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THE STATUS OF JUNIOR HIGH SCHOOL INTEGRATED SCIENCE TEACHING AND LEARNING IN KADJEBI DISTRICT

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(202114501)

A thesis in the Department of Science Education, Faculty of Science Education, submitted to the School of Graduate Studies, in partial fulfillment of the requirement for the award of the degree of Master of Philosophy (Science Education) in the University of Education, Winneba

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DECLARATION

STUDENT'S DECLARATION

I, BEN KWAME BANINI, declare that this thesis, with the exception of quotations and references contained in published works which have all been 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 work was supervised in accordance with the guidelines for supervision of thesis as laid down by the University of Education, Winneba.

Name of Supervisor: Prof. J. K. EMINAH

SIGNATURE …….

DATE ……..……

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DEDICATION

This work is dedicated to my Wife and my Children who loved me and strengthens me throughout the journey of this academic journey.

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This research work would not have been possible without the support and encouragement from my supervisor Prof. J.K Eminah who offer useful suggestions on all portions of this work and made necessary corrections.To you l say GOD BLESS YOU.

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To those whose names l did not mention, I say thank you very much.

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TABLE OF CONTENTS

University of Education,Winneba http://ir.uew.edu.gh

University of Education,Winneba http://ir.uew.edu.gh

University of Education,Winneba http://ir.uew.edu.gh

University of Education,Winneba http://ir.uew.edu.gh

LIST OF TABLES

University of Education,Winneba http://ir.uew.edu.gh

University of Education,Winneba http://ir.uew.edu.gh

LIST OF FIGURES

University of Education,Winneba http://ir.uew.edu.gh

ABSTRACT

The study investigated the status of teaching and learning of Integrated Science in selected urban and rural Junior High Schools (JHSs) in the Kadjebi District in the Oti region of Ghana. A qualitative approach was employed. Stratified random sampling was employed to select 12 teachers and 120 pupils in urban and rural JHSs from the District. The instruments used to collect data are questionnaire and observation.The study was a descriptive survey. The study revealed that there were inadequate instructional materials as well as academic and professional qualifications of the integrated science teachers.It was also found that practical activities were not organised in some selected JHSs as most of the pupils found integrated science difficult. It was also found that the time allocated for teaching both practical and theory was not enough. The study concluded that if these challenges were addressed, teaching and learning of Integrated Science would be improved in rural JHSs. It was recommended that Integrated Science teachers should be trained to improvise instructional materials using materials in the environment to teach the subject. This would help pupils to conceptualize scientific concepts as they interact with the materials. Again,the school administration together with the GES should help integrate ICT technology into teaching and learning of integrated science as an alternate means of teaching science. It was also revealed that in-service training should be organised frequently for science teachers to help enhance the teaching and learing of integrated scince.

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CHAPTER ONE

INTRODUCTION

1.0 Overview

This chapter contains the background to the study, statement of the problem, research objective, research questions, purpose of the study, followed by limitation and delimitation of the study.

1.1 Background to the Study

The teaching of integrated science at JHS level was considered generally as the fundamental of science learning and this leads students towards the understanding of knowledge of science. One may say that science teaching take place when the teacher organizes series of practical experiences in scientific activities, the intention is of which is to make students learn new knowledge and acquire skills and competence in science (Erinosho 2008). A lot of research in teaching and learning of science education point to the fact there is the need to adopt interative and more engaging methods in teaching the subject to make it more meaningful,arouse and sustain student's interest in studying it and improve their performance (Akpan, 1992; Anderson, 2006; Jenkins & Nelson, 2005; Namrata, Amrita, & Singh, 2014; Antwi, Anderson, & Sakyi- Hagan, 2015).

How well learning takes place depends on the quality of teaching and quality of teacher's interaction with the students (Lowman, 1995; Black & William, 1998; Stiggins, 1999). Science teachers should be able to provide ample opportunities for students to engage in a variety of learning experiences such as investigation, discussion, demonstration, practical work, field studies, oral reports, assignment, debates, information search and role play.

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When teachers make science lesson more meaningful, relevant, enjoyable, interst and challenging, students have a higher intrinsic motivation to learn (Brophy, 1987; Cimer, 2007; McCombs, 2011).

Knowledgeable, dedicated and resourceful science teachers are therefore needed to lay good foundation of science in these young ones. Integrated science education emphasizes fundamental unity of scientific knowledge and encourages students to combine perspectives, concepts and methods from various disciplines to comprehend and interpret scientific phenomena in daily life (Frey, 1989).

Many researchers have noted that the quality of science teaching and learning could be affected by many factors including inadequate content knowledge, subject based qualification, restricted instructional periods,insufficient teaching materials, unqualified teachers, lack of mini laboratory and lack of school collaboration were found to negatively impact the implementation of integrated science (Venville, Wallace, Rennie, & Malone, 2002).

O'Connor (2000) also identified the use of inappropriate teaching methods as one of the factors that contribute to low participation and performance of students in science. The teaching methods used are not practical enough and that teachers make little effort to relate the concepts learnt and the examples/illustrations used to real life, especially within the context of the students' own lives and environment. This has a negative effect on students' interest and motivation to study science, mathematics and technology (SMT) subjects. It also makes students show lack of conceptual understanding in many scientic principles in their study,which results in ambivalence towards their study of integrated science. Salau (1996) also argue that science learning at schools tend to be rote and that students still find the learning of science to

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be difficult. Danso (2010) indicated that teachers favour teacher-centred, knowledge based teaching methods that leave little room for learners' participation. The most commonly used teaching methods at both basic and secondary levels have been found to be lecturing; question and answer; explanations of procedures and note giving, in that order (O'Connor, 2002). The quality of integrated science teaching and learning is questionable because of the poor performance of a greater number of junior high school pupils in integrated science.

Recent report from the Kadjebi District indicated that the status of teaching and learning of integrated science in JHS was nothing to write home about as most of the pupils performed woefully in integrated science.In addition, information gathered from headteachers in the district and West African Examination council (2005, 2009, 2010, 2012. 2013) also shew that majority of candidates who passed integrated science in BECE obtained grades 5,6,7 and 8 with very few of them getting grade 3 and 2. It is therefore essential to investigate these challenges confronting integrated science teaching and learning and develop recommendation to improve the quality of teaching and learning of integrated science in Kadjebi.

1.2 Statement of the Problem

In spite of the numerous policies and academic provisions and other efforts by the government of Ghana to lay emphasis on science education as the engine for growth and development of the country, its achievement has not been up to expectation (Anamuah-Mensah,1995). There is ample evidence that all is not well with the status of teaching and learning of integrated science in the country especially Kadjebi District. The rate at which students fail integrated science currently shows that effective learning has not been attained by these students. Studies show that many of

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our students tend to learn science by rote and hence lack understanding of science concepts since no meaningful learning occurs (Anamuah-Mensah & Benneh, 2010; Jones, 2008; O'Connor, 2002). The quality of science teaching and learning in Junior High Schools,Senior High Schools and Tertiary Institutions in Ghana has therefore been criticized by parents,science educators,technocrats and the government (Anamuah-Mensah, Mereku, & Ampiah, 2010; Ndago, 2012).

The poor teaching and learning of integrated science in Kadjebi District schools has been reflected in the poor performance of JHS students in BECE at Kadjebi. The dearth of integrated science teachers in Ghana and the lack of teaching skills and competencies among teachers are the result of their poor instructional approaches (Anamuah-Mensah & Benneh, 2010; Jones, 2008) to integrated science and the resultant mass failure of students in this subject every year. The present crops of teachers who teach integrated science have been trained in specific subject areas of biology, chemistry, physics, and agriculture (Nyavor & Seddoh, 2000; Haggis, 1969). Hence, they generally lack the skills of teaching science as a unified whole. Anamuah-Mensah and Asabere-Ameyaw (2011) observed that there are weaknesses in the teacher preparation, for whilst low emphasis is given to subject matter content during pre-service training there is also a disconnection between theory and practical application.

It is upon background that this study was aimed at finding out the status of teaching and learning of integrated science in junior high schools in Kadjebi District.

1.3 Purpose of the Study

The purpose of the study was to investigate the status of teaching and learning of integrated science at the junior high school level in Kadjebi District.

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1.4 Objectives of the Study

The objectives of the study were to determine

1. The academic and professional qualifications of the integrated science teachers.
2. The availability of instructional materials for teaching and learning integrated science in the selected schools.
3. The factors that hinder teaching and learning of integrated science in the selected schools.
4. 4. Interventions that can be designed to improve science teaching and learning in the selected schools .

1.5 Research Question

The following research questions guided the study:

1. What are the academic and professional qualifications of the integrated science teachers?
2. What instructional materials are available for the teaching and learning of integrated science ?
3. What factors hinder the teaching and learning of integrated science in the selected schools?
4. What interventions can be designed to improve science teaching and learning in the selected schools?

1.6 Significance of the Study

The information obtained from the study may help to expose the problems of teaching and learning of integrated science.

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It also hope that this study will inspire integrated science teachers of Kadjebi District to use different teaching method and also improve their competence in teaching and learning of integrated science in junior high schools.

The findings will help the Ministry of Education to improve teacher quality in Ghanaian schools by paying much attention to policies concerning recruitment, early preparation, and professional development as well as attention to working conditions. Teacher training institutions will come out with educational programmes to prepare effective and highly qualified science teachers with the current pedagogical skills to enable them teach well

The study may also provide very useful information to Ministry of Education (MOE), government and agencies to provide interventions for promoting the teaching and learning of integrated science in Kadjebi District and also to formulate appropriate educational policies.

Furthermore, the research may help the Curriculum Research Development Division (CRDD) to design effective integrated science curriculum for the schools. It may help the GES to organize in-service professional courses for junior high schools teachers in Kadjebi District to improve upon their own professional competencies in handling integrated science so as to enable pupils to understand integrated science and develop interest in it.

Additionally, the study augments the pool of data required by other educational researchers in their bid to design intervention to solve educational problems in the sciences in general.

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1.8 Limitations of the Study

They are those conditions beyond the control of the researcher that may place restrictions on the conclusions of the study and their application to other situations (Best and Khan, 2006).

There are a lot of junior high schools in the country and as such it may not be easy to carry out the study in all the schools in the short time at the disposal of the researcher and also due to the financial constraints'.study is also limited to only teachers and pupils in the selected schools which may not be the true reflection of the study.

Also, teachers for fear of laying bare their weakness in terms of their competence in handling integrated science in question may feel reluctant to provide honest and truth responses.

1.9 Delimitations of the Study

Delimitation refers to the scope or confines of the study

Study is limited to some selected Junior High Schools pupils and their science teachers in Kadjebi District. Teachers and pupils content knowledge area of the subject matter were not determined in the study. For this reason, items on personal sensitive issues were excluded from the instruments used for the study.

1.10 Definition of Terms

Teaching: This is an act of imparting knowledge to or instruct someone as to do something or teaching is the act or process of helping a learner to acquire information (knowledge and skills)

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Learning can be defined as the activity or process of gaining knowledge or skill by studying, practicing, being taught, or experiencing something (Merriam-Webster dictionary).

Stellenbosch university researchers (1999) defined teaching as engagement with learners to enable their understanding and application knowledge, concepts processes. It includes design, content, selection, delivery, assessment and reflection. Effective teaching: is a process by which a teacher adopts all the possible skills or method used in teaching in the classroom to make sure that students understand the lesson and be able to respond positively during evaluation and produce a good result.

Integrated science: It is defined as a cumulative approach of scientific study that synthesizes the perspectives of the individual's discipline and integrates them during all phases of the approach to a question or problem with the results having an influence on policy and management decision. It includes chemistry, physics, biology and agriculture.

In a publication of UNESCO (1973), integrated science is defined as an approach to the teaching of science in which concepts and principles are presented so as to express the fundamental unity of scientific thought and avoid premature or undue stress on the distinction between the various scientific fields.

Integrated science brings together many inclusive aspects of science that will encounter in the high school science core curriculum.

Status:the position or rank of someone or something when compared to others in a society,organization,group etc.It is the current state of someone or something. (www.britannica.com)

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The status of teaching and learning integrated science is defind the current state of teaching and and learning of integrated science.

Descriptive survey:is atype of research that uses survey to gather data about varying subjects. It collects data about the research problems.

1.11 Abbreviations

BECE :Basic Education Certificate Examination.

CoE :Colleges of Education

CRDD :Curriculum Research and Development Division

GES:Ghana Education Service

ICT :Information and Communication Technology

IAEP: International Assessment of Educational Progress.

JHS :Junior High School

MOE :Ministry of Education

MoESS :Minitry of Education Science and Sports

SHS :Senior High Scool

SSCE :Senior Secondary School Certificate Examination

SMT :Science Mathematics and Technology

TLMs :Teaching and Learning Materials.

UNESCO :United Nations Educational,Scientific and Cultural Organization

WASSCE :West African Senior Secondary School Certificate Examination.

1.12 Organization of the Report

This record of study is organized into five chapters. Chapter I provides the background of study, the statement of the problem to be researched, purpose of the study, objective of the study, the research questions, and the significance of the

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study.This follows by limitations and delimitations of the study. Chapter II consists of a review of literature that provides a comprehensive background for the study in terms of the nature of integrated science teaching and learning in JHS, issues regarding teachers' content knowledge and pedagogy, academic and professional qualifications of integrated science teachers, availability of resource materials, teaching and learning environment, teacher professional development, content of JHS syllabus, students attitude towards the learning of integrated science, intervention teaching and learning of science, integrating technology into teaching and learning of science. The literature review also includes challenges that teachers face in the teaching of integrated science, conceptual and empirical frameworks. Chapter III details the methodology and techniques used to carry out the study: the type of research and design selected for the study, target population, sample size, sampling techniques, research instruments, data collection procedures, data analysis procedures, validityand reliability of the main instruments. Chapter IV includes the results of the study and interpretations. Chapter V contains a summary and discussion of the results of the study, as well as conclusions and recommendations.

