**UNIVERSITY OF EDUCATION, WINNEBA**

# THE STATUS AND QUALITY OF JUNIOR HIGH SCHOOL SCIENCE TEACHING AND LEARNING IN THE SUNYANI MUNICIPALITY

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**A Thesis in the Department of Science Education, Faculty of Science Education, submitted to the School of Research and Graduate Studies, University of Education, Winneba in partial fulfilment of the requirements for award of the Master of Philosophy Degree in Science Education.**

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# DECLARATION

## STUDENT'S DECLARATION

I, Rachael Rukaya Bawre, declare that this dissertation, 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: ……………….

## SUPERVISORS' DECLARATION

We hereby declare that the preparation and presentation of this work was supervised in accordance with the guidelines for supervision of dissertation as laid down by the University of Education, Winneba.

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# DEDICATION

This work is dedicated to my husband, Duut Bedima, my children (Teata, Meely, Naama, Remi Bamoni, Sandah), my sister in-law Margaret Yaro, my sister Adisah Ibrahim and Solomon Sarkodie.

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# ABSTRACT

The study investigated the status and quality of science teaching and learning in some selected Junior High Schools of the Sunyani Municipality. The research involved 10 randomly selected schools within the Sunyani Municipality. A total of 100 pupils were selected in addition to 20 Integrated Science teachers. The study was a descriptive survey. A self -constructed questionnaire (SCQ), structured observation checklists and interviews were the main instruments for the data collection. A duration of four weeks was used for the collection of data from both pupils and teachers; who were observed and questionnaires administered and the data finally analyzed using SPSS version 16.0. The study revealed that 65% of the science teachers were experienced in teaching science at the JHS level. Schools within the municipality lacked laboratories, and therefore used normal classrooms as laboratories. Instructional materials were inadequate for the teaching and learning of science. Teachers within the municipality attested to the need to use practical oriented methods to teach science. Additionally, about 90% of the science teachers confirmed the lack of organization of in-service training for science teachers within the municipality. In view of this, the researcher suggested the use of practical oriented methods in the teaching and learning of science and the discontinuation of literacy approaches to science teaching and learning. It was further recommended that in-service training should be regularly organized for science teachers. Efforts should also be made by the relevant authorities in education to ensure that adequate materials and laboratories exist at JHS level in the research area.

# CHAPTER ONE

# INTRODUCTION

## 1.1 Overview

This chapter provides the background to the study. It also gives the statement of the problem, justification for the study, the purpose of the study, the objectives of the study, research questions and significance of the study. The chapter also considers the delimitation and the limitations of the study.

## 1.2 Background to the study

Current advances in science and technology have influenced the rate of economic development of nations, improved the quality of life in most parts of the world, and provided solutions to major problems and needs of societies. The impact of science and technology is felt on education, health, nutrition, transport and communication.

The need to improve the quality of science teaching and learning for citizens so that they develop scientific literacy to cope with the demands of science and technological growth has been the yearning of every nation in this $21^{st}$ century. Efforts have been made by researchers in the United States of America (Darling-Hammond, 1997), Australia (Goodrum, Hackling & Rennie, 2001) and the United Kingdom (Millar & Osborne, 1998) by engaging the support of key stakeholders in science education. It is very important to involve key stakeholders in science education in making recommendations for improving the quality of science teaching and learning in Ghanaian basic schools as a means of helping citizens to become more scientifically literate, is a task that is widely acknowledged as important.

The continued existence of human depends on the mastery of the knowledge and attitudes of science and technology (Anderson, 2006). In view of this, a country like Ghana needs scientifically literate citizens who can make informed choices in their personal lives and approach challenges in the workplace in a systematic and logical order. They also need to become competent professionals in the various scientific disciplines who can carry out research and development at the highest level.

Despite the great deal of activities that are being directed towards the teaching of science, studies have shown that a large number of students seem to learn very little science at school. For example, Salau (1996) argued that science learning at school tends to be rote and that students still find the learning of science to be difficult. The quality of science teaching and learning is questionable because of the poor performance of a great number of junior high school students in integrated science. For example, Ghana participated in the Trends in International Mathematics and Science Study (TIMSS), a worldwide assessment which took place every four years and provided data about performance in mathematics and science achievement over time in 2003, 2007 and 2011. This programme focused on pupils in their second year in junior high schools. The highest international score for science in 2003 was 474 and Ghana‘s score was 255. Although in 2007, Ghana registered an improvement by scoring 303 in science; her score was one of the lowest and was significantly lower than the TIMSS scale average of 500. This poor performance placed Ghana at the 48th or last position on the overall science achievement results table when the 48 participating countries were ranked by their mean performance. In 2011, Ghana‘s average scale score was 306 out of 500(Martin, Mullis, Foy & Stanco, 2012).

