated to use ICT in teaching. The study by Pelgrum (2001) found that in the view of primary and, secondary teachers, one of the top barriers to ICT use in education was lack of technical assistance. Lewis (2003) asserted that without both good technical support in the classroom and whole school resources, teachers cannot be expected to overcome the barriers preventing them from using ICT. The findings show that one of the challenges facing the use of ICT in teaching and learning is the availability of support staff. The interview conducted revealed that breakdown of a computer causes interruptions and if there is lack of technical assistance, then it is likely that the regular repairs of the computer will not be carried out resulting in teachers not using computers in teaching. The effect is that teachers will be discouraged from using computers because of fear of equipment failure since no one would give them technical support in case there is technical problem. BECTA (2004) agrees that if there is a lack of technical support available in a school, then it is likely that technical maintenance will not be carried out regularly, resulting in a higher risk of technical breakdowns. Therefore, if there is no technical support for teachers, they become frustrated resulting in their unwillingness to use ICT, ICT support in schools influence teachers to apply ICTs in classrooms without wasting time troubleshooting hardware and software problems.

5.1.5 Teaching Experience

The study result shows that there is a digital divide (generation gap) between the teachers. Younger teachers have emerged to be positive about using ICT to facilitate teaching than older teachers, the study indicates that for most of younger teachers apart from owning computers and tablets or smartphones they occasionally engage in using software and mobile applications and educational websites in teaching as compared to senior teachers. The study reveals that senior teachers indicated that their age and teaching experiences were the barriers to adapt to the ICT integration into their lessons. The older teachers with more experience in teaching did not prefer to use ICT tools in their classes.

5.1.6 Professional Development

Insufficient amount of in-service training programs for teachers is another barrier that hinders the use of ICT in teaching, during the interview session respondents reported that there were not enough in-service training opportunities for teachers in the use of ICTs in teaching. A study by Newhouse (2002) states that “teachers need to not only be ICT literate; but they also need to develop skills in integrating ICT use into their teaching”. According to Newhouse (2002), teachers need training in technology education (focusing on the study of technologies themselves) and educational technology (support for teaching in the classroom). It can be concluded that there are barriers which hinder the use of ICT to facilitate teaching and learning which are teachers’ attitudes toward use of ICT, lack of teacher training on the use of ICT to facilitate teaching and learning, unavailability of technical support staff, availability and accessibility of ICTs resources and facilities. These factors have been mentioned repeatedly as the barriers to the use of ICT to facilitate teaching process.

5.2 The Benefits of Using ICT to Facilitate Teaching and Learning of integrated science in Junior High Schools.

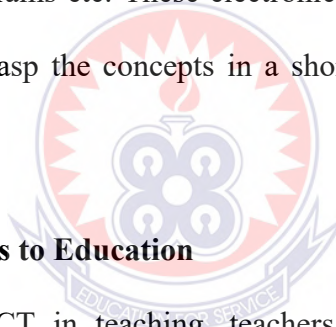
This section discusses the benefits of the use of ICTs in teaching processes in secondary schools.

5.2.1 ICT Facilitate and Make Teaching Process Easier

From the finding the study shows that the use of ICT in teaching makes the teaching easier and hence teaching is simplified. The study agrees with study by Bransford et al., (2000), several studies have reviewed the literature on ICT and learning and have concluded that ICT has great potential to enhance teacher performance. Another study by Dawes (2001) views that, new technologies have the potential to support education across the curriculum and provide opportunities for effective communication between teachers and students in ways that have not been possible before. Using ICT in teaching is also perceived as having the advantage of heightening motivation for the learner; helping recall previous learning; providing new instructional stimuli; activating the learner's response; providing systematic and steady feedback; facilitating appropriate practice; sequencing learning appropriately; and providing a viable source of information for enhanced learning. Consider teaching respiratory system by using YouTube with moving picture and traditional explanation that teachers usually do in the classroom. A teacher's job is simplified, and the role becomes that of a facilitator. Research and active projects, such as those run by EdQual, a Research Consortium of educational institutions in the UK and Africa (Ghana, Rwanda, South Africa, Tanzania) on Educational Quality, typically indicate two main reasons why teachers use ICT: teachers feel that their own use of computers benefits their learners, teachers feel learners benefit from using computers themselves, they gain confidence, self-esteem and renewed motivation.