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CHAPTER TWO

LITERATURE REVIEW

2.0 Overview

This chapter reviews relevant literature on the status of junior high school science teaching and learning. These review are discussed below:

2.1 Conceptual Framework

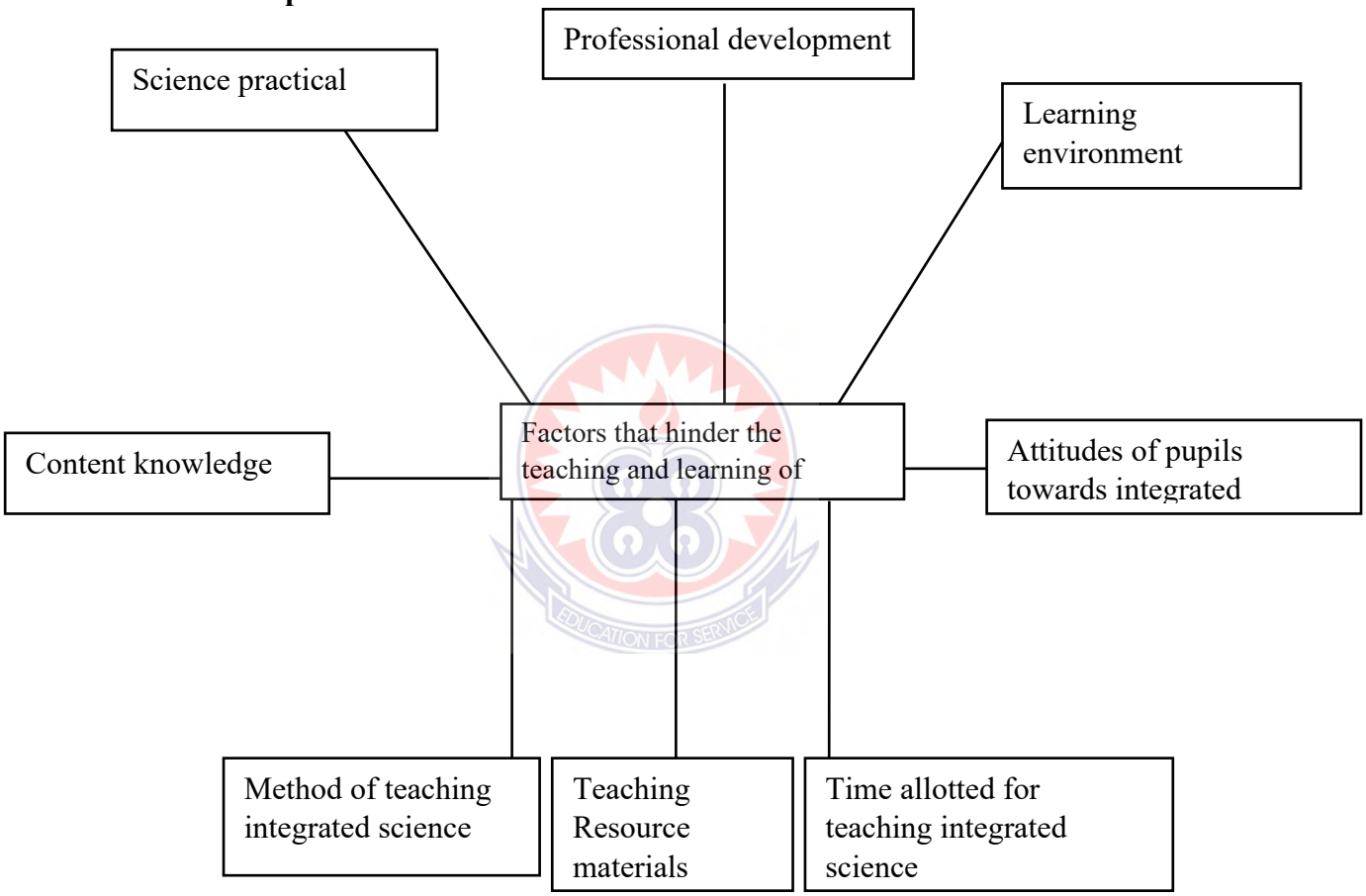

Fig 1: Diagrammatic form of conceptual framework

Handelsman et al. (2004) reported that some teachers are intimidated by the challenge of learning new instructional strategies and therefore resist any change in their respective instructions. Wieman (2008) in his presentation revealed that the issue with science education is for teachers to develop a mind-set that their instruction should be deployed in a similar way with all the rigor and standard as scientists conduct scientific research.The poor performance of pupils in integrated science could be

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traced to certain factors that hinder the teaching and learning of integrated science in JHSs.Indequate content knowledge of teachers,lack of (or inadequate) science practical,inadequate teaching and learning resources,teaching method etc are factors that affect teaching and learning of integrated science. Fig.1 above represent conceptual framework for the study.The above factors are discussed into detailed below.

2.1.1 Content Knowledge

Teachers with inadequate content knowledge find it difficult to interact with pupils when teaching integrated science. Content knowledge is defined as a teacher's expertise in the subject that is taught (Shulman, 1987). Kennedy (1998) has suggested that there are two dimensions to content knowledge – quality and quantity. Through optimum content knowledge it is expected that students will ask questions that go beyond the prescribed science curriculum (Kennedy, 1998). Therefore, a large amount of content knowledge should be in place to accommodate students. Quality content knowledge goes beyond surface level knowledge and addresses students' deeper and more complex understandings (Kennedy, 1998).

Additionally, research from Ball and MacDiarmid (1990) cautioned about the harm can do if they do not possess accurate content knowledge, as they may pass these inaccurate ideas to their students. They stated, "Subtly, teachers' conceptions of knowledge shape their practice-the kinds of questions they ask, the ideas they reinforce, the sorts of tasks they assign" (p. 639). This is alarming when research shows that teachers' knowledge of content and pedagogical knowledge are linked to student achievement (Monk, 1994).

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In their work on teacher management of subject matter knowledge, Newton and Newton (2001) suggested that teachers with incomplete subject content knowledge tended to interact less with their students and ask them fewer questions. However, teachers with a better understanding of science content asked more challenging questions and interacted more with their students, and these interactions included opportunities for students to participate in content-related dialogue (Newton & Magnusson et al. (1999) describe pedagogical content knowledge for science teaching as the transformation of several types of knowledge not only subject matter knowledge. These knowledge areas consist of five components which include orientation toward science teaching, knowledge and beliefs about the science curriculum and assessment in science, knowledge about students' understanding and misconceptions of specific science topics and knowledge about instructional strategies for teaching science or topic specific pedagogy.

Pedagogical content knowledge develops with teachers' experience (Abell, 2008; Davis, 2007). It is a cyclical process whereby teachers transform, reflect and evaluate their practices and continue to learn as they develop their practices. Pedagogical content knowledge is also content–specific or subject-specific knowledge that is fundamental for effective science teaching (Magnusson et al., 1999). Subject-specific knowledge entails general strategies applicable to teach science. Content-specific strategies, such as illustrations, models, analogies, experiments and activities are required when teaching particular topics within a science field. This implies that teachers need to develop different instructional strategies when teaching integrated science (one of the components of pedagogical content knowledge). Having an in-depth knowledge of the subject matter helps teachers provide alternative explanations or use different approaches to help students understand complex scientific concepts.

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2.1.2 Science Practical

One of the factors that hinder the teaching and learning of integrated science is lack of practical activities. Integrated science teaching without practical makes it difficult for pupils to understand the concept.

Practical work is an essential component when it comes to the study of science. It is based on the assumption that learning by doing is the best for acquiring scientific skills. Practical work is viewed by the vast majority of science teachers as an essential and integral part of science education. In fact, many regard it as an indispensable aspect of being a science (Dolly, 1998 from review practical work effectiveness in primary/secondary schools Abraham).'Any science teaching and learning activity which at some point involves the students, working individually or in small groups in observing or manipulating objects to build up understanding (Millar, 2009).

Science without practical is like swimming without water (Score, 2008). Researchers suggest that real-life application may be a way to engage students interest inscience (McComas, 1996).

Practical teaching is defined as the process of carrying out activities that provide students with experiences that can induce learning (National Research Council, 1997; Smith, 2007). One may say that science teaching takes place when the teacher organises a series of practical experiences in scientific activities, the intention of which is to make students learning new knowledge, acquire skills and competence in science.

Many studies provide evidence supporting the idea that students' interest is enhanced by their involvement in real-world science projects and investigations (Barron et al,1998; Hallinger, Leithwood & Murphy, 1993; Siegel & Ranney, 2003). When

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teachers make science lesson more meaningful, relevant, enjoyable, interst and challenging, students have a higher intrinsic motivation to learn (Brophy, 1987; Cimer, 2007; McCombs, 2011).

Forsyth and McMillan (1991) emphasize that variety in teaching activities revitalizes students' involvement in the course and their motivation. Practical activity is important as it enhances the understanding of the science concept.

Student engagement in science instruction takes different forms throughout the literature. Those forms include active participation in scientific observations and experimentation (Genesee et al., 2006).

2.1.3 Methods or Strategies used in Teaching Integrated Science

To make teaching interesting, enjoyable and knowledge transmission, teachers should apply appropriate teaching methods that best suit specific objectives and level exit outcomes. Several studies conducted on teaching methods in many parts of the world have demonstrated that teaching methods impact students' performance. For example, in USA (Haas, 2002), Nigeria (Asikhia, 2010, Bategek22, 2012) and (Luntungan, 2012).

Teaching methods are used to impart knowledge to students, they are the means by which teacher attempts to impart the desired learning or experience (Ndirangu, 2007). There are many methods of teaching integrated science at the junior high schools. No single method can be said to be enough to be used in the teaching and learning of integrated science in junior high schools. Shield (2002) pointed out that good teachers follow no one method; instead, he/she uses whatever method and materials seem to be the right materials for the teaching and learning of integrated science. The questions

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about effectiveness of teaching methods on students learning have consistently raised considerable interest in the thematic field of educational research (Hightower et al.,2011). Quite remarkably, regular poor academic performance by the majority students is fundamentally linked to application of ineffective teaching methods by teachers to impact knowledge to learners (Adunola,2011). Adunola (2011) maintains that teachers need to be conversant with numerous teaching strategies that take recognition of the magnitude of complexity of the concepts to be covered. For effective teaching and learning to take place, different methods of teaching must be employed and it must be students' centeredness. For the purpose of this study, some of these methods of teaching science are discussed below.

2.1.3.1 Inquiry-based method

Inquiry-based learning grounded in constructivism means a transition from traditional teaching styles to more active mode of learning and teaching. In inquiry-based instruction, learners are active participants in their learning process by asking questions, discussing ideas, reflecting on observations, investigating of events and teachers are facilitators of students' learning (NRC, 1999; Prince & Felder, 2007; Von Secker & Lissitz, 1999)). In general sense inquiry is defined as:

A student-cantered pedagogy that uses purposeful, extended investigations set in the context of real-life problems as both a means for increasing student capacities and as a feedback loop for increasing teachers' insights into student thought processes (Supovitz, Mayer & Kahle, 2000).

In such classrooms, students are presented with a challenge (such as "authentic" question to be answered, an observation or data set to be interpreted, or a hypothesis to be tested), and they accomplish the desired learning outcome in the process of

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responding to that challenge (Prince & Felder, 2007, p. 14). In order to solve the given task, students plan and conduct their own investigations, use suitable tools and techniques to collect data, think logically and critically about relationships, construct and analyse alternative explanations and solutions, and finally, communicate on findings in terms of scientific arguments (Johnson, 2006). State differently, in these environments students could find solutions to authentic problems by asking questions, gathering and analysing data, making conclusions and presenting their findings (Engeln et al., 2013, Krajcik et al, 1998, Puntambekar, Stylianou, Goldstein, 2007). In that way, learners construct their own solutions; learn through inquiry rather than obtaining information automatically (Holbrook & Kolodner, 2002) which leads more to the understanding of the concept (Sweller, & Clark, 2006). Pedaste and Sarapuu (2012) stated that inquiry helps students to grasp the idea on what science is about and what scientists are doing effective learning experiences (Kirschner, Sweller, & Clark, 2006). Pedaste and Sarapuu (2012) stated that inquiry helps students to grasp the idea on what science is about and what scientists are doing.

Bybee (2006) described the features of inquiry in the science classroom as:

- Learner engaged in scientifically oriented questioning,
- Learner gives priority to evidence in responding to the question,
- Learner uses evidence to develop an explanation,
- Learner connects the explanation to scientific knowledge, and learner communicates and justifies the explanation (p. 9).

Using inquiry-based method of learning takes a lot of time, energy, and planning but it is very effective. This teaching method is extremely student-cantered and student-directed, and can be modified for students at any level, reaching them where they are.

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Inquiry-based learning also promotes collaborative social skills (Zion et al., 2004).The current integrated science curriculum developed by CRDD of Ghana Education Service (2010) encourages the use of this approach. Scientific inquiry is crucial for defining the characteristics of scientifically literate persons (Ogunmade, 2005).

The use of inquiry in the classroom emphasizes true learning occurring through students' ideas, questions, and understanding (Fosnot, 1996; Wu & Tsai, 2005).

2.1.3.2 Activity-based method

Akpan(1992) articulates that activity methods of teaching offer the students the opportunity to interact with materials so as to develop self- reliant personality. Science is activity-based subject and effective science learning is by doing. Koranteng (1998) explained that the activity methods of teaching and learning is learner centred approach as it places the learner at the centre of teaching and learning process.

According to Farrant (1985), nothing is learnt unless we are actively involved in it.This presupposes that for learning to take place, the learner must be actively involved in the teaching and learning process.

The activity –based method is a method of teaching in which the learner is placed at the centre of teaching and learning process, made to interact with the materials (provide either by the teacher or the students) to discover concepts and facts unaided or with a minimum of teacher interference (Mensah & Nartey,2001).

From the views of various experts on activity method, the researcher can conclusively say that the activity method is the learner- centred where the learner is placed at the centre of teaching and learning process. The primary or ultimate aim of teaching and

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learning science in JHS can be achieved only through the use of activity based method as learner learn through first-hand experience by interaction.

2.1.3.3 Demonstration method

Erinosho (2008) explained demonstration method of teaching and learning science as the teacher showing students a procedure or the students showing a procedure to one another.

Asafo-Adjei and Koranteng (2001) defined demonstration method as the method of doing something in the presence of other in order to show them how to do it or to illustrate a principle. They said that demonstration can be presented by a student, a teacher and a resource person.

Enemali(2010) described this method of instruction as showing procedure to explain, teach and inform students while Arubayi (2009) described demonstration method of teaching as a visible presentation of ideas, skills, attitudes, processes and other intangibles. Demonstration is a practical display or exhibition of a process and services to show or point out clearly the fundamental principles or action involved (Kimweri, 2004). Demonstration helps learners get the actual experience of what they are learning and interesting to learners and thus promote their attention and retention. Demonstration is more appealing when used with a group that has a limited number of learners.

2.1.3.4 Cooperative learning

This is a method of teaching considered highly effective when it is done correctly. With this method of teaching, students are put in small groups to work together. The students are then given tasks to accomplish together. The teacher monitors each

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groups carefully to make sure they are performing the task and that all students are participating. This form of method lends itself well to differentiation, because the teacher can assign specific tasks to students at different ability levels (http://www. wisegeek.com).

Cooperative learning improves students achievement and enhances students enjoyment of and attitudes towards learning science (Springer & Stanne, 1999; Lord, 2001). Cooperative learning works, because it is active, student centred and social (Johnson & Johnson, 1998).

Cooperative learning activity involves reading, writing, planning experiments, designing questions and solving problems. This multiyered approach towards students' interaction with the content improves understanding and retention. Since cooperative learning shifts emphasis from the instructor to the students, the later opportunities to build social support networks and to learn and practice many skills such as leadership, communication, inquiry and respect for diversity (Lord, 2001).

The development of social relationship and skills help students to build confidence in learners and to build trust in their team mates. This leads to improved attitudes towards the subject often to retention of underrepresented populations in science programmes.

Peer tutoring is a type of cooperative learning. It is a personalized system of instruction is learner centred rather than teacher oriented. Research has shown that this instructional strategy benefit both the students being tutored the tutor, although the tutor is associated with greater cognitive gains than the student being taught (Annis, 1982; Bargh & Schul, 1980; Lambiotte, 1987). It has been observed that when

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integrated science lessons are done in groups, students are allowed to make valuable decision which together lead to a satisfactory accomplishment

2.1.3.5 Discussion method

Discussion method is an important component for any teaching or learning situation which allows students to share their ideas (Ndirangun, 2007). It can be used at the beginning of a lesson to ascertain students preconceived motion of the subject matter or towards the end of a lesson by presenting students with a new situation and asking them to explain it in terms of what they have just learned. Discussion group method entails teaching and learning strategy through sharing and exchange of ideas, experience and opinion takes place, accompanied by active learning with all members of the group participating in it (Kimweri, 2004). Discussion can be instructor centred (students answer the instructor questions) or student-centred (students address one another and the teacher mainly guides the discussion toward important points). In any case, discussion sessions more productive when students when students are expected to prepare in advance. Focused discussion is an effective way for many students to develop their conceptual framework and to learn problem solving skills as they try out their own ideas on other students and the teacher. The give and take of technical discussion also sharpens critical and quantitative thinking skills. Discussion method increases the depth of understanding and grasp of subject matter, enhances motivation and generate greater involvement of the learners, promote leadership role skills, develop skills of organizing and presenting in logical form and develop spirit of cooperation among learners (Kimweri,2004)

However, there are some short falls in this method of teaching. It is time consuming, it requires more skills from the teacher and less predictable.