Even though there was an improvement in the results compared to the previous years, Ghana‘s performance was still below average. Thus, Ghana‘s performance in science remained one of the lowest in Africa and in the world (Anamuah-Mensah, Mereku &Ampiah, 2009). This raises serious questions about the quality of the teaching of science especially in the basic schools. Incidentally these schools form the foundation for the study of science at the secondary and tertiary levels of education.

The goal of the Ministry of Education, Science and Sports (MoESS) for science teaching and learning is to raise the level of scientific literacy of all students and equip them with the relevant basic integrated scientific knowledge needed for their survival and for the development of the country (MoESS, 2007). It was also expected that scientific experiences in school will help cultivate in pupils the interest and love for science that will urge some of them to seek further studies in science as preparation for careers in the sciences. For a successful study of science at the basic level, the curriculum requires that pupils should have good observational skills, mathematical skills and communication skills (CRDD, 2007).

The goal for science teaching and learning as indicated above is not being achieved fully as a result of poor performance of most students in the core subjects which include science. Bonney (2009) reported that just a little over 50 per cent of the candidates who sat for the Basic Education Certificate Examination (BECE) in 2009 qualified for placement into Senior High Schools and Technical Institutes. This was because most of them could not get a pass in all the four core subjects, especially in integrated science. The situation in the research area is not different. A high proportion of the candidates presented for the BECE, have over the years, performed poorly in integrated science. This was indicative of weak background knowledge in science among the JHS pupils in the Sunyani municipality.

In recent years, science in basic schools has been found to be poorly taught: Harlen (2000) reported the results of a two-year study of primary teachers' understanding of concepts in science and technology. It was found that the teachers' confidence in teaching science was low. Some teachers had no experience of science. Others had negative attitudes towards science based on their own science educational experiences. Weak teacher knowledge and low confidence in the teaching of science have been reported to result in teachers who focused on process skills in science and avoided concept development (Harlen & Holroyd, 1995). According to Ryan and Cooper (1992), the characteristics of an effective teacher is the ability to ask different questions each of which requires different types of thought processes from the learners, the ability to reinforce certain kinds of learner behaviours, the ability to diagnose learner needs and learning difficulties and the use of technological equipment, the ability to vary the learning situation continually to keep the learners involved, and the ability to recognize when students are paying attention and to use this information to vary behavior and, possibly, the direction of the lesson.

**1.3 Statement of the problem**

Integrated science teaching and learning in Ghana is a concern to all stakeholders including government and the society at large because it is one of the compulsory entry requirements into higher levels of education in the country. Presently in Ghana, integrated science is perceived to be a difficult subject due to its broad nature (Abanyie, 2014). This perhaps may be responsible for the poor performance of some Junior High Schools (JHS) pupils in the subject at the Basic Education Certificate Examination (BECE). In the research area, records from the Sunyani Municipal Ghana Education Service (GES) office from 2012-2014 indicated that the BECE integrated science results for the three years were poor. Schools in the municipality presented 2933 candidates for the BECE in 2012. Out of this number, 1200 (40.90%) candidates had grade 1-3, and 1733 (59%) had grade 4 and below. In 2013, 3016 candidates were presented and out of that, 1403 (46.50%) candidates had 1-3 and 1615 (53.55%) candidates had grade 4 and below. In 2014, a total of 3198 candidates were presented and out of this number, 1429 (44.69%) had grade 1-3 and 1769 (55.31%) had grade 4 and below. The breakdown of the results for the three years showed that the performance of the pupils in integrated science was below expectation. The causes of this problem might be multidimensional. Other researchers including, Parku (2012) and Adongo (2011) have carried out similar researches in other regions but nothing of that sort has been done in the study area. For this reason, the researcher undertook this study to determine the possible contributory factors to the problem of the low academic performance of the JHS pupils in integrated science in the Sunyani Municipality.

### 1.4 Purpose of the Study

The purpose of the study was to determine the status and quality of JHS science teaching and learning in the Sunyani Municipality.