5.2.2 Delivery of Educational Resources

ICT has increased the flexibility of delivery of education so that learners can access knowledge anytime and from anywhere. ICT has improved the delivery of education and enable wider access to the same. In addition, it has increased flexibility so that learners can access the education regardless of time and geographical barriers. A study by Gillespie (2006), revealed that new technologies can be used to enable students to collect information and interact with resources, such as images and videos, and to encourage communication and collaboration among students. Through ICT the delivery of education resources can be in the form of computer tutorials, simulation software, digital media such as CDs, DVDs and blue ray, video and audio cassettes, television and radio programs etc. These electronic media can simplify concepts and enable the students to grasp the concepts in a shorter time than it could have been explained by the teacher.



5.2.3 ICT Provide Access to Education

Another benefit using ICT in teaching, teachers have wide access to education resources. Teachers and learners no longer have to rely solely on printed books and other materials in physical media housed in libraries for their educational needs, with the Internet and the World Wide Web, a wealth of learning materials in almost every subject and in a variety of media can now be accessed from anywhere at any time of the day and by an unlimited number of people. ICT are potentially powerful tool for extending educational opportunities, through their ability to transcend time and space, online educational materials, for example, may be accessed 24 hours a day, 7 days a week, in certain types of ICT, such as teleconferencing technologies, enable instruction to be received simultaneously by multiple, geographically dispersed learners.

5.2.4 ICT Provides Potential to Innovate

The findings show that majority of the respondents who are teachers agreed that ICT when integrated in teaching it provides potential to innovate. Underwood (2006) report provides evidence that many teachers use ICT to support innovative teaching, by stating that new technologies that provides a good fit with existing practices, such as interactive whiteboards, are first to be embedded, but others like video conferencing, digital video and virtual learning environments are now being incorporated. Therefore, ICT can improve teaching by enhancing an already practiced knowledge and introducing new ways of teaching and learning. Punie et al., (2006), states by using ICT in teaching flexibility, personalization and different learning styles can be combined; and learning can be authentic, motivational and conceived as a social process enabling peer-to-peer informal interactions that lead them to learn from each other. Craft (2005) argues digital technologies have great potential to enable creative processes. Loveless (2007) holds that creative learning activities need meaningful contexts and ICT can offer tools for creating such contexts. These tools can represent information in a variety of modes that enable learners to make changes, try out ideas and approaches to problem solving.

5.3 The Factors Determining the Use of ICT to Facilitate Teaching in JHS.

This section discusses the factors that influence the use of ICT in teaching integrated science in Junior High schools.

5.3.1 Positive Attitude towards ICT and ICT Self-Efficacy

The findings of this study indicated that the teachers' attitudes levels towards the use of ICT had a direct relation with the use of ICT in teaching. Results of two similar studies done by Albirini (2004) and Isleem (2003) indicate that there is a significant

relationship between users' attitudes towards ICT and the actual level of ICT use in teaching. This indicates that if teachers hold positive attitudes towards the use of ICT, they are likely to effectively use of ICT in teaching. Jones (2004), teachers feel reluctant to use computer if they lack confidence, Balanskat et al., (2007) stated that fear of failure and lack of ICT knowledge have been cited as some of the reasons for teachers' lack of confidence for adopting and integrating ICT into their teaching. Positive attitudes often encourage less technologically capable teachers to learn the skills necessary for the implementation of technology-based activities in the classroom. Therefore, if teachers want to successfully use technology in their classes, they need to possess positive attitude to use technology. Such attitude is developed when teachers are sufficiently comfortable with technology and are knowledgeable on its use.