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2.1.3.6 Project method

This method came into existence as reaction against the former, purposeless and monotonous method of teaching science in which there is no link between the knowledge imparted in schools and activity outside the classroom. The method consists in building up a comprehensive unit of connected fact around a central theme which may be some matter of scientific interest, a scientific principle or theory or topic of immediate interest to the students. The central theme is so chosen that its pursuit provide all sorts of activities inside the classroom as well as outside. A project is usually defined as a piece of whole-hearted and purposeful activity to completion in its natural environment.

Essentially, the method is based on the fact that students learn through association, activity co-operation. The students also learn related science besides learning science. The teacher acts as a guide and leads the students by putting questions at the right to find the fact and principles themselves. Such a project may be chosen from any fields of science. Careful planning and organization of the connected experiences can impart a wide variety of knowledge even through simple projects.

The project method is a suitable method for teaching science in elementary classes. Planning and carrying out a project involves much more work on the part of the students than the traditional method of teaching science.

A project helps to widen the mental horizon of the students. They realize that the use of science is not for the benefit of purely science interest students experience this when they go out to the actual site of the project outside the school. It is convenient in this method to choose scientific themes of common interest to the students and also of use to the community. In such a topic, the interest of the students is spontaneous.

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Within the framework of the same schemes, task can be provided to suit the students of different tastes and aptitudes. This method helps to correlate school life with outside world and bring students in direct contact with the real situations. Such an experience enables to make a realistic approach to the other problems as well. The method develop a sense of responsibility, self-activity, initiative and eagerness to learn more. It also makes them careful and accurate observers. The method inculcates the habits of creative thinking and organizing knowledge in a scientific way. In such a project students learn a good deal about science and also get first-hand knowledge of facts and materials. In pursuing a project, the students realize the importance of theoretical knowledge needed for practical work.

2.1.4 Resource materials for teaching

Lack of or inadequate teaching and learning materials makes the lesson boring and difficult for pupils to undertand. Muriithi et al (2004) from their paper on resources and facilities for teaching and learning define a resource as any source of information or support that the teacher uses to make teaching more effective and meaningful to the learner. A facility provides the teacher with conducive environment in which to carry out effective teaching.

Research indicates that most teachers of integrated science did not use textbooks prescribed by Ghana Education Service and some of the information gather from the textbooks are not correct. Some of these textbooks lack illustrations and carry wrong information making it difficult for students to understand science concepts.

A laboratory is an instructional for an effective science programmed where development of scientific skills and attitudes are greatly facilitated. It is an important facility in a school and if present it should be well equipped with facilities that will

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enhance the teaching and learning of integrated science. The challenge of lack of resources and mini laboratory in the schools is a matter of concern worldwide. The laboratory is an indispensable tools in the teaching of science which provides students with a place or setting to attack and solve problems, collect data, prove ideas and carry out investigations which emphasize learning by doing.Arubayi (2003) summarized the major objective sought in the laboratory work, as the development of skills, concepts, cognitive abilities and understanding of the nature of science. Skills such as manipulative, inquiry, investigation, organizational and communicative can be developed from laboratory experience.

The lack of resources such as textbooks, physical infrastructure and laboratory equipment have led to the learners losing interest in the subject and hence poor performance(Mwenda et al., 2013; Muwanga-Zake, 2000; Makgato & Mji, 2006; Amukowa, 2013: 105; Mwaba, 2011:33).

Availability of teaching and learning materials for teaching integrated science plays an important role in the teaching of integrated science. Many scholars (Bajah,1986; Akinwumji and Orimoloye,1987) contended that the availability of physical and materials resource is very significance for success for any worthwhile educational endeavor. These researchers agreed that the availability of adequate teaching and learning materials and laboratories for science teaching are imperative for attainment of any educational objectives. Adequate provision of instructional materials is an important that science teachers can use to promote skills acquisition by students (Eshiet,1987). Teaching and learning materials enhance the understanding of the concept and make the lesson lively and real. Adequate and appropriate use of instructional material ensures effective teaching and learning of science. Adequate

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instructional materials and strategies give students the chance to use their senses of hearing, smelling, tasting, seeing, and feeling (Opara & Etukudo, 2014).The benefits of the use of instructional materials in teaching and learning of science cannot be overemphasized. This is because as pupils become involved in science activities with the materials they understand scientific concepts better and ultimately improve their performance.

2.1.5 Time allocation for practical activities/science lessons

Time is a resource which is not renewable and finite. Most science teachers overlook the use of teaching and learning materials because of inadequate time allocated for teaching and learning of integrated science and the number of topics to be covered. Matthew (1989) is of the opinion that a pupil level of attainment was directly related to the period actively spent on leaning. The finding was also supported by the international assessment of educational progress [I A E P] projects in 1991/1992. The integrated science curriculum for Junior High Schools Advocated for seven period of forty (40) minutes for a period in walk through the idea of time allocation was clearly spelt in the syllabus, most junior high schools did not follow it. This inadequacy of lesson time for integrated science perhaps has forced teachers to teach without demonstration. Fisher and Fraser (1990) gave two ways by which time for subjects can be allocated in curriculum. The two ways were time allotment in periods and allotment of time to the subjects, taking into consideration the number of activities involved in the teaching and learning of subject. Kraft (1994), in his view, saw the amount time spent on the basis of language and mathematics as a critical factor in the achievement level of the students in integrated science. Kraft's study which was focused on primary education, gave insights into time allocation and use in our schools.

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2.1.6 Attitudes of students towards integrated science

Osborne et al. (2003) defined attitudes towards science as the feelings, beliefs and values held about an object that may be the enterprise of science, school science, the impact of science on society or scientists themselves**.** Students' poor attitude and interest towards school science is an issue identified across the world (Adu-Gyamfi, 2013; Fensham, 2008; Hallack & Poisson, 2001; UNESCO, 2010). In some instances, students' lack of interest in science is associated with the use of science to select a small fraction of elite students at the early ages to become science specialists and in Malaysia,

Students' lack of interest in science is associated with scarcity of well-paid jobs for science Professionals (Hallack & Poisson, 2001). The teachers acknowledged that one of the challenges of teaching science at the JHS level was the students' attitude toward science. It was common that one of the students' attitudes towards learning science was that they perceived Integrated Science as a difficult subject with respect to the other subjects they study at the JHS level.

The investigation of student's attitudes towards studying science has been a substantive of the work of the science education research committee for past years. Its current Importance is emphasized by the now mounting evidence of a decline in the interest of Young people in pursuing scientific careers. (Department of Education, 1994; Smither and Robbins, 1988) combined with research indicating widespread scientific ignorance in the general populace (Durant and bauer, 1997; Durant & Thomas, 1989; Miller, Pardo & Niwa, 1997) and increasing recognition of the importance of scientific knowledge and its Cultural significance the falling numbers choosing to pursue the study of science has become a matter of considerable societal

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concern. According to Anamuah-Mensah (2004), there are many reasons for this situation of Ghanaian students' failure and ambivalence in science education. Anamuah-Mensah considers over-dependence on the chalk-and-talk instructional approach as a major cause for students' disinterest and failures in science learning. Other uncreative and traditional methods of teaching and learning are textbook dependent teaching and learning; examination-oriented teaching; learning by rote memorization; lack of science practical work in most schools; and even where they are done they are designed in a cookbook manner to confirm known answers, as well as the use of de-contextualised curricula.

Student's negative attitudes towards integrated science could be traced to the way teachers approach the teaching of science making it difficult for them to understand the science concepts. Some teachers teaching integrated science have inadequate knowledge about the pedagogical content. They find it difficult to explain certain scientific term and concepts. The methods or strategies that some of them Employed in their teaching also made it difficult for students to understand integrated Science. Few of these teachers result to lecture method instead of demonstration and activity method that would enable students to be actively involved in the teaching and learning process. Students who are not actively involved in teaching and learning science always developed negative notion that science is difficult and therefore have no interest in Pursuing science in senior high level.

2.1.7 The teaching and learning environment

Learning environment plays vital role in the success of learning process. Research conducted by Fraser (2002) showed that learning environment do not only have positive correlations with the student's outcome, motivations and attitudes but also

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teacher's motivation. According to him, the factor that contributes most to self-evaluation is the learning environment. Such an environment allows students to synthesize, explore, criticize and create their own concepts about learning. Consequently, science teachers are expected to create an environment conducive for students' active questioning and identification of issues and answers by employing appropriate instructional strategies (Dass &Yager, 2009). Effective learning will take place if the classroom environment is well structured. This is done through proper introduction of the delivery and the teaching strategy that will involve and arouse student's interest. The classroom, laboratory and the school environment can be made conducive to teaching and learning of integrated science through improvisation of materials by teachers when standard Laboratory equipment are not available.

2.1.8 Professional Development of Teachers

Continuous teacher development is pivotal for any country's discourse on labor force and capacity building. Professional development programs are systematic efforts to bring about change in the classroom practices of teachers, in their attitudes and beliefs, and in the learning outcomes of students (Guskey 2002).

According to the thesaurus of the Education Resources Information Center database (Houston, 2001), professional development is described as a process by which educators increase knowledge, skills, and abilities to meet professional goals. Fullan and Steigelbauer (1991) broaden the definition to include the sum total of formal and informal learning experiences throughout one's career from preservice teacher education to retirement.

Providing growth opportunities for teachers is a sure way to make them relevant for the job market. If teachers are to develop as agent of change, the focus must be on

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their cognitive, moral and competence, as well as their pedagogical and management skills. Ensuring a consistent lifelong development of the teacher means ensuring that the school system is on its way to achieving 'going concern'.

As suggested by Mensah and Addah (2016), teacher professional growth is a critical element in revamping education outcomes and therefore should not be underestimated in building teacher 'capacity in the school system. Any effective professional development in the likes of what Ghana intends to roll out enables teachers to think and act faster in solving problems with skills learned through collaborative efforts. Any effective professional development program for teachers is one that sees teaching learning as a collaborative venture and not just a mere series of presentations. Darling –Hammond (1999) suggested that there is a linkage between higher improve learning outcomes and teacher involvement in consistent formal professional growth programs that is geared towards context-specific pedagogy. This implies that learning is enhanced when teachers are seen as critical stakeholders in advancing new and improved ways of doing the things which will invariably lead to new results

Continue development of a teacher is very important to update his or knowledge and teaching skills. This continue development include such things as attending workshop, participation in professional organizations, continuing education, enrollment in training programs and research institutions. Professional development is geared towards improving an area 'in need of improvement 'from a previous one.

Numerous programs have been developed to aid teachers professional development regarding science and technology education(e.g, Akerson et al, 2009, Berry et al.2009,Van der valk & De Jong 2009, Banerjee 2010). For example, such programs have focused on the use of scientific modelling to improve teachers views of the

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nature of science and inquiry(Akerson et al,2009),or have used reflective approach to aid teachers and elicit rich insights into their teaching and their students learning of science (Berry et al, 2009).

Staff training and ongoing professional development are essential components of effective schools for JHS students (Supovitz & Turner, 2000). Research emphasizes the positive relationship between quality professional development and an increase in the use of inquiry based instructional practices in science instruction (August, Beck, Calderon, Francis, Lesaux, & Shanahan, 2008; Darling-Hammond, 1996; Supovitz & Turner, 2000). The intent of professional development is to provide teachers with tools and resources needed for quality instruction, so that learners may acquire a deep understanding (Buczynski & Hansen, 2010).

Professional development of teachers is considered the most effective way to improve the teaching process and thereby improve student achievement (Eun, 2008; McKenzie et al., 2011). Instructional leadership, as it sets a vision for its teachers in terms of effective pedagogy, is becoming more responsible for not only determining topics of teacher trainings, but also for delivering these trainings. Therefore, instructional leadership, should be aware of the characteristics of quality professional development. However, more importantly, leadership should also be cognizant of the importance of having professional development which is focused on specific areas of instructional practice. Training must also meet varying teachers' needs and experience, as well implement instructional strategies that support and respect the adult learner. Campus leadership must also understand that fruitful professional development does not occur as part of an isolated event. These leaders should ensure structures are in place for continuous teaching training in order to support sustained change in instructional

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practices. As evidenced by the results of this study, traditional models of professional development will not effectively equip teachers with the knowledge and skills necessary to meet the instructional demands of junior high classroom. The challenge for campus leadership is to not only provide these optimum conditions for professional growth, but as McKenzie et al. (2011) suggested in their work on high achieving urban high schools, to shield their teachers from all the unproductive practices that do not result in long lasting student achievement. As instructional leaders who provide the professional development, it is the leaders 'charge to provide meaningful and relevant quality learning experiences with a goal of growth for both teachers and students (Mckenziel et al,2010)

Professional development is essential to achieving the dual goals of promoting high academic achievement while simultaneously pursuing educational equity for diverse student groups (Lee, et al, 2007). In fact, research has documented incidents where professional development could have made a difference in circumstances where teachers used strategies that appeared to be ineffective in the JHS classroom (Akerson & Hanuscin, 2007; Buczynski & Hansen, 2010). Therefore, the school leader should work to attain current and substantial knowledge about trends in effective professional development and should be engaged in ongoing professional development activities (González, 1998).

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However, research points out clearly that teacher development lacks the consistency it deserves as well as a thought out plan in making it achieve its intended purpose after initial training from the colleges of education.Acheampong & Furlong (1999) stated that even if there is any growth program at all, it is in the form of the train –to-train model where head teachers and the circuit supervisors are given some form of training and are expected to give the same to their subordinates. Such training workshops normally focus on new reforms or areas of the curriculum which they might have never studied in the detail during their initial teacher training programs. These discrepancies are the cause to low growth in teacher professional competence (Acheampong & Furlong, 1999).

2.2 The nature of the JHS Integrated Science Syllabus

The Ghanaian JHS Integrated Science Syllabus had a goal of inculcating scientific literacy and culture in high school students to enable them make informed choices in their personal lives. It was further aimed at producing competent professionals in various scientific disciplines at other levels of education (Ministry of Education [MOE], 2012; Ministry of Education, Science and Sports [MOESS], 2007). The syllabus has been organised into five sections as diversity of matter, cycles, systems, energy, and interactions of matter. All the five sections were carefully structured for the three-year programme to help achieve the two main goals of teaching Integrated Science at the JHS level. Under each section for each year group, there were general objectives from which specific objectives and corresponding content were outlined. Teachers teaching JHS Integrated Science were expected to devote 20%, 40%, and 40% respectively to Knowledge and Comprehension, Application of Knowledge, and Experimental and Process Skills in their teaching, learning and testing (MOE, 2012; MOESS, 2007). This is an indication that the planners of the syllabus require teachers

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to emphasize much on teaching, learning, and testing in the dimensions of application, experiment and process skills which could help to attain the goals of the syllabus.

The topics in the syllabus were carefully selected and developed to meet the aims and objectives of the syllabus. Almost all the teachers were of the view that the topics in the syllabus which seemed difficult and lengthy were broken down to meet students' growth and maturity.