### 1.5 Objectives

The main objective of the study was to determine the status of the teaching and learning of Integrated Science in Junior High Schools in the Sunyani Municipality in the Brong Ahafo Region of Ghana, and to identify factors that hindered science teaching and learning in the selected schools. In order to achieve this main objective, the following secondary objectives were formulated

To determine:

1. the academic and professional qualifications of JHS science teachers in the Municipality.
2. the difficulties teachers and pupils encounter during science lessons.
3. the instructional materials available for science teaching and how they were used during lessons.
4. the predominant instructional approaches utilized by the teachers during science lessons.
5. Whether or not capacity enhancing activities were organised in the Municipality for JHS science teachers.

**1.6 Research Questions**

The following research questions guided the investigative activities:

1. To what extent are the teachers academically and professionally qualified to teach science?
2. What difficulties do the teachers and pupils encounter during science lessons?
3. What instructional materials are available for science teaching and how are they used during science lessons?
4. What are the predominant instructional approaches utilized by the teachers during science lessons?
5. What capacity enhancing activities are organised for science teachers in the municipality and how are these rated by the teachers?

### 1.7 Significance of the Study

In an attempt to improve the teaching of integrated science in Ghanaian basic schools and make the learning of integrated science more attractive to pupils, this study could make the following important contributions to knowledge and education.

The study would provide science educators, science curriculum planners and government with detailed information about the actual picture of science teaching, science learning, and educational practices in Ghanaian basic schools, and realistic, cost-effective ways of improving the situation. This could help in planning and formulating further policies for science education in Ghana.

The study would engage key stakeholders in science education in revealing the actual and ideal pictures and gaining their support for recommendations for closing the gap. This could inform them about the features of quality science education and gain their support for improving the recommendations of the study.

The results of the study could give useful information to the Ministry of Education and other educational authorities to undertake interventions to promote practical lessons in science. This study could also serve as a source of information for further research work on the topic. Additionally, the findings could augment the pool of data required by other educational researchers in their bid to design particular interventions to solve educational problems in sciences.

### 1.8 Delimitation of the Study

The study focused only on selected JHS pupils and their science teachers in the in the Sunyani Municipality. The study only sought to identify problems that hindered effective teaching and learning of integrated science in the selected schools. The teachers' and pupils' knowledge of the subject matter was not determined.

## 1.9 Limitations

According to Best and Kahn (1992), limitations are conditions beyond the control of the researcher that will place restriction on the conclusion of the study and its application. The study was limited to only the municipality with twenty teachers and JHS pupils from the ten schools in the municipality. Since the subject used in the study are humans, they are likely to change their behaviours towards the researcher during the collection of data.

## 1.10 Operational Definition of Terms

Equipment: they refer to tools used to teach practical lessons in the laboratory.

Apparatus: They are used to measure, observe and gather data for experiment, as well as to safely perform reactions and to heat things.

Chemicals: These are consumables that are used to perform various routine tests and experiments in the laboratory.

Improvised materials: They are science materials designed by the teacher for teaching.

Glassware: They are objects made from glass for the purpose of science teaching and learning.

Quality: The performance of student in terms academics, discipline, etc per their expectations

Status: The state or prevailing conditions of the JSH schools in the Sunyani Municipality

## 1.11 Abbreviations

BECE : Basic Education Certificate Examination.

CRDD : Curriculum Research and Development Division.

GES : Ghana Education Service

JHS : Junior High School

MoESS; Ministry of Education Science and Sports

SHS: Senior High School.

SSCE: Senior Secondary School Certificate Examination.

TIMSS: Trends in Mathematics and Science Study.

TLMs: Teaching and Learning Materials.

WASSCE: West Africa Senior Secondary Certificate Examination

# CHAPTER TWO

# LITERATURE REVIEW

## 2.1 Overview

This chapter reviews literature related to the study including empirical framework and conceptual framework. Topics reviewed under this chapter include the overview of the JHS integrated science curriculum, teacher‛s qualification and area of specialization, teacher professional development, instructional materials used in teaching, and problems teacher‛s encounter during science lessons.