5.3.2 Competence in ICT Use

The study points out that respondents who had received some form of computer training displayed more use of ICT in teaching various lessons than those who did not receive any training. Becker et al., (1999) stated that there is a positive relationship between ICT training and teachers' attitudes. Training can significantly influence the ways in which a teacher includes technology tools in the classroom. The lack of computer training could lead to technophobia that is likely to limit the use of ICT in teaching. This study aligns with a study by Dogan (2010) which points out that, teacher training in ICT is vital for future conception and uses of computers for teaching process. However, for proper ICT integration in education, the quality of training needs to be taken into account. This finding of the study indicates that lack of adequate training in technology use and experience is one of the main reasons why teachers do not use technology in their teaching. Therefore, training teachers and

providing them with the appropriate knowledge and skills facilitates the integration of ICTs in teaching.

5.3.3 Professional Development

The term professional development may be used in reference to a wide variety of specialized training, formal education, or advanced professional learning intended to teachers, improve their professional knowledge, competence, skill, and effectiveness. Professional development of teachers sits at the heart of any successful use of technology in teaching. Professional development has a significant influence on how well ICT is embraced in teaching. Teachers need to be given opportunities to practice using technology during their teacher training programs so that they can see ways in which technology can be used to supplement their classroom activities. Rosenthal (1999), argues that teachers are more likely to integrate ICT in their courses, when professional training in the use of ICT provides them time to practice with the technology and to learn, share and collaborate with colleagues. According to Bordbar (2010), teachers who spent more time in professional development activities are more likely to show that they felt well prepared to teach with computer technology. Therefore, professional development in ICT use in teaching provides teachers with the necessary skills to include information and communication technology into their teaching and learning and also provide numerous initiatives to urge teachers to use ICT in teaching.

5.3.4 Accessibility of ICT Facilities

This study suggests that, efficient and effective use of technology depends on the availability of hardware and software and the equity of access to resources by teachers. The results of the study revealed that teachers who had own computers,

computers labs and media rooms in their schools acknowledged that occasionally they were more likely to use them in instruction and lesson preparation than teachers who did not; furthermore, the study results disclose that more than 50% of teachers who had computers in their schools used them for research and activities related to lesson preparation and teaching. Effective adoption and integration of ICT into teaching in schools depends mainly on the availability and accessibility of ICT resources such as hardware, software, etc. Another study by Yildirim (2007) found that access to technological resources is one of the effective ways to teachers' pedagogical use of ICT in teaching. Therefore, access to ICT facilities such as internet, CDs, updated software and hardware are key elements to successful adoption and integration of technology in teaching.

5.3.5 Availability of ICT Technical Support

Based on the findings obtained from this study, it is suggested that in order to understand how computer technology is effectively used by teachers, it is essential to provide sufficient support from computer experts. ICT support in schools helps teachers to use it in teaching without losing time through solving software and hardware problems. It is significant to provide teachers with technical support concerning repair and maintenance to continue the use of ICT in schools. Tong and Trinidad (2005) assert that if there is no technical support for teachers, they will be disappointed to use ICT. Therefore, ICT support in schools helps teachers to use it in teaching without losing time through solving software and hardware problems, get rid of the fear of equipment failure and that technical maintenance will be carried out regularly, resulting in less risk of technical breakdown.

5.4 Chapter Summary

This chapter presents discussion of the findings of the study. The research questions lead the discussion which is organized under the following broad themes: the barriers hindering the use of ICT to facilitate teaching in secondary schools, the benefits of using ICT to facilitate teaching and the factors influencing the use of ICT to facilitate teaching in secondary schools.



CHAPTER SIX

SUMMARY, CONCLUSIONS, RECOMMENDATIONS AND SUGGESTIONS FOR FURTHER RESEARCH.

6.0 Overview

This chapter provides the last part of the research report; it covers summary, conclusion, and recommendations for actions and suggestions for further research.