Matter was a perfect example here as aspects of it were treated every year for the three-year period. However, topics such as introduction to Integrated Science, hazards, measurement, acids, bases and salts, machines, and water are treated and completed in only the respective year selected for such topics. Notwithstanding these observations made by the teachers from the syllabus, the teachers were unanimous in saying that the teaching the syllabus depends largely on the characteristics of the students.

The teaching of Integrated Science at the JHS level was considered generally as an interesting thing to do by the teachers. Reasons given by the teachers as to why it was interesting to teach science at the JHS level included the opportunities given to the teachers to train students at this level; teachers' interactions with students on some scientific concepts which students have prior knowledge and experience of, students sharing of scientific knowledge and experience with colleague students as well as their teacher; students' interactions with materials in learning the scientific concepts and students' reactions after sitting for their final examinations.

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2.3 Teaching and Learning of Integrated Science

Teaching and learning are not separate entities but should be interpreted and planned to enhance quality learning (Biggs, 2003). In an efficient school system "all aspects of teaching and assessment are to support high level learning" (Biggs, 2003). Teaching and learning of integrated science are inter-related activities that bind the teacher and the students together. Science teaching and learning would be expected to concentrate on learning outcomes that would contribute to scientific literacy. Teaching becomes meaningful when the child is placed at the center of learning process. Teaching and learning goes on well when the learning environment is structured. Teachers are expected to organise educational setting to facilitate learning. Science teaching is not well understood if the teacher did not take students through variety of activities such as experiments, demonstration, explaining concepts, moderating discussions and solving problems. Teaching activities are carried out with intention to facilitate learning. Integrated science teaching is a task which requires that teachers develop new conceptual structures for science topics they teach so that students can understand the concepts. Teachers should provide ample opportunities for students to engage in a variety of learning experiences. The activities of the teacher connote teaching because they aimed at facilitating the intellectual understanding of science as a subject. Likewise student's activities that result in gaining knowledge ability constitute learning. One may say that science teaching takes place when the teacher organises series of practical experiences in scientific scientific activities, the intention is of which is to make students to learn new knowledge and acquire skills and competence in science.

A lot of research in teaching and learning of science education point to the fact there is the need to adopt interative and more engaging methods in teaching the subject to

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make it more meaningful, arouse and sustain student's interest in studying it and improve their performance (Akpan, 1992; Anderson, 2006; Jenkins & Nelson, 2005; Namrata, Amrita, & Singh, 2014; Antwi, Anderson, & Sakyi- Hagan, 2015). The studies clearly shows teaching method used by the teacher have an impact on the students'performance and the medium of instruction also impacts on students' performance (Senkoro, 2004 & Canton, 2007). Teaching methods used in the class have imperative role in the learning and producing skilled and knowledgeable students.

Not all teaching results in learning. For example, a teacher might anticipate that certain activities will make students to learn'if the teacher use plane mirror to teach reflection of light', but cannot guarantee that learning actually occurs if, despite the instructional experiences, the students unable to perform related tasks effectively (Adu- Gyamfi, 2013).

How well learning takes place depends on the quality of teaching and quality of teacher's interaction with the students (Lowman, 1995; Black & William, 1998; Stiggins, 1999).

The current approach to integrated science teaching in most JHS is often based on classroom and laboratory work which are intended to meet examination requirements. Unfortunately, the examination –driven mode of integrated science teaching has limited the practical teaching of science and the technological aspect of it. Not only does the approach tend to make the study of science uninteresting, boring and unenjoyable. Students also find it difficult to relate the theoretical knowledge with the practical realities of life and the use of manipulative skills. Most junior high school teachers result to the use of chalk and talk method of teaching which makes it difficult

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for students to understand the concept taught. As aresult of this,students therefore learned what is taught by rote without understanding the the topic.

Science teaching should bring about the three domains of learning among students. It is important therefore, that a teacher approaches every teaching context by stating explicit behaviour changes that are intended for students, and selecting relevant activities that will induce effective learning.

2.4. Empirical framework

The main empirical framework underpinning this study is the situated in cognition theory which emphasizes that people's knowledge is constructed within and linked to the activity, context and culture in which it was learned (Brown, Collins & Dugid, 1989). As people learn while interacting with each other through shared activities and through language, they discuss, share knowledge and problem-solve during these tasks (Hurst, Wallace, & Nixon, 2013).

Vacca and Vacca (2002) contend that we need to shift "the burden of learning from teachers' shoulders to students'. In this case students must be made to actively participate in the teaching and learning process. According to Hurst, Wallace and Nixon (2013), one way for students to shoulder the responsibility of learning is for them to be the readers, writers, speakers, listeners and thinkers in the classroom through active engagement in social interaction with others (Alvermann & Phelps, 2005; Vacca, Vacca, & Mraz, 2011).

In Hurst, Wallace and Nixon's (2013) research, they intimate that the main intent of cognitive apprenticeship, which has some similarity to Vygotsky's Zone of Proximal Development (Vygotsky, 1978), is to engage the learner in meaningful and

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constructive activities that encourage augmentation and preparation of new skills and conceptions (Moll, 1990; Newman, Griffin, & Cole, 1989). This theory has helped researchers understand more widely about how people learn because it has focused on what people learn in their everyday experiences, which are authentic contexts for a variety of skills (Brown, Collins, & Newman, 1989). In addition, it has also helped educators to understand how to capitalize on knowledge and skills that their students already possess in order to help them learn new content and skills. Therefore, in this study, the researchers employed highly interactive instructional approaches using multiple modes to help the students generate their own knowledge and apply the understanding to learning scientific concepts. The introduction of multimodal methods of learning helped the students to accomplish different levels of tasks through different degrees of skills, which also helped them to recognize that no one is an embodiment of expertise, and thus encouraged them to understand that learning is a continuing process (Vygotsky, 1978).

This study was also based on the constructivist theory of learning put forward by Piaget The theory is of the view that learners constructs knowledge from experience which is special to each individual. This suggests that learning is an active process in which the learner is physically and mentally engaged in constructing meaning from text or experiment. According to Novak (1998), learning outcomes depend on the learning environment as well as learner's prior knowledge. Learning involves reorganization and imaginative reconstructing of the conception or framework which learners are already familiar with. Learning is a continuous process, hence the need for appropriate teaching method. The study was also based on the view that knowledge is not ready made transferable product but rather a product of the learner's thinking (George, 1999).

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2.5. Intervention for Teaching and Learning integrated science

An intervention is defined as' a specified set of activities designed to put into practice an activity of known dimensions'(Fixsen, 2005).Intervention is used to refer to programmes and activities that aim to improve teaching and learning in order to raise achievement and improve learning experiences in science education. It includes activities designed to alter approaches to teaching and the ways in which the curriculum is implemented. When the intervention has been evaluated as having yielded the expected result, it can be considered effective within targeted populations and settings. Some of the interventions used to help students understand integrated science are discussed below (Fixsen, 2005).

2.5.1 Differentiation

Differentiated instruction allows teachers to cater for the individual learning needs of each students. This is particularly helpful in science classroom. As an example, a teacher could provide an inquiry-based activity for those students that grasp the concept, while at the same time provide individualized instruction to struggling students. This method allows for the fast learning students to deepen their content knowledge while simultaneously allowing the struggling students to receive the help they need.

2.5.2 Scaffolding

Scaffolding instruction is imperative for teachers with struggling students. Before moving onto the next lesson, take a few minutes each day to review the lessons of the past few days. Reviewing the previous lesson enhance the understanding of the concept better.This enable students who did not understand the topic taught first to understand. Reviewing lesson will remind the teacher whether students have

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understand the concept or not and this done through asking students question. Humans need to interact with content an average of three times before the content is committed to memory.

2.5.3 Types of learning styles

The three main types of learning styles are visual, auditory, and kinaesthetic/hands-on. Make sure you are diversifying instruction for students with all type of learning styles. Students with a visual learning styles will benefit from graphic organizers, while students with a kinaesthetic/hands –on learning styles will prefer activities such as total physical response.

2.5.4 Use Technology to incease engagement

Using technology enhances the understanding of the concept also and support the classroom instruction.It brings variety into the teaching and learning of science.

Students are more excited and motivated to learn when they have controlled over the learning process.Technology in the classroom allows them to do just that. For example,many online programs have virtual laboratories in which students can investigate science principles and manipulate different aspects of experiment, providing a way for students to investigate the concept for themselves.

Technologies provide new opportunities for accessing information, allow students to organize and edit that information for projects, and promote significant learning among students.

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2.5.5 Pedagogical Interventions

Pedagogical interventions provide teaching and learning strategies that are used to engage students in learning in order to improve their skills,knowledge and conceptual understanding.Bboth generally and in specific disciplines.

Example of pedagogical interventions rangedfrom small changes in the way a teacher uses questions to larger interventions that become adopted as policy.The former were uppermost in the mind of many of the teachers, who referred,for example,to the need for'wait-time'when asking pupils,questions,and the use of resources such as concept cartoons and barger tasks,among other things.These interventions were felt to be successfulwhen they helped to engage pupils with strting points in lesson or revision of ideas and topics.

2.5.6 Teach perseverance and provide encouragement

The most successful students are those who never give up,no mather how difficult the task at hand may be. Perseverance is a life long skill, but it can sometime be missing in students who are stuggling because these students may become easily discourage.The most important thing to teach your struggling students is to develop perseverance in students.Help your students prove to themselves that they can do anything they put their mind to as long as they keep working at it and never give up.The teacher can give example of scientist such as Isaac Newton, wright brothers, Marie and Curie etc have never given up.When struggling students become discouraged be sure to encourage them to keep trying.It is incredibly impotant to make learning a positive experience for students so that they will be self-motivated learners for the rest of their lives.

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2.5.7 The use of multisensory instruction

Multisensory instruction links together what students see,hear,do and feel.Combining these senses during instruction can help students recall information.The total physical response activity falls into this category,as it combines students motions with verbal vocabulary. In a research by Picciano (2009), it was discovered that multimodal designs of teaching allow learners to experience learning in ways that they are more comfortable with, while challenging them to learn in other ways as well. To understand further the interaction between the senses and how teachers can capitalize upon this phenomenon in their classrooms.Mayer (2005) demonstrated the advantages of including as many senses as possible in the learning process. One of Mayer's experiments that exemplify this point involved three groups of people. One group received information delivered via one sense (hearing), another, the same information from another sense (sight), and the third group the same information using a combination of the first two senses. The results confirmed that the multisensory group did better than the unisensory groups. According to Mayer (2005), they had superior and more accurate recall and had better resolution, which lasted longer. Mayer (2005) further indicated that the benefits were not just confined to a combination of sight and sound. When touch was combined with visual information, recognition learning leaped by almost 30%, as compared with touch alone. Mayer (2005) contends that students learn more deeply from a combination of words and pictures than from words alone; known as the "multimedia effect".

Highly interactive multimodal learning environments allow instructional elements to be presented in more than one sensory mode. In turn, materials that are presented in a variety of presentation modes may lead learners to perceive that it is easier to learn and improve attention, thus leading to improved learning performance; in particular,

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for lower-achieving students (Chen & Fu, 2003; Moreno & Mayer, 2007; Zywno, 2003). This mode of learning according to Jewitt, Kress, Ogborn and Tsatsarelis (2001) also deepen students' understanding of scientific knowledge leading to enhanced grasping of concepts. Again, the interactive approach to teaching and learning enables students to accurately translate a concept from one mode to another easily (Lesh, Post, & Behr, 1987).

2.5.8 Integrating Technology into the Teaching and Learning of Integrated Science

Teaching integrated science using practical activities in the laboratory is very important but at times it can be challenging and time wasting as it calls for an advance skills (technology in science teaching). Technology integration is the use of technology to enhance and support the classroom instruction.

Owens et al. (2002) advocated that inquiry-based learning is not an innovative approach, but enrichment of this process with technology, especially computer and internet-related technologies play an important role in science teaching. These researchers supported the usage of inquiry-based teaching approaches enhanced with technology in that technology can stimulate students' curiosity and facilitate learning by providing a real world context that engages learners in solving complex problems. Furthermore, some evidence have been reported indicating that technological tools facilitate teachers' implementation of inquiry practices with the help of simulations, digital media, modeling tools, data analysis and interpretation programs, and visualization opportunities (Bell, Maeng & Binns, 2013; Lee, Linn, Varma & Liu, 2010). Owens et al. (2002) also pointed out that computer technologies provide new opportunities for accessing information, allow students to organize and edit that information for projects, and promote significant learning among students.

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CHAPTER THREE

METHODOLOGY

3.0 Overview

This chapter deals with the description of the procedures followed to conduct research. This include research design,target population,sample and sample selection technique,research instrumen*t*, validity of the main instrument,reliability of the main instrument, data collection and analysis of the data.

3.1 Research Design

The research design that was used in the study was the descriptive survey. This type of research describes and interprets what is concerned with issues, conditions and practices that exist, belief and points of views that are going on. According to Gay (1987), the descriptive survey involved collecting data in order to test hypothesis or to answer questions concerning the current status of the subject study.

The descriptive survey has also been recommended by Babbie (2001) for the purpose of generalizing from a sample of a population so that references can be made about characteristics, attributes or behavior of the population. The purpose of descriptive survey, according to Merriam (2009), is to collect detailed and factual information that describes an existing phenomenon. Since it is the purpose of the research to survey how integrated science is taught in the twelve junior high schools in Kadjebi District of Oti region, descriptive sample survey is considered the best. This design was chosen because it would give a clear picture of the situation on the ground to help obtained more information about a particular characteristic of the study.

The study was carried out in the Kadjebi District in the Oti Region of Ghana. The District has 48 public JHSs out of which six rural and six urban area schools were

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purposively chosen.A community is classified as urban or rural based on the classification provided by the Ghana Statistical Service (2002). A community with a population of <5000 is classified as a rural community, while a community with population of 5000 or more is classified as urban.

3.2 Population

The target population was made up of all integrated science teachers and pupils in junior high schools in Kadjebi.

3.3 Sample and Sampling Technique

A total of 132 pupils and teachers comprising 120 students and 12 teachers were selected as a sample size from the twelve junior high schools in Kadjebi District. The sample was also made up of 60 students from urban and 60 students from rural schools with 6 teachers each from both urban and rural areas.

A Stratified random technique was used to select third year students for this research. The final-year students were chosen because they would have had more exposure to the use of instructional materials in relation to the teaching and learning of Integrated Science. The selection was done equally irrespective of the students and teachers' population in each of the selected junior high schools.

3.4 Research Instruments

An instrument is any device used to collect data for a study. They include questionnaires, interview schedules, observation schedules and document analysis. Two instruments were designed and validated for data collection. These were questionnaire and observation schedule combined and it is most suitable for the purpose of triangulation.According to Cohen Manion & Morrison (2007),

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triangulation is the use of two or more methods of data collection techniques in a study

3.4.1 Questionaire

Wallen and Frankel (2001) recommended that questionaires are suitable technique for collecting data about phenomena that cannot be observed directly. A questionnaire therefore,has the potential of eliciting important information, in particular the views of the respondent. According to McMillan and Schumacher (1993), a questioaire is an instrument which is presented to solicit reactions, beliefs and attitudes.

A questionnaire was used to elicit detailed information on the current status of teaching and learning from teachers in the 12 selected schools of Kadjebi District. Some demographic information (e.g age, gender and year of teaching experience) was sought from the teachers.