## 2.2 Conceptual Framework

The woeful performance of pupils in integrated science cannot be blamed solely on the pupils as far as academic work is concerned. Fig 1 represents the conceptual framework for the study. The listed factors were believed to affect the overall performance of pupils in integrated science in junior high schools in the research area. Each of these factors is important in teaching and learning of integrated science. For instance, teachers‛ and pupils‛ difficulties. Both the teacher and the pupils have peculiar challenges which could be personal, institutional, emotional and sometimes even social problems which affect teaching and learning and subsequently the performance of the pupils in examination. Even in the right state of mind of both teacher and pupils, the right TLMs should be used to enhance both teaching and understanding of lessons. The choice of TLMs used can either affect performances of pupils positively or negatively. Human beings are dynamic and need the rightful approach to remain focused. Hence in science lessons, another factor that affects academic performance is the instructional approach. If the approach is not suitable, especially to the pupils, then they lose focus right away and it is difficult to bring such pupils back on track. This will adversely affect the overall output (final exam). The instructor (the teacher for that matter) should be able to model capacity- enhancing activities at all times in order to always create a positive impact. This is a very sensitive factor which is often overlooked by most teachers and which often tends to have a negative influence on pupils. If the same boring teaching activities are carried out all the time, then nothing motivates pupils to be serious and take part in the learning, so the capacity enhancing activities should constantly be varied and if this is done the end results will be very good. It is not for nothing that teachers are trained. It is certainly important that professionally trained teachers teach science in junior high schools to improve pupils‘ performances. Someone who is untrained could be good, but would not have the skills of teaching, hence his lessons could be boring and this could yield poor results. Hence the professional development of the teacher is as important as all other factors and should be taken seriously to avert the poor performances we have in our schools.

To achieved effective teaching and learning of integrated science by pupils all these factors must be adhered to and should balance. For this reason, the variables listed in the conceptual framework shown in the Figure1, were measured to determine the extent to which each of them affected science teaching and learning in the research area.

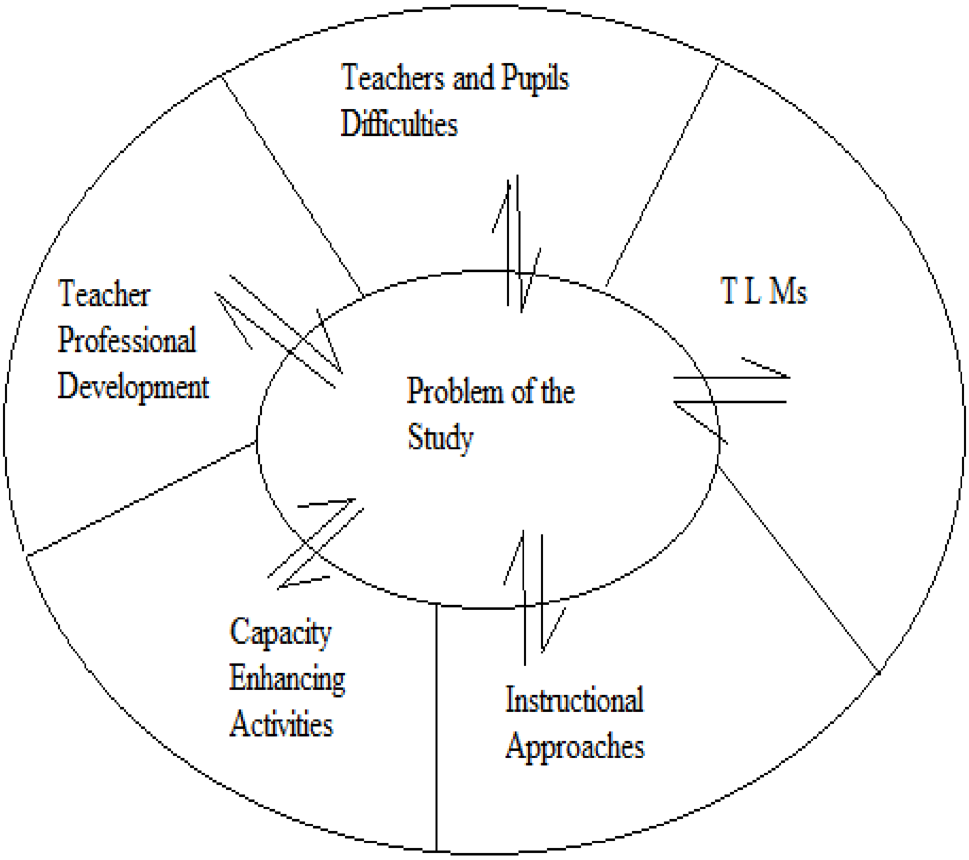


**Figure 1: Diagrammatic form of the conceptual framework**

## 2.3 Overview of the JHS Integrated Science Curriculum.

The JHS, integrated science curriculum is teaching a syllabus which contains