6.1 Summary

This study intended to examine the status of the use of ICT in teaching integrated science in Junior High schools in the Wa municipality. The study was guided by four (4) objectives:

- i. To determine the perception of teachers in integrating ICT in the teaching of integrated science in the Junior High School.
- ii. To explore the benefits of using ICT to facilitate teaching process in selected Junior High schools in the Wa municipality.
- iii. To explore the barriers of using ICT to facilitate teaching process in selected Junior High schools in the Wa municipality, and
- iv. To identify the factors determining the use of ICT in teaching process in selected Junior High Schools in the Wa municipality.

The Sample was selected from 15 different Junior High schools located in the Wa Municipal. The participants selected were expected to provide maximum information about the research problem. The sample size of ninety-six (96) respondents were purposely selected to provide information regarding their perception and views on the use of ICT to facilitate teaching within their schools through the questionnaire. Also interview schedule were used to support information obtained through questionnaire

and to increase reliability of the findings. The study employed descriptive survey research design.

6.2 Summary of the Findings

The summary of the findings is organized in line with the research questions.

6.2.1 Benefits of Using ICT to facilitate Teaching Processes in Selected Junior

High schools in the Wa municipality.

On examining the benefits of using ICT to facilitate teaching, the following were identified as the benefits of using ICT to facilitate teaching: - individualized interactivity, delivery of educational resources, access to global knowledge base, facilitate integration with resources, simplify teachers work. The study indicates that using ICT in teaching has benefits to teachers.

6.2.2 Barriers Hindering Use of ICT in Teaching and Learning in Selected Junior High Schools in the Wa municipality, teachers' attitude, teacher confidence and competence, unlimited access to ICT resources and facilities and lack of technical support, inadequate ICT infrastructure on ICT and lack of professional development were identified as the barriers hindering teachers to use ICT to facilitate teaching in Junior High schools.

6.2.3 Factors Determining the Use of ICT to Facilitate Teaching in selected Junior High Schools in the Wa municipality.

On examining the factors determining the use of ICT in teaching in Junior High Schools, the study identified the following factors: - teachers' positive attitude,

teachers' competence in ICT use, accessibility of ICT facilities, professional development and availability of technical support.

6.3 Implication of the Study

The findings of the study established that Junior High school teachers teaching integrated science in the Wa municipality are qualified to teach in the Junior schools. The results show that there is a positive perception of science teachers in integrating ICT in teaching. Majority of teachers integrate ICT in their instructional practice with varied challenges. According to the finding of the study male teachers frequently use ICT in teaching as compared to the female teachers, the study also identified a generation gap amongst teachers' junior teachers demonstrating much interest of learning how to and integrating ICT in teaching as compared to senior teachers, the study reveals there is a digital divide- the gap between schools who have access to ICT facilities and those who do not, which makes a huge difference in the use of ICT in teaching among schools. The findings of the study also identify a direct relationship between level of education among teachers and their use of ICT to facilitate teaching, whereby teachers with first degree or higher have shown intentions and interest in using ICT to facilitate teaching as compared to diploma holders. According to objective one of this study, the finding indicates that teachers are aware of benefits of using ICT in teaching. Teachers were able to identify the benefits of using ICT to facilitate teaching which are; - ICT make teaching job easier, ICT promote individualized interactivity, ICT improves delivery of educational resources, and ICT offers a wide access to global knowledge, ICT facilitate interaction with resources. In objective two of the study, the following were identified as barriers of the using ICT in teaching; - negative attitude, teacher competence and confidence, teaching experience, inadequate infrastructure, lack of training and lack of technical support.

The third objective of this study was to identify the determinants of ICT use in teaching and the teachers these variables were identified as determinants of ICT integration in teaching: - positive attitude towards ICT, teacher competence and confidence in ICT use, availability and accessibility of ICT infrastructure and availability of technical support. The major implication of this study is, teachers are aware of the benefits of using ICT in teaching and generally they support the use of ICT in teaching, however majority of the teachers prefer traditional way of teaching. According to the study findings, teachers do face barriers when using ICT in teaching and these barriers constrains them from using ICT in teaching. For the successful integration of ICT in teaching, the identified factors as determinants for the use of ICT in teaching must be given a serious consideration by ensuring the barriers are reduced or completely eliminated through;- increasing access to ICT facilities (computers, connectivity, software, rooms etc.), training teachers on how to use ICT in teaching, hire ICT technical support staff, teachers to change their attitudes towards ICT use , provide pre service and in service trainings and seminars on how to integrate ICT in teaching, investing in ICT infrastructures and resources.