The questionnaires developed are of two types. One for the teachers and the other for pupils. Both sets of questionnaires were designed in such a way that they contain open-ended and closed ended question. The closed-ended question was given to the students where options are given and are asked to tick the answer which is applicable. The open-ended closed ended question was also given to the teachers where they express their own kind of responses in the spaces that were provided on questionnaire. All questionaires were administered directly to students and teachers by the researcher himself. They were given an explanation related to the purpose of filling out the questionnaire.The students and teachers had freedom to respond without having to experience pressure. (see Appendix A and B). The questionnaire items were of four item Likert-type-often (3), sometimes (2) and not at all (1)

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3.4.2 Observation schedule

According to Patton (2002),the purpose of observation data is to describe the setting that was observed, the activities that take place in that setting,the people who participate in the activities and the meaningfulness these activities to form a view of participant'experience. Marshall and Rossman (2006) define participant observation as an approach to inquiry and a data gathering. They describe it as "….the systematic noting and recording of events,behaviours and artifacts(objects) in the social choosen for study"(p.139). McMillan and Schumacher (1993) define observation as a particular kind of data gathering in which the researcher observes and,visually and auditory.some phenonmenon and systematically records the resulting observation. Sidhu's (2003) also explains that observation seeks to what people think and by watching them in action as they express themselves in various situations and activities. In the observation instruments the researcher looks for instructional behaviours patterns and pedagogical strategies employed that may have reflected teachers'attitudes perceptions regarding science instruction. For the purpose of this study, the researcher adapted a personal form of observation (PFO) which was used to collect data. The observation instrument is made up of three forms 1, 2 and 3. Form 1 contains instructional behaviour of the teachers which was categorized under L1-L8. Form 2 contains method used by teachers which was categorized under M1-M7.Form 3 contains pupils activities in the classroom which was put into N1-N4

The pupils and teachers activities were coded.The personal observation form was displayed at Appendix c

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3.5. Validity of the main Instrument

The validity of the instrument is define as the extent to which the instruments measures what it purports to measure.Questionaire items were developed for both teachers and pupils.

According to Joppe (2000),validity determines whether the research truly measures what it is intended to measure and how truth the research is. In order to ensure that the questionaires are valid,it was given to the supervisor of the the project who went through and gave necessary corrections and suggestions

For content validity concerns,the questionaires were also given to the supervisor of the project. After the examination,changes were were effected as a result of coments and suggestions from them. The face validity of the instruments were also determine by the two Educationist. These were in the form of delection of incorrect items,additions of new items and modifications of the existing ones. At the end of the adaptation process,the number of items were reduced to a certain number.

3.6 Reliability of the main Instrument

Reliability may be defined as the extent that research results can be replicated (Creswell, 2003; Guba & Lincoln, 1998; Schwandt, 2001). Therefore the goal may not be to eliminate inconsistencies,but to that the researcher is cognizant of their occurrence (Creswell, 2003). With regards to the reliability of the questionnaire,a pilot test of the instrument was carried out with 60 pupils in one of the schools which share similar characteristics with the selected schools. The pupils chosen did not form part of the main study. This was done to avoid contamination of the sample for the study and hence the results. The reliability of the questionnaire was determined using the Cronbach's Alpha.A value of 0.78 was obtained.

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3.7 Data Collection Procedure

A copy of introductory letter from UEW was used to introduce the researcher to the head teachers of the selected basic schools in Kadjebi District. When the head teachers got the import of the letters,they asked their respective teachers concerned to assist in organising the respondents for the data collection exercise. The researcher was asked to come at an appointed time by which the time the necessary grounds work was completed. The second visit was to enable the researcher to introduce himself to the science teachers and pupils and to explain the purpose of the study. A convenient dates and times for teachers and pupils of the selected schools were shecduled for the study. The researcher administered questionnaire personally to the respondents. This paved way for the researcher to explain parts of the questionnaire items that posed problems to the pupils. Data for the study was obtained by administering 132 questionaires to 120 pupils and 12 teachers.

The questionnaire consist of three sections:Section A explained the purpose of the questionnaire and elicited some demographic information from the respondents. Section B contained a number of question items that sought information about teaching and learning materials. Section C contained question items that elicited information about factors that affect teachers instructional activities during teaching and learning of integrated science. The survey questionnaire items were of four item Likert-type-often (3),sometimes (2) and not at all (1).Responses from teachers and pupils were noted and summarized. Classroom observation was also conducted in each of the twelve selected scholls in the Kadjebi District.

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3.8 Ethical Consideration

Ethical consideration is a set of principles that guide your reseaech designs and practices. It is specified as one of the most important parts of the research (Bhandari, 2021). The researcher ensured that the use of offensive,discriminatory or unacceptable language were avoided in the formulation of questionnaire questions.The researcher emphasized that the participants remained anonymous.In otherwise,the questionaires were formulated without the names of participant.The confidential issues concerning the participant and the data were kept secret.

3.9 Data Analysis Procedures

First and foremost,the data collected were grouped according to the research question each item answered.Afterwards each of the items was coded by given it a numerical value for clarity of expression.

When this first stage of the data analysis was over, the second stage commenced and each completed questionnaire,coded with numerical value,was keyed into the data view of the SPSS version 22.0. This data input was transformed into frequency tables and percentages for the results in chapter IV.

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CHAPTER FOUR

RESULTS AND DISSCUSION

4.0 Overview

This chapter is devoted to the presentation of the results of the study obtained through the analysis of the data. The presentation of the results is done in the tables first before the discussion is done.Frequency distribution tables with percentages based on the questionnaires were constructed.The qualitative analysis of the observation was also done. Where it is not necessary to present the responses in a tables,the results are presented in prose.

4.1 Backround Data on the Reseach Subjects

The sample for study consisted of 120 pupils from both urban and rural junior high schools. This consist of 60 pupils from urban schools made of 36 males and 24 females. Also, 60 pupils were from rural junior high schools consisting of 32 males and 28 females. The pupils were sampled from co-educational schools.

The sample for the study consists of 12 teachers from both urban and rural aschools. This was made of 6 teachers from urban schools and the other 6 teachers from rural schools. All the selected teachers were male and were chosen from co-educational schools.

4.2 Presentation of the Results by Research Questions

Data collection was guided by the number of research questions posed to the respondents. Each research question is presented taking into consideration the objective it was developed to achieve. It should be emphasised that the central focused of each research question is designated as heading under which the responses under which the responses to that research questions presented and discussed.

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4.2.1 Research Question 1: What are the academic and professional qualifications of the integrated science teachers?

The research question sought to find out the academic background of teachers who taught integrated science at the JHS level especially in Kadjebi District in Oti Region.

3(50%) teachers in urban schools are SSSCE certificate holders whilst 5(83.3%) teachers in rural schools are also SSSCE certificate holders. It was also revealed that 3(50%) of the teachers in urban schools are BSC degree holders as against 1(16.7%) teacher in rural schools who is a BSC holder. It is cleared that majority of the teachers in rural schools are SSS certificate holders in different fields. This makes it difficult for some them to handle integrated science effectively. The result are in seen table 1

Table 1: Academic qualification of integrated science teachers in urban and rural schools

Qualification	Urban schools		Rural Schools	
	Frequency	Percentage (%)	Frequency	Percentage (%)
S.S.S.C.E/WASSCE	3	50	5	83. 3
H.N.D	0	0	0	0
BSC	3	50	1	1 6. 7
Total	**6**	**100**	**6**	**100**

The result shows 16.7% of teachers in rural schools are 3-years post-secondary certificate A holders whilst none of the teachers in urban schools are post-secondary certificate holders. 50% 0f teachers in urban and rural schools are Diplomat in Education certificate holders.Also,50% of teachers in urban schools are Bachelor in Education certificates holders as against 33.3% of teachers in rural schools who are also Bachelor of Education certificates holders. It is clearly seen that majority of teachers in urban are BED certificates holders and therefore can teach integrated

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science very well. This shows that urban teachers who are BED certificates holders are well prepared in content and they can demonstrate the ability to understand and can successfully convey to the students the major concepts,principles,theories laws etc.This is shown in table 2

Table 2: Professional Qualification of Integrated Science Teachers

	Urban Schools		Rural Schools	
Professional Qualification	**Frequency**	**Percentage (%)**	**Frequency**	**Percentage (%)**
3-years post cert A	0	0	1	16.7
Diploma in Education	3	50	3	50
BED	3	50	2	33.3
TOTAL	**6**	**100**	**6**	**100**

It was shown that 50% of teachers in urban and 33.3% of teachers in rural schools indicated that their area of specialisation is integrated science.33.3% of teachers in urban schools and 16.7% 0f teachers in rural schools are specialised in art 33.3% of teachers in rural schools are specialised in Vocation. The percentage of teachers in both urban and rural schools who say that they are specialised in mathematics is 16.7%. It is clearly seen that majority of teachers in urban schools are specialised in science than those in rural schools. It indicates that teachers in urban schools are more qualified to teach integrated science than teachers in rural schools. The result is shown seen in table 3.

Table 3: Areas of Specialisation of the Integrated Science Teachers

	Urban Schools		Rural Schools	
Subject Area	**Frequency**	**Percentage (%)**	**Frequency**	**Percentage (%)**
Integrated Science	3	50%	2	33.3%
Art	2	33.3%	1	16.7%
Vocational	0	0	2	33.3%
Mathematics	1	16.7%	1	16.7%
Total	**6**	**100**	**6**	**100**

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The result showed that 16.7% of urban and 50% of rural schools teachers taught for less than 6 years. Also, 50% of both urban and rural schools teachers said they taught for a period ranging from 6 to 10 years. Finally,33.3% of teachers in urban schools taught for period between 11-15 years It is therefore cleared that the majority of teachers have less than 11 years working experienced whiles few teachers have less than 16 years.This is illustrated in Table 4.

Table 4: Teachers respons on the Number of years of teaching integrated science

	Urban schools		Rural Schools	
Teachers	**Frequency**	**Percentage(%)**	**Frequency**	**Percentage (%)**
0-5 yrs	1	16.7	3	50
6-10yrs	3	50	3	50
11-15yrs	2	33.3	0	0
16-20yrs	0	0	0	0
21 yrs and Above	0	0	0	0
TOTAL	**6**	**100**	**6**	**100**

It was indicated that 50% of teachers in urban school attendeded integrated science workshop, seminars or in-service training as against 16.7% of teachers in rural schools who said similar thing. 50% of teachers in urban schools said that they attended any other workshop, seminar or in-service training. Whilst 83.3% of teachers in rural schools also expresses similar sentiment. It is evidently cleared that more teachers in urban schools attended workshop, seminar or in-service training than rural schools teachers. Therefore, urban schools teachers are more expose to the idea of integrated science than rural schools teachers.This is indicated in table 5

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Table 5: Teachers Response on Integrated Science Workshops, Seminars or in-Service Trainings Attended

	Urban Schools		Rural Schools	
Responses	**Frequency**	**Percentage (%)**	**Frequency**	**Percentage (%)**
Yes	3	50	1	16.7
No	3	50	5	83.3
Total	**6**	**100**	**6**	**100**

16.7% of urban schools teachers attended workshop organised by GES. 33.3% of teachers in urban schools indicates that the workshop was organised by GAST whilst 16.7% of teachers in rural schools said that the workshop was also organised by GAST. Apart from workshop being organised by GES, GAST, STME, 50% of teachers in urban also said that they organised workshop for them at the department level whiles 33.3% of teachers in rural schools also said they organised similar workshop for them at their schools. The result is displayed in table 6

Table 6: Organisers of workshop

	Urban	Schools	Rural	Schools
Organisers	**Frequency**	**Percentage (%)**	**Frequency**	**Percentage (%)**
GES	1	16.7	0	0
GAST	2	33.3	1	16.7
STME	0		0	0
Any other	3	50	5	33.3
Total	**6**	**100**	**6**	**100**

4.2.2 Research Question 2: What instructional materials are available for the teaching and learning of integrated science ?

It was cleared that that 33.3% of teachers in urban schools say that they have resource centre in their schools for teaching integrated science practical while 16.7%

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of teachers in rural schools also said similar thing. 66.7% of teachers in urban schools indicated that they did not have resource where they can carry out integrated science practical activities as against 83.3% of teachers in rural schools. It is cleared that majority of teachers in both urban and rural schools did not have resource centre where they can carry out their integrated science practical.The results have summarized in table 7.

Table 7: Teachers Response on the availability of resource centre in the school for integrated science practical

	Urban Schools		Rural Schools	
Responses	**Frequency**	**Percentage (%)**	**Frequency**	**Percentage (%)**
Yes	2	33.3	1	16.7
No	4	66.7	5	83.3
Total	**6**	**100**	**6**	**100**

33.3% of the pupils in Junior High Schools in Urban Area indicated that they have resource centre in the District whilst 66.7% have no resource centre in theDistrict.However, none of Junior High Schools pupils have resource centre in the rural schools. This is a barrier that has negative effect on the understanding of the integrated science concepts since integrated science requires practical activities. The results have been summarized in table 8.

Table 8: Pupils response on the availability of Resource centre in the school

	Urban Schools		Rural Schools	
Pupils	**Frequency**	**Percentage (%)**	**Frequency**	**Percentage (%)**
Yes	20	33.3	0	0
No	40	66.7	60	100
Total	**60**	**100**	**60**	**100**

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66.7% of teachers in urban schools indicated that they have not visited resource centre with their pupils at all whiles 83.3% of teachers in rural schools also indicated similar thing. Also,16.7% of teachers in urban schools said that they have been visiting resource centre frequently with their pupils whiles in rural schools none of the teachers said they visit resource centre frequently with their pupils. Finally,16.7% of teachers in urban schools said that they have not been visiting resource frequently (quite frequently) as against 16.7% teachers in rural schools who also express similar sentiment. However, it is cleared that the number of teachers in urban schools who visited resource centre with their pupils outweighs the number of teachers in rural schools who visited resource with their pupils.The results are indicated in table 9.

Table 9: Teachers views on the number times they visited resource centre in a term

	Urban Schools		Rural Schools	
Responses	**Frequency**	**Percentage (%)**	**Frequency**	**Percentage (%)**
Not at all	4	66.7	5	83.3
Frequent	1	16.7	0	0
Quite frequent	1	16.7	1	16.7
Total	**6**	**100**	**6**	**100**

From Table 10, 66.7% of pupils in urban schools and all pupils(100%) in rural schools indicated that they have not visited resource centre at all in aterm. Also,16.7% of pupils in urban schools said that they visited resource 1 to2 times in a term whiles in rural schools none of the pupils visited the resource centre. Again it was indicated that 16.7% of the pupils in urban schools visited resource centre 3 to 4 times in a term as against none in rural schools. Finally,none of the pupils visited resource centre for 5 times. This means that few pupils in urban schools visited resource whiles all the pupils in rural schools have not visited any resource centre in a term.