6.4 Conclusions

In line with the findings obtained and the ensuing discussion, the following conclusions can be made:

- The use of ICT in teaching processes has benefits to teachers and learners.
- The barriers that hinder using of ICT in teaching and learning can be eliminated.
- For successful integration of ICT in teaching, the determining factors must be given consideration.

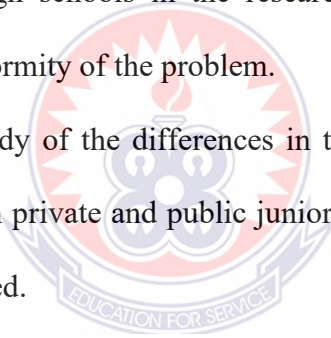
6.5 Recommendations

The study recommends that teachers in the Wa Municipality should develop a positive attitude towards ICT. Ghana Education Service through the Regional Director of education should organize training workshops to train teachers on how to integrate ICT in teaching and not only on the general use of ICT tools. The study also recommends that schools authorities should empower teachers by facilitating in-service training, provide enough ICT facilities. The Ministry of education needs to give more funds to establish at least minimum ICT facilities to enable the school to have these infrastructures for teaching. The study further recommends that the government through the Ministry of Education should make ICT training mandatory in Teacher's education, introduce in-service ICT training programmes for teachers in public schools in the Wa Municipality, fund public schools to purchase ICT infrastructures, employ ICT technical staff in public schools as there are IT technicians churned out by the Technical Universities in the country. Teachers resource centers in the Wa Municipality should be equipped with ICT facilities for immediate access by teachers. There should be an ICT integrated lesson with projector and other audio-visual devices in Junior High schools in the Wa Municipality at least three (3) times a week.

6.5.1 Suggestions for Further Research

This study was only carried out in selected Junior High schools in the Wa municipality.

- i. The researcher therefore suggests that a similar study can be done in other Metropolitan areas, municipalities and Districts (MMD) in Ghana.
- ii. It is also suggested that this study be replicated using a case study design to provide in-depth information on the underlying causes of the challenges science teachers face in integrating technology into their instructional activities.
- iii. It is suggested that a survey of the available ICT equipment and materials in selected junior high schools in the research area be conducted to provide insight into the enormity of the problem.
- iv. A comparative study of the differences in the integration of technology into science teaching in private and public junior high schools in the research area should be conducted.



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APPENDIX A

Questionnaire For Teachers

Objective: - The questionnaire intended to collect information on the use of ICT to facilitate the teaching of integrated science in Junior High Schools. This is purely an academic work conducted in partial fulfilment of Master's Degree in Science Education (MPhil Science Education) All answers in this work remain as confidential.

SECTION A

tick the appropriate box

Questions:-

1. Tick your sex i. Male () ii. Female ()

2. What is your age?

Tick one box only 30 or less () 31-35 () 36-45 () 46-55 () More than 55

3. Tick your education level

i. Certificate ()

ii. Diploma ()

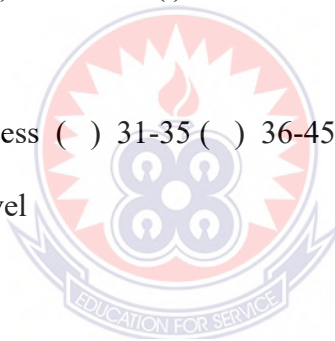
iii. Bachelor ()

iv. Postgraduate ()

4. For how many years have you been teaching in secondary schools? Numeric characters only. Use decimal point (.) and not comma if necessary.