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Table 10: Pupils views on the Number times they Visited Resource Centre in a term

	Urban Schools		Rural Schools	
Pupils	**Frequency**	**percentage(%)**	**Frequeny**	**Percentage(%)**
Not at all	40	66.7	60	100
1-2	10	16.7	0	0
3-4	10	16.7	0	0
Over 5 times	0	0	0	0
Total	**60**	**100**	**60**	**100**

It was cleared in Table 11 that 33.3% of teachers in urban schools said that they have laboratory assistants or technician who assist them during integrated science practical lesson as against none of teachers in rural schools. 66.7% of teachers in urban schools and 100% (all) of teachers in rural said that they did not have laboratory assistants or technicians to assist them in integrated science practical. Since there are no laboratory assistants or technician, most teachers result to lecture method of teaching instead of activity method. The results have been summarized in Table 11

Table 11: Teachers response on the availability of laboratory assistant(s) or technician(s)

	Urban Schools		Rural Schools	
Teachers	**Frequency**	**Percentage(%)**	**Frequency**	**Percentage(%)**
Yes	2	33.3	0	0
No	4	66.7	6	100

It was cleared that 33.3% of pupils in urban schools said that they have laboratory assistant whiles none of pupils in rural schools has laboratory assistant. 66.7% of teachers in urban and all the pupils in rural schools did no have laboratory assistant. The results are shown in table 12

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Table 12: Pupils response on the availability of laboratory assistant or technician(s)

	Urban Schools		Rural Schools	
Pupils	**Frequency**	**Percentage(%)**	**Frequency**	**Percentage (%)**
Yes	20	33.3	0	0
No	40	66.7	60	100
Total	**60**	**100**	**60**	**100**

50% of teachers in urban schools indicated that pupils have integrated science textbook whiles 16.7% of teachers in rural schools also said similar thing. Also,50% of teachers in urban and 83.3% of teachers in rural schools said that pupils did not have integrated science textbooks. It is indicated that the number of pupils in urban schools who have textbooks are more than the number of pupils in rural schools. This simply means that pupils in urban schools will understand the integrated science concepts better than pupils in rural schools. The summary of the results is in table 13.

Table 13: Teachers response on the number of pupils having textbooks or not

	Urban Schools		Rural Schools	
Response	**Frequency**	**Percentage (%)**	**Frequency**	**Percentage (%)**
Yes	3	50	1	16.7
No	3	50	5	83.3
Total	**6**	**100**	**6**	**100**

It was cleared that 46(76.7%) of the pupils in urban schools said that they have integrated science textbooks whilst 25(41.7%) of pupils in rural schools also said similar thing. The number of pupils who have textbooks in urban schools are more than the number of pupils who have integrated science. 14 (23.3%) pupils in urban schools and 35(58.3%) of pupils in rural schools have no integrated science textbooks.The summary of results are displayed in table 14

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Table 14: Pupils Response on the availability of integrated science textbooks

	Urban Schools		Rural Schools	
Pupils	**Frequency**	**Percentage(%)**	**Frequency**	**Percentage(%)**
Yes	46	76.7	25	41.7
No	14	23.3	35	58.3
Total	**60**	**100**	**60**	**100**

It was revealed that 33.3% of teachers in urban schools were of the view that the integrated science textbook use by the pupils are recommended by GES whiles 16.7% of teachers in rural schools also said similar thing. 66.7% of teachers in urban schools and 83.3% of teachers in rural schools indicated that integrated science textbook use by pupils is not recommended by GES. The results are summarized in table 15

Table 15:Teachers view on the recommendation of textbooks by GES.

	Urban School		Rural Schools	
Response	**Frequency**	**Percentage (%)**	**Frequency**	**Percentage (%)**
Yes	2	33.3	1	16.7
No	4	66.7	5	83.3
Total	**6**	**100**	**6**	**100**

It was indicated in Table 16 that 35(58.3%) of pupils in urban schools and 10(16.7%) of pupils in rural areas indicated that their textbooks are recommended by GES whilst 11(18.3%) of pupils in urban schools and 15(25%) of pupils in rural schools said that they have textbooks that are not recommended for used by GES. The number of pupils in urban schools who said that textbook are recommended by GES are more than those in rural schools.The results have been summarized in Table 16

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Table 16: Pupils Response on the Recommendation of Textbooks by GES

Response	Urban Schools Frequency	Percentage (%)	Rural Schools Frequency	Percentage (%)
Yes	35	58.3	10	16.7
No	11	18.3	15	25.0
Totals	**46**	**76.6**	**25**	**41.7**

66.7% of urban teachers indicated that they have embarked on field trip with their pupils and 16.7% of teachers in rural schools also said the same thing. The percentages of teachers in urban and rural schools who said they have not embarked on field trip with their pupils are 33.3% and 83.3% respectively. It is therefore shows that number of teachers in urban schools who embarked on field trip/excursion with the pupils are more than the number of teachers in rural schools. The summary of the results is in table 17

Table 17: Teachers view on field trips and excursions

Response	Urban Schools Frequency	Percentage (%)	Rural School Frequency	Percentage (%)
Yes	4	66.7	1	16.7
No	2	33.3	5	83.3
Total	**6**	**100**	**6**	**100**

Information from Table 18 indicated that 10(16.7%) of pupils in urban schools go for field trip and excursion. In rural schools none of the pupils embarked on field trip and excursion. Also, 50(83.3%) of pupils in urban and all pupils in rural schools show that they did not go for field trips and excursion.It was clearly seen that majority of pupils did not go for field trip and excursion.

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Table 18: Pupils Response on field trips and excursions

Response	Urban Schools Frequency	Percentage	Rural Schools Frequency	Percentage
Yes	10	16.7	0	0
No	50	83.3	60	100
Total	60	100	60	100

The information in table 19 showed that 66.7% of teachers in urban schools indicated that they improvise some of the teaching and learning materials whiles 33.3% of the teachers in rural schools said similar thing.33.3% of teachers in urban schools said that als. they find it difficult to improvise teaching and learning materials as against 66.7% of teachers in rural schools who said that due to time constrain they find it difficult to improvise some of the teaching and learning materi

Table 19: Teachers Response on improvisation of teaching and learning materials

	Urban Schools		Rural Schools	
Response	**Frequency**	**Percentage (%)**	**Frequency**	**Percentage (%)**
Yes	4	66.7	2	33.3
No	2	33.3	4	66.7
Total	**6**	**100**	**6**	**1**

It was indicated that 33.3% of teachers in urban schools said that at times the employed the use of technology in teaching whiles in rural schools none of the teachers use technology in teaching integrated science. It was also indicated that 66.7% of teachers in urban schools and all teachers in rural schools did not use technology in teaching integrated science. The results are summarized in Table 20

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Table 20: Teachers response on the integration of technology in teaching and learning of integrated science

	Urban school		Rural Schools	
Teachers	**Frequency**	**Percentage (%)**	**Frequency**	**Percentage (%)**
Yes	2	33.3	0	0
No	4	66.7	6	100
Total	**6**	**100**	**6**	**100**

4.2.3 Research Question 3: What factors hinder the teaching and learning of integrated science in the selected schools?

Table 21: Observation Schedule

Factors	Urban Frequency	Schools %	Rural Frequency	Schools %
L1. Availability of resource/ materials for teaching integrated Science	4	2.4	5	3.0
L2. Integrated science requires knowledge in all science subjects	3	1.8	4	2.4
L3. Time requires for teaching integrated science is insufficient	5	3.0	4	2.4
L4.Negative attitudes of pupils towards integrated science.	5	3.0	5	3.0
M1. Lecture	3	1.8	4	2.4
M2. Demonstration	1	0.6	1	0.6
M3. Practical work	2	1.2	1	0.6
N1. Time requires for teaching integrated science	40	24	50	30
N2. Availability of resources/materials for teaching integrated science	20	12	10	6
N4. Integrated science requires knowledge in all science subjects.	44	26.4	40	24
N4. Pupils attitudes towards Science	40	24	39	23 .4
TOTAL =	**167**			

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The results of the observation conducted are shown in table 21 above. It was observed that 2.4% of teachers in urban schools and 3.0% of teachers in rural schools did use resource materials such as chart,models and realia for teaching integrated science whiles the rest did not use TLM during the lesson observed. This researcher agreed that the availability of adequate teaching and learning materials and laboratory for science teaching are imperative for attainment of any educational objectives. It was also seen during the lesson that 1.8% of urban schools teachers and 2.4% of teachers in rural schools were able to teach all aspect of integrated science to the pupils very well. Having an in-depth knowledge of all science subject helps teachers provide alternative explanations or use different approaches to help students understand complex scientific concepts.

Integrated science requires knowledge in all science subjects areas such as physics,chemistry,biology and agriculture science.The rearcher realised that most of the teachers did not finish the lesson due to inadequate time allocated for the teaching of integrated science. 3.0% of teachers in urban and 2.4% of teachers in rural schools were not able to finish integrated lesson on time as they complain bitterly about the inadequate time for teaching integrated science. Most science teachers overlook the use of teaching and learning materials because of inadequate time allotted for teaching and learning of integrated science. It was observed that most teachers result to lecture method of teaching integrated science beause of inadequate time and lack of teaching and learning resources. Finally, the researcher observed the way teachers teach integrated science without the needed resource to make lesson meaningful to the pupils. Teachers engaged in lenghy explanations instead of practical lessons. This makes pupils have negative attitudes towards science that science is a difficult subject. This perception has deepend due to the fact that pupils at the JHS level are

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not exposed to the rudiments of science in order to lay the prerequisite foundation for its continuation at the senior high level. It can be seen in table 21 that 3.0% of teachers in both urban and rural schools said that the negative attitudes of pupils hinders the teaching and learning of integrated science.Another thing observed is the methods that JHS teachers used in teaching integrated science. It was observed that most teachers result to lecture method of teaching integrated science beause of inadequate time and lack of teaching and learning resources.1.8% of teachers in urban and 2.4% of teachers in rural schools used lecture method in teaching integrated science. Due to the scarcity of materials 0.6% of teachers in urban and rural schools used demonstration method.In terms of practical work 1.2% of teachers in urban and 0.6% were able to carry out practical work successfully.

On the part of pupils,the researcher discovered most pupils also complain bitterly about insufficient time allocated for the lesson. They said that the manner in which teachers teach integrated fast just to cover the topic makes them found it difficult to followed the lesson closely. 24% of pupils in urban and 30% pupils in rural schools said that the time allocated for integrated science is inadequate.

The researcher also observed that lack of teaching materials or insufficient materials prevent the pupils from understanding the lesson. 24% of urban and 30% rural school pupils said that few TLMs are used for teaching integrated science. Most pupils also complain bitterly about insufficient time allocated for the lesson. The researcher realised that most teachers could not teach all aspect of integrated science due to inadequate knowledge in all science subjects.This makes pupils lack knowledge in certain aspects of science. 26.3% pupils in urban and 30% pupils in rural schools complain bitterly about teachers inability to teach all aspects of integrated science.Finally,most pupils have the notion that science is difficult because of the way

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teachers approach the teaching of integrated science. Teachers teach integrated science without the use of charts,models and realia. This chalk and talk method of teaching integrated science has made pupils developed negative attitudes towards the subject. Most of them made up their mind that they would not do science in SHS level. All the results are summarized in Table 21 above.

4.2.4 Question 4: What interventions can be designed to improve science teaching and learning in the selected schools?

Intervention designed to improve teaching and learning

Majority of the teachers in both rural and urban schools indicated that the school administration should help in the provision of teaching and learning resources to help improve teaching and learning of integrated science.Teaching and learning resources for any educational institution is indispensable. This teaching and learning resources includes recommended integrated science textbook, equipment and laboratory. Some of the teachers said that for integrated science teaching to improve, the administration should help in organising seminar, workshops and in-service training for most schools in the rural and urban areas. These seminars, workshops and in-service training help teachers to update their knowledge and teaching skills. All teachers said that more laboratory should be provided and supply with new equipment for effective teaching of integrated science. Few of the teachers indicated that internet learning should be encouraged. Finally, some of the teachers said that resource personel should also be provided to help them carry out practical activities.Textbooks recommended by GES should be provided for both teachers and pupils.

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4.3 Discussions

1. Acaemic and professional qualifications of integrated science teachers

Academic qualification of integrated science teachers at basic level is paramount to the teaching and learning of integrated science. The qualification of science teachers is important in deciding teacher accountability and quality in the light of pupils' assessment results.Teachers with requisite qualifications are needed to handle integrated science. The summary of table 1 shows that majority of teachers in rural and urban schools are SSS certificates holders. SSS certificates holders are do not qualify to handle subject like integrated science that requires competent professional teachers and therefore teach it without involving pupils in the leaning process.The finding of the research shows that few of rural schools teachers are BSC degree holders whiles more than half teachers in urban schools are also BSC degree holders. The higher the academic qualification the more competent and knowledge the teacher will have in content. It is clear that urban teachers have the highest qualification than teachers in rural schools and can therefore explain concepts better to pupils than rural school teachers with low qualification.

Professional qualification is pivotal for any country's discourse on labour force and capacity building. Academic and professional qualifications such as diploma in education, degree from well recognized university of education such as UEW, UCC ETC are very important for the teaching and learning of integrated science. As indicated by Kadingdi, the only way to maintain quality and effective teacher workforce is to ensure quality at the start of the process of recruitment and quality of training (pre -service and in-service)the recruits receive**.** According to Pearce (2007), teaching requires highest standard of professional in order to perform it well. Teachers have to undergo necessary professional training in order to teach integrated

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science very well. The professional qualification and training of science teachers at basic schools is important as any other level. According to Sheppard and Robbins (2007), professional science teachers are prepared in content and pedagogy and they can demonstrate the ability to understand and can successfully convey to students the major concepts, principles, theories, laws and interrelationships of their fields of specialisation.The summary of the Table 2 clearly shows that 16.7% of teachers in rural schools are 3-years post-secondary certificate A holders whiles 50% of teaches in urban and rural schools are diploma in education certificate holders. Again the table also revealed that most of teachers in urban and rural schools are Bachelor of Education certificates holders. Even though, most of the teachers have professional qualification certificates, the teacher with the highest professional qualification are fully prepared in content and pedagogy and can teach integrated science better for pupils to understand.

Teaching integrated science requires knowledge in all fields of sciences. For instance, teacher who is teaching integrated science should have knowledge in biology, chemistry, physics and agriculture. It was discovered that most teachers who teach integrated science in basic schools are specialised in different fields other than science. This makes some of them find it difficult to teach integrated science due to the lack of content knowledge in the subject. The teachers knowledge base strongly influences all aspects of teaching like preparation, planning and decision making regarding the choice of the content to be learnt (De Jong, Veal,& Van Driel, 2002). Therefore, one can argue that one of the most important characteristics of being a good science teacher is having a very good basis of subject matter knowledge. The summary of table 3 shows that 50% of teachers in urban schools and 33.3% of teachers in rural schools are specialised in integrated science whiles other teachers are

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specialised in Art, Vocation and Mathematics. This reveals that the number of teachers who can teach integrated science in urban schools are more than teachers in rural schools.

The summary of Table 4 showed that 16.7% of urban and 50% of rural schools teachers indicated that they taught for less than 6 years In all 66.7% of teachers have taught integrated science for lesson than 6 years.Finding also revealed that 50% of teachers have less than 11years teaching experience. It is therefore cleared that the majority of teachers have less than 11 years working experienced. Only a small percentage of teachers in urban schools have taught for more than 15 years. The number of years a teacher teaches depend on the experience the teacher has in the subject. Experience counts a lot as far as teachers' percepton of the job is concerned. According to Moriana and Herruzo (2006), professional or organisational characteristics such as the amount of teaching experience or the characteristics of the students,have adirect or indirect on teachers job satisfaction and perceptions.

Staff training and ongoing professional development are essential components of effective schools for JHS students (Supovitz & Turner, 2000). Professional development of teachers is considered the most effective way to improve the teaching process and thereby improve students achievement (Eun, 2008; McKenzie et ai., 2011). Professional development include such thing as attending workshop, participation in professional organizations,continuing education enrolment in training programs, in-service training, seminar and research institution are important for integrated science teacher as it helps teachers deliver effectively. The summary of Table 5, revealed that 50% of teachers in urban schools and 16.7% of teachers in rural schools attended workshops, seminars and in-service training to update their

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knowledge. However most the of teachers did not attend any workshop, seminar and in-service- training. Only a small fraction of teachers attended workshop organised by headteachers of the basic schools.Providing growth opportunities for teachers is a way to make them relevant for the job market.

The finding of the research discovered that few teachers in urban schools attended the workshop whiles none of the teachers in rural schools attended attended the workshop and in-service training organised by GES. However, few teachers of urban and rural schools attended sensitization workshop organized by GAST. Also,the finding revealed that some of the teachers in the selected schools also attended other workshops organised by headteachers of both urban and rural schools. This was summarized in Table 6.In terms of professional development for science teachers, according to the National Science Foundation (NSF) (2006), in the 1990's professional development in many school districts consisted of a single workshop with little support or follow-up with the teacher thereafter.

A lot of teachers in urban and rural express misgiving about the way workshop and in- service training are organised poorly as most of them said it does not convey good ideas about integrated science teaching. Some of the teachers said they have not attended workshops and in-service training for the past 3-years.

2. Resources/teaching and learning materials

A laboratory is an instructional for effective science programmed where development of scientific skills and attitudes are greatly facilitated. The laboratory is an indispensable tools in the teaching of science which provides students with a place or setting to attack and solve problems, collect data, provide ideas and carry out investigations which emphasize learning by doing. Arubayi (2003) summarised the

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major objective sought in the laboratory work as the development of skills, concepts, cognitive abilities and understanding the nature of science.

It is clear from Table 7 that, 66.7% of teachers in urban and83.3% of teachers in rural school indicated that there is no resource centre in their school. It is cleared that majority of teachers in both urban and rural schools did not have resource centre where they can carry out their integrated science practical. This is a barrier that has negative effect on the understanding of the integrated science concepts since integrated science requires practical activities. Without science resource centre, pupils will not understand integrated science concepts. Resource centre helps reduce the way the teachers will talk much.

It was also found in the area of science materials and equipment that the schools at the JHS level are without science laboratories but science teachers are expected to train their Students to acquire practical knowledge in science (MOE, 2012). This is becausethe teaching of Science cannot go on without practical lessons (Millar, 2001). Meanwhile, there was a Requirement for JHS pupils to have laboratory practical experience.

The summary of table 8 shew that 33.3% of the pupils in Junior High Schools in Urban area indicated that they have resource centre in the District whiles none of the teachers in rural schools have resource centre in theDistrict. It is cleared that majority of teachers in both urban and rural schools have no resource centres

This is a barrier that has negative effect on the understanding of the integrated science concepts since integrated science requires practical activities.

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Even though there were slight difference in the responses of teachers and pupils but it is cleared that majority of teaachers and pupils said that there were *no science laboratory or science resource centre in their schools.* They also highlighted that for the few apparatus and materials available "*we carry them from the head teachers' office to the classroom to demonstrate the scientific concept taught*." Due to the inadequacy of the apparatus, Integrated Science lessons were mostly in the lecture format with limited demonstrations.

The summary of table 9 revealed that 66.7% of teachers in urban schools and 83.3% of teachers in rural schools indicated that they have not visited resource centre or laboratory at all. In term of how frequent they visit resource or laboratory only 16.7% of teachers in urban schools said that they have been visiting resource centre frequently with their pupils. Finally, 16.7% of teachers in urban schools said that they have not been visiting resource frequently(quite frequently) as against 16.7% teachers in rural schools who also express similar sentiment. Few of them said they visit laboratory once a term whiles some said they visit laboratory or resource centre twice in a year. However, it is cleared that the number of teachers in urban schools who visited resource centre with their pupils outweighs the number of teachers in rural schools who visited resource with their pupils. Regular visiting of resource centre is very important as it provide first-hand information to pupils about integrated science concepts. It helps pupil to be familiar with equipment in the resource centre and how to use it regular visiting of resource is very important as it helps the pupils to be familiar with the teaching and learning materials in the laboratory and how to use it.

On the part of the pupils, summary of table 10 indicated that 66.7% of pupils in urban schools have not visited resource centre or laboratory at all whiles in rural schools all

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the pupils have not visited resource centre or laboratory at all. 16.7% of pupils in urban schools visit resource centre frequently whiles 16.7% of pupils in the same schools said they did not visit laboratory or resource centre often. Some of them said they visit resource centre or laboratory once in a term or a year. Both teachers and ppupils said the same thing which indicates that the have not be visiting laboratories often for integrated science practicals.

Laboratory assistant or technician is needed for setting up the laboratory for practical work. In some situation laboratory assistants or technician also take pupils through practical activities. Laboratory assistants or technicians play vital role for the success of the practical lesson. The summary of table 11 indicated that 33.3% of teachers in urban schools said that they have laboratory assistants or technician who assist them during integrated science practical lesson as against 16.7% of teachers in rural schools who said similar thing.66.7% of teachers in urban schools and 83.3% of teachers in rural said that they did not have laboratory assistants or technicians to assist them in integrated science practical. Since there are no laboratory assistants or technician, most teachers result to lecture method of teaching instead of activity method.

Also the summary of Table 12 shows that 33.3% of the pupils in urban schools said that they have laboratory assistant(s) who assist them during practical lesson. It is cleared that majority of pupils in urban and rural schools do not have laboratory assistant.

Comparing the two responses, it is true that both teachers and pupils complain bitterly about lack of or insufficient laboratory assistants or technician to help them carry out integrated science practicals.

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The availability of science materials such as textbooks has been one of the issues confronting school science (Anderman etal. 2012). Lack of resources such as textbooks, physical infrastructure and laboratory equipment have led to the learners losing interest in the subject and hence poor performance (Mwenda etal., 2013; Muwanga-Zake, 2000; Makgato & Mji, 2006; Amukowa, 2013:105; Mwaba, 2011:33).

Adequate provision of textbooks is important that integrated science teachers and pupils can use to enhance the understanding of science concepts. Summary of table 13 shows that 50% of teachers in urban schools indicated that pupils have integrated science textbook whiles 16.7% of teachers in rural schools said that their pupils have integrated science textbooks. Also, 50% of teachers in urban schools said that pupils did not have integrated science textbooks as against 83.3% of teachers in rural schools who said that pupils did not have integrated science textbooks. With respect to students' textbooks recommended for the teaching of Integrated Science at the JHS level, the textbook were identified as being of low quality and currently not good enough for meeting the current expectation of the JHS Integrated Science Syllabus (MOE, 2012).Some of the teachers said that *student's textbooks' content are old and were not prepared in agreement with the current syllabus. I must say they are of no relevance in terms of the practical test*." Teachers use other books though not recommended by the Ghana Education Service (GES) but they are of relevance as they supplement what we have in the schools. Science teacher has to be resourceful. Where students' textbooks were not sufficient and hardly do students have individual copies, teachers were prevented from using reading assignments as a means of engaging students during their out of school hours.

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It is indicated that the number of pupils in urban schools who have textbooks are more than the number of pupils in rural schools. This simply means that pupils in urban schools will understand the integrated science concepts better than pupils in rural schools.

The summary of Table 14, revealed that most pupils in urban schools have integrated science textbooks whiles less than half of the pupils in rural schools have integrated science textbooks.Learning materials to be precise textbooks plays important role in the understanding of integrated science concepts.The research discovered that some of the pupils in the selected schools have integrated science textbooks based on the old syllabus whiles most of them have integrated science textbooks based on the new syllabus. Pupils therefore cannot do without integrated science textbooks.Moreover, the new textbookse outline, describe phenomenon, and show pictures about things and what they would observe in the outlined practical activities.

Most teachers of integrated science did not use textbooks prescribed by Ghana ducation Service and some of the information gather from the textbooks are not correct. Some of these textbooks lack illustrations and carry wrong information making it difficult for pupils to understand science concepts. Also some of the integrated science textbooks that pupils are using are not prescribed by Ghana Education Service. The summary of table 15 revealed that less than 40% of teachers in urban schools said that pupils have integrated science textbook recommended by GES whiles less than 20% of teachers in rural schools also said similar thing.66.7% of teachers in urban schools indicated that integrated science textbook use by pupils is not recommended by GES as against 83.3% of teachers in rural schools who said that the integrated science textbook that pupils are using is not recommended by GES.

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It was indicated in Table 16 that 58.3% of pupils in urban schools and 16.7% of pupils in rural areas indicated that their textbooks are recommended by GES whilst 18.3% of pupils in urban schools and 25% of pupils in rural schools said that they have textbooks that are no recommended for used by GES.The number of pupils in urban schools who said that textbook are recommended by GES are more than those in rural schools.Textbooks are very important as it provides additional information leading to the understanding of the integrated science concepts. The information from the teachers and pupils indicated most of the textbooks that pupils used are not prescribed by GES as some of them carry wrong information.

Effective learning will take place if pupils are taken out of the classroom to an environment away from the school or excursion to have a feel of something they are learning in integrated science. This will help pupils develop interest in the subject, understand and retain what they have learned. It enables pupils to gain first-hand knowledge about a concept under study.The summary of table17 shows that 66.7% of urban teachers indicated that they have embarked on field trip with their pupils and 16.7% of teachers in rural schools also said the same thing. The percentages of teachers in urban and rural schools who said they have not embarked on field trip with their pupils are 33.3% and 83.3%respectively. It is therefore shows that number of teachers in urban schools who embarked on field trip/excursion with the pupils are more than the number of teachers in rural schools. Therefore, they have more exposure than teachers in rural areas. Most teachers did embark on field trips and excursions with their pupils because there is no availability of funds.

Information from Table 18 indicated that 16.7% of pupils in urban schools go for field trip and excursion. In rural schools none of the pupils embarked on field trip and

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excursion. Also, 83.3% of pupils in urban schools show that they did not go for field trips and excursion. It was clearly seen that majority of pupils did not go for field trip and excursion due to lack of availability of funds for the trip or excursion. Field trip and excursion play an important role in the understanding of integrated science concepts as pupils see the real thing it ginger them to learn more. If field trips were embarked upon as follow ups to what has been learnt in classroom, then students would be equipped with strong foundation in most of the subjects they are taught.

It is cleared that the information provided by both teachers and pupils are contradictory.Most teachers said they embarked on field trips and excursion with the pupils whiles most pupils were not in agreement with what their teachers said.

Benefit of the use of improvise materials in teaching learning of science cannot be overemphasized. This is because as pupils become involved in the science activities with the improvised materials, they understand scientific concepts better and ultimately improve their performance. It also give opportunity to the pupils to explore their environment to come out with new discovering. The information in table 19 shows that 66.7% of teachers in urban schools indicated that they improvise some of the teaching and learning materials whiles 33.3% of the teachers in rural schools said similar thing. 33.3% of teachers in urban schools said that they find it difficult to improvise teaching and learning materials as against 66.7% of teachers in rural schools who said that due to time constrain they find it difficult to improvise some of the teaching and learning materials.

The summary of table 20 shows that 33.3% of teachers said that at times the employ the use of technology in teaching whiles in rural schools none of the teachers use technology in teaching integrated science. It was also indicated that 66.7% of teachers

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in urban schools and all teachers in rural schools did not use technology in teaching integrated science. Even though most teachers said the use of technology would bring variety in teaching but they did not use it because of lack of computer and projector. It is cleared that few of the teachers in urban schools have been using technology to teach whiles none of teachers use technology in their teaching. Coble and Koballo (1996) proposed that using technology especially computers guide teachers' visions on what and how to teach in a science or math class. The students in computer-based classes have a chance to develop science process skills, science content, problem solving, and graphical skills (Krajcik & Layman, 1992). According to Krajcik and Layman (1992), in these interactive classroom environments, students ask questions, search for answers, test the explanations in different ways, and communicate their findings with others. Owens et al. (2002) also pointed out that computer technologies provide new opportunities for accessing information, allow students to organize and edit that information for projects, and promote significant learning among students.

3: Factors that hinder the teaching and learning of integrated science

Discussion on Lesson Observation

Classroom observation were conducted for 12 teachers and 120 pupils from both urban and rural. The teaching of integrated science cannot be complete without the use of teaching and learning mareials. After the observation it was cleared that both teachers and pupils complained bitterly about lack of materials or insufficient resources. To this end, Adeyanju (1997) indicates that learning can be reinforce with learning aids of different varieties because they stimulate, motivate as well as arrest the learner's attention for a while during the instructional process. Lack of resources such as textbooks, physical infrastructure and laboratory equipment have led to the learners losing interest in the subject and hence poor performance(Mwenda etal.,

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2013; Muwanga-Zake, 2000; Makgato & Mji, 2006; Amukowa, 2013:105; Mwaba, 2011:33). Adequate provision of instructional materials is an important that science teachers can use to promote skills acquisition by students (Eshiet, 1987). It enhances the understanding of science concepts. This finding agrees with Idiaghe (2014) that pupils in schools with inadequate instructional materials performed poorly as compared with their counterparts in schools with adequate facilities. The availability of variety of instructional materials would afford the teachers the opportunity to use variety of teaching strategies and encourage pupils to find out more on their own thereby stimulating self-learning. It could also create interactions and interest in class and saves the teacher the trouble of explaining at length. Again, it would encourage more pupils to explore and discover knowledge within their environment and make meaningful contributions to existing scientific principles. These would help deepen many pupil's understanding of concepts taught which would then impact positively on their performance. Many scholars (Bajah, 1986; Akinwumji & Orimoloye, 1987) contended that the availability of physical and materials resource is very significance for success for any worthwhile educational endeavour. These researchers agreed that the availability of adequate teaching and learning materials and laboratory for science teaching are imperative for attainment of any educational objectives. Adequate provision of instructional materials is important that science teachers can use to promote skills acquisition by students (Eshiet, 1987).

Practical science depict issues in real life situation that makes its learning becomes lively but it turns out to be a reading subject. According to Opara & Etukudo (2014), adequate instructional materials and strategies give the students the chance to use their sense of hearing, smelling, tasting, seeing and feeling. The available textbooks and charts are not enough to promote effective teaching and learning of Integrated

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Science, so most of the concepts are explained for pupils to memorize. This affirms the findings of Azure (2015) This finding agrees with Idiaghe (2014) that pupils in schools with inadequate instructional materials performed poorly as compared with their counterparts in schools with adequate facilities.

The researcher also observed that few teachers were able to teach all aspect of integrated science. This makes pupils deficient in some aspect of integrated science knowledge. Research from Ball and MacDiamid(1990) cautioned about the harm a teacher can do if they do not possess accurate content knowledge as they may pass these inaccurate ideas to their students. Pedagogical content knowledge is also content –specific or subject –specific knowledge that is fundamental for effective science teaching(Magnusson,et al.,1999). Having an in-depth knowledge of the subject matter helps teachers provide alternative explanations or use different approaches to help students understand complex scientific concepts. Integrated science requires knowledge in all science subjects areas such as physics, chemistry, biology and agriculture science. Knowledge in these subjects areas are very important for integrated science.