5. Do you have your own computer in an office at the institution? Yes, a desktop computer Yes, a laptop computer Yes, both of them No

6. What best describes your level of technology expertise? (tick)



I'm very uncomfortable using technology at home () I'm fairly uncomfortable using technology at home () I'm fairly comfortable using technology at home() I'm very comfortable using technology at home()

SECTION B

Tick the appropriate box the extent to which you Agree or Disagree with the following statements.

	Statement	Strongly disagree/disagree	Undecided	Strongly Agree/Agree
1	Technology integration is learning about computers.			
2	Technology integration is using computers and other tools in teaching.			
3	Technology integration is using electronic tools and methods in teaching			
4	Educational technology integration can improve the quality of teaching and learning that take place in schools.			
5	Educational technology resources are important learning tools.			

Appendix A continued

6	Students who have access to technological resources are more likely to do better than those who do not			
7	Educational technology resources should be available in each school.			
8	Educational technology should be available in each classroom.			
9	Access to computers should be limited to the school library for research.			
10	Having computers in my class is a waste			
11	If I integrate technology in my teaching, I will not have enough time to cover all the topics in the syllabus.			

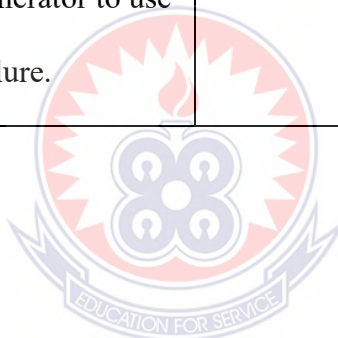
SECTION C

Tick the appropriate box the extent to which you Agree or Disagree with the following statements.

		Strongly Disagree/Disagree	Undecided	Strongly Agree/Agree
12	My school administration supports activities geared towards technology integration.			
13	My school administration /municipality encourages and supports teaching with technology.			
14	There are enough educational technology tools in my school.			
15	If I encounter problems when using technology, there is IT technician or someone to provide technical assistance.			
16	Funds are made available for purchase of educational technology tools for my school.			
17	Colleague teachers in my school encourage me to use educational technology in my teaching.			

Appendix A continued

18	There are professional development sessions for teachers to develop their ICT competencies			
19	My school is connected to the national grid.			
20	My school has a constant power supply.			
21	My school has a /thinking of having a standby generator to use in case of power failure.			



SECTION D

Tick the appropriate box the extent to which you Agree or Disagree with the following statements.

		Strongly Disagree/Disagree	Undecided	Strongly Agree/Agree
22	If I want to teach a computer-based lesson, computers are available for use			
23	My students have access to computers to complete course assignments.			
24	Pupils have computers at home			
25	My school has internet connectivity for use by teachers			
26	My school has internet connectivity for pupils.			
27	My school has various educational software for use by teachers.			
28	Only ICT teachers are allowed to use the computers.			
29	My school has an ICT laboratory			

Appendix A continued

30	Computers are locked up in computer laboratory			
31	My school has a projector for use during lesson delivery			

SECTION E

Tick the appropriate box the extent to which you Agree or Disagree with the following statements.

		Strongly Disagree/Disagree	Undecided	Strongly Agree/Agree
32	I have a need to use educational technology in my instructional activities			
33	There are opportunities at my school/Municipality for the professional development of teachers interested in using educational technology in their class.			
34	Workshops are organized by my school/municipality on how to use educational technology in my class			

Appendix A continued

35	Training is focused on integrating technology in classroom teaching rather than teaching basic ICT skills			
36	I have knowledge in basic ICT skills			
37	I have knowledge in how to integrate technology in teaching.			
38	I have sufficient knowledge about the different types of software to use in my science lessons.			
39	I feel prepared to teach using educational technology resources			
40	When a computer develops a technical problem, I can fix it.			
41	When a computer develops a technical fault, there is a resource person/IT technician to fix it.			

APPENDIX B

Interview Items For Teachers

- i. What are the benefits of integrating ICT in teaching integrated science in the Junior High School?
- ii. What are the barriers of using ICT in teaching integrated science in the Junior High School?
- iii. In what ways can we improve the use of ICT in teaching and learning of integrated science in the Junior High School?