However, all the teachers in both urban and rural schools disagree that teachers teach science based on areas of specialisation. Most science teachers overlook the use of teaching and learning materials because of inadequate time allotted for teaching and learning of integrated science. Teaching integrated science practical or theory requires more time to enable pupils to understand science concepts very well. This also reveals that there is the need to allocate more time for practical activities to enable pupils acquire practical skills to enhance performance.Both pupils and teachers said "*the time allocated for Integrated Science on the timetable is not enough to teach the*

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theory, have practical activities, and assess the pupils; this makes us haste the pupils through the topics." Again, "*teachers are unable to cover all topics lined up in the syllabus before pupils take the BECE.*" These may contribute to pupils' poor performance in the BECE. Matthew (1989) is of the view that a pupil level of attainment was directly to the period actively spent on learning. The finding was also supported by International Assessment of Educational Progress (IAEP) PROJECTS IN 1991/1992.

The observation by the researcher revealed that most of the teacher of urban and rural schools agree that the negative attitude of pupils toward the integrated science hinder the teaching of integrated science. According to Anamuah-Mensah (2004), there are many reasons for this situation of Ghanaian students' failure and ambivalence in science education.

Anamuah-Mensah considers over-dependence on the chalk-and-talk instructional approach as a major cause for students disinterest and failure in science learning. Other uncreative and traditional methods of teaching and learning are textbook dependent teaching and learning; examination –oriented teaching; learning by rote memorization; lack of science practical work in most schools. Students' poor attitude and interest towards school science is an issue identified across the world (Adu-Gyamfi, 2013; Fensham, 2008; Hallack & Poisson, 2001; UNESCO, 2010.

When it comes to the method of teaching science, the researcher observed that most teachers used lecture method in teaching integrated science whiles few teachers used demonstration method of teaching due to inadequate teaching and learning materials.Some of teachers also carried out practical work.Pupils also express shared similar views about the method of teaching integrated science when the researcher

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engaged them. O'Connor (2000) also identified the use of inappropriate teaching methods as one of the factors that contribute to low participation and performance of students in science. The teaching methods used are not practical enough and that teachers make little effort to relate the concepts learnt and the examples/illustrations used to real life, especially within the context of the students' own lives and environment. This has a negative effect on students' interest and motivation to study science, mathematics and technology (SMT) subjects.It also makes students show lack of conceptual understanding in many scientic principles in their study,which results in ambivalence towards their study of integrated science. Danso (2010) indicated that teachers favour teacher-centred, knowledge based teaching methods that leave little room for learners' participation. Quite remarkably, regular poor academic performance by the majority of students is fundamentally linked to application of ineffective teaching methods by teachers to impact knowledge to learners (Adunola, 2011).

The researcher also discovered after the observation that most pupils complain that the time allocated for teaching integrated science is not sufficient. Matthew (1989) is of the opinion that a pupil level of attainment was directly related to the period actively spent on leaning. The finding was also supported by the international assessment of educational progress [I A E P] projects in 1991/1992. The integrated science curriculum for Junior High Schools Advocated for seven period of forty (40) minutes for a period in walk through the idea of time allocation was clearly spelt in the syllabus, most junior high schools did not follow it. This inadequacy of lesson time for integrated science perhaps has forced teachers to teach without demonstration.

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4. The interventions or measures used to improve sciennce teaching and learning

Intervention is used to refer to programmes and activities that aim to improve the teaching and learning in order to raise achievement and improve learning experiences in science education. Teaching and learning cannot go on well without the support of administration. Some of the teachers in both rural and urban schools indicated that effective and learning can go on well if school administration help in the provision of teaching and learning and resources. Teaching and learning resources for any educational institution is indispensable. This teaching and learning resources in includes recommended integrated science textbook, equipment and laboratory. It was also indicated that the administration should help in organising seminar, workshops and in-service training for some schools in the rural and urban schools. These seminars, workshops and in-service training help teachers to update their knowledge and teaching skills.

Some of the teachers advocate the use of ICT technology as an alternative in teaching integrated science whiles most of teachers said that more practical activities should be done to enhance the understanding of the integrated science concepts. Few of them indicated that internet learning should be encourage among the pupils to help them have first hand information about the concepts before coming to class. However, it was suggested that more science equipment should be provided to enhance teaching and learning of integrated science.

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CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter deals with the summary of the research study, findings, recommendations on how to improve on the teaching and learning in basic schools and suggestions for further research. It also includes the conclusions drawn from the study.

5.1 Summary of the Main Findings of the Study

The study sought to investigate the status of teaching and learning of integrated science in some selected JHSs.It focuses on the academic and professional qualification of integrated science teachers. It also concerns with the availability of resource materials, factors that hinder the instructional activities of integrated science teachers and pupils. Finally, the study investigate intervention that can be designed to improve science teaching and learning.

The academic and professional qualification of integrated science teachers is an issue affecting teaching and learning of science. The academic and professional qualification of teachers of integrated science is paramount to the teaching and learning of integrated science in JHS. Academic and professional qualifications such as diploma in education and degree in education from well recognized university such as UEW, UCC etc. are very important to the teaching and learning of integrated science.

The finding of the research also shows that there were no proper laboratories, laboratory technicians, practical equipment and teaching materials in most JHSs school. Lack of materials and equipment therefore prevented the pupils from engaging in self-initiated explorations. Researchers suggest that real-life application is the only

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way to engage and arouse students' interest in science (McComas, 1996; Simon, 2000).

It was also discovered that the time allotted for teaching integrated science practical and theory was not sufficient. Most of the teachers and pupils in both urban and rural schools complain bitterly about inadequate time allocated to the teaching and learning of integrated science. As a result of this most teachers result to lecture method of teaching integrated science instead of activity or demonstration method which they said consume much time. That is they teach without using teaching and learning materials due to insufficient time.

It was also realised that majority of teachers and pupils did not go on field trips and excursions to study topics related to the integrated science they are doing. Pupils learn better when they interact with materials relating to what they have studied or taught.

The finding also revealed that most teachers in the schools did not use ICT technology in their teaching as an alternative way of teaching so as to bring variety in their teaching. In the absence of teaching and learning materials, technology can be used.

Thirdly, the methods that teachers use in the teaching and learning of integrated science. Both teachers and pupils considered the activity method as the most effective method of teaching and learning integrated science.

There are many factors that hinder the teaching and learning of integrated science Some of these factor are lack of teaching and learning materials, inadequate time and the negative attitudes of pupils towards integrated science.

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Finally, lack of support/inadequate support from the administration and inability to integrate ICT technology into their teaching as an alternative way of teaching and learning integrated science.

5.2 Conclusion

Teaching and learning integrated science in JHS requires qualified and professional teachers who can teach integrated science very well. Academic and professional qualification of teachers is an issue that hampers the teaching and learning of integrated science in basic level.

It was also seen that inadequate or lack of teaching and learning materials makes teaching and learning not to be effective. It was observed that most of the selected schools did not have laboratories, insufficient practical materials and textbooks. Inadequate supply of materials and equipment by the stake holders in education to meet the standard required by WAEC has an adverse effect on the teaching and learning of integrated science. Inadequate time allotted for the teaching and learning of both practical and theory lessons in JHSs did not promote effective teaching and learning of science. It was deduced from the research that most teachers find it difficult to improvise some of science teaching and learning materials.

Again, it was also found out that most teachers especially teachers of rural schools use lecture method due to inadequate teaching and learning materials whiles most teachers of urban schools used activity and demonstration method.

Finding of the research revealed that teachers of integrated science encountered some challenges in the teaching and learning of integrated science. Some of these challenges are inadequate teaching and learning materials, insufficient time and the

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negative attitudes of the pupils towards the teaching and learning of integrated science and inadequate pedagogical content knowledge in some selected areas. Integrating ICT technology into the teaching and learning of integrated science was discovered. It was realised that the use of technology as an alternative for teaching and learning science as it enhance the understanding of science

Finally, it was discovered that the administration and stake holders in education did not come to the aid of the schools by supplying the teaching and learning materials that will improve teaching and learning of science. The excuse they gave was that there were no available fund for buying the teaching and learning materials.

5.3 Recommendations

Based on the findings, the following recommendations are made:

1. Regular workshops and in-service professional training for all teachers to enable them handle Integrated Science effectively. Also, Kadjebi District Education in collaboration with MOE should organise refresher courses for science teachers to update and up-grade their knowledge. Teacher education should take cognizance of changes in methodology and in the curriculum, so as to expose teachers to innovations in their profession; in- service training should be an integral part of continuing teacher education.
2. Head teachers and other stake holders in education should ensure that the teaching and learning materials needed in the laboratories for undertaking integrated science practical lesson are provided. They must ensure that specially trained laboratory technicians are employed to manage the laboratories so that effective integrated science practical lessons are organized.Also,JHSs with inadequate teaching and learning materials are

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advised to make good use of various resource centre closer to them for practical activities.

3. Kadjebi District Education Service in collaboration with other stake holders in Education should organize in-service training on the improvisation of instructional materials for Integrated Science teachers in JHSs. This will help vary their instructional strategies so as to reach the individual pupil in class. The improvised instructional materials would also help pupils to develop scientific concepts on their own as they interact with them.
4. More time should be allotted on the teaching timetable to an enable maximum coverage of outline topics in the Integrated Science syllabus and also for practical activities upon consultation with the curriculum developer, Educational Directors and head teachers. This enable teachers to have more time for both practical and theory.
5. Teachers in consultation with head teacher can introduce field trips and excursions as part of their integrated science teaching and learning programmes.
6. Head teacher in conjunction with District Education service should provide resource persons who will take teachers through the use of ICT technology in teaching and learning integrated science in JHSs.
7. In the wake of these challenges and their effects on Basic School

Science which is crucial to the success of science education in general, the MOE, GES, and Non-governmental organisations interested in science education should go to the aid of Basic School

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5.4 Suggestions for Further Research

1. The study was limited to some selected JHSs in Kadjebi District.There is therefore the need for further research to be conducted in other parts of the nation to meet the aspirations of the society
2. More research should be carried out on the use of ICT technology in teaching and learning of integrated science as an alternative way of teaching science theory and practical.
3. The study should be replicated using large number of research subjects in Kadjebi District
4. A survey of available science instructional materials should be conducted in the in the research area.

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APPENDICES

APPENDIX A

QUESTIONNAIRE FOR PUPILS

UNIVERSITY OF EDUCATION, WINNEBA
DEPARTMENT OF SCIENCE EDUCATION

The purpose of this questionnaire is to obatain information for a research work on 'The status of teaching and learning of integrated science in JHS in Kadjebi District of Ghana.This questionnaire is designed for academic purpose only and as such any information provided for this studywill be treated with utmost confidentiality and anonymity.
Kindly read through each of the item carefully the opinion that nearest expression of your view on each of the issues raised.

SECTION A: Biograpy Information

Name of school……

Type of school : Boy's only [ ] Girl's only [ ] Mixed [ ]
1. Sex: Male [ ] Female [ ]

SECTION A :Resources / Instructional Materials
1.Do you have a science resource centre in your school for integrated science practical ?
(a) Yes [ ] (b) No [ ]

2. If yes, how many times do you visit the science resource centre in a term?

(a) Not at all [ ] (b) 1 -2 times [ ] (c) 3 – 4 times [ ] (d) over 5 times [ ]
3 . If no, then where do you mormally have integrated science practical lessons?
(a) Classroom [ ] (b) Under a tree [ ] (c) Not at all [ ]

4 . Do you have a laboratory assistant(s) or technicians who assists you during integrated science practicals
(a) Yes [ ] (b) No [ ]

5.Do you have integrated science textbook ? (a) Yes [ ] (b) No

6. Do you go on field trips and excursions ?
(a) Yes [ ] (b) No [ ]

7. Do you go for field work and excursions?
(a) Yes [ ] (b) No [ ]

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APPENDIX B

QUESTIONNAIRE FOR TEACHERS

UNIVERSITY OF EDUCATION, WINNEBA
DEPARTMENT OF SCIENCE EDUCATION

The purpose of this questionnaire is to obatain information for a research work on 'The status of teaching and learning of integrated science in JHS in Kadjebi District of Ghana. This questionnaire is designed for academic purpose only and as such any information provided for this studywill be treated with utmost confidentiality and anonymity.
Kindly read through each of the item carefully the opinion that nearest expression of your view on each of the issues raised.

GENERAL INSTRUCTION: Please tick ( ) or write in the space provided your responses

SECTION A: Biograpy Information

Type of School: Boy's only [ ] Girl's only [ ] Mixed [ ]

1. Sex: Male [ ] Female [ ]

2. Setting of the school: Rural [ ] Urban [ ]

SECTION B:

Please tick [ ] the appropriate bracket or column or fill in the blank spaces where necessary.

1. What is/ are your academic qualification ?
(a) SSSCE (b) HND (c) BSC

2. What is/ are your professional qualification?

(a) teacher's 3 – year post sec cert A [ ] (b) Dip Ed [ ] (c) BEd [ ]

3. What is your area of specialization?

(a) science [ ] (b) art (c) vocational [ ] (d) Mathematics [ ]

Any other (specify)……

4. How many years teaching experience do you have in integrated science?
(a) 0 – 5 years [ ] (b) 6 – 10 years [ ] (c) 11-15 years [ ] (d) 16 -20years [ ] (e) 21 years and above [ ]

5. Do you attend workshops, seminars or in – service trainings in the teaching of integrated science?
(a) Yes [ ] (b) No [ ]

6. If yes, who organized it ?
(a) GES [ ] (b) GAST [ ] (c)STME [ ]

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8. Any other (specify)…….

SECTION B: RESOURCES/ TEACHING AND LEARNING MATERIAL

1. Do you have a science resource Centre in the district for science practical work?
(a) Yes [ ] (b) No [ ]

2. If yes, how many times do you visit a science resource center in a term with the students?
(a) Not at all [ ] (b) Frequent [ ] (c) Not at all [ ]

3. If no, then where do you normally have integrated science practical lesson?
(a) Classroom [ ] (b) Under a tree [ ] (c) Not at all [ ]

4. Do you have a laboratory assistant(s) or technicians who assist you during integrated science practical lesson in the District?
(a) Yes [ ] (b) No [ ]

5. Do you have teaching and learning materials for practical work?
(a) Yes [ ] (b) No [ ]

6.. Each of my students has a science textbook (a) Yes [ ] (b) No [ ]

7. Are the textbooks recommended by GES? (a) Yes [ ] (b) No [ ]

8. Do you go for field trips and excursions ?
(a) Yes [ ] (b) No [ ]

9. Do you improvise some of the teaching and learning materials?
(a) Yes [ ] (b) No [ ]

10.Do integrate ICT into teaching and learning of integrated science ?
(a) Yes [ ] (b) No [ ]

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APPENDIX C

OBSERVATION INSTRUMENT ON FACTORS THAT AFFECT TEACHING AND LEARNING OF INTEGRATED SCIENCE

Form 1

NAME OF SCHOOL……..
FORM……..
PERIOD……
TOPIC……...

Teachers' Engagement

	Urban	Schools	Rural	Schools	
Factors	Frequency	%	Frequency	%	
L1.Availability of resource/ materials for teaching integrated Science					
L2.Integrated science requires knowledge in all science subjects					
L3.Time requires for teaching integrated science.					
L4Attitudes of pupils towards integrated science.					

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FORM 2

Method used in teaching integrated science

	Urban	Schools	Rural	Schools
Method	Frequency	%	Frequency	%
M1.Lecture				
M2.Demonstration				
M3.Practical work				

FORM 3:Pupils Engagement

	Urban	Schools	Rural	Schools
Factors	Frequency	%	Frequency	%
N1.Time requires for teaching integrated science				
N2.Availability of resources/materials for teaching integrated science				
N4.Integrated science requires knowledge in all science subjects.				
N4.Pupils attitudes towards Science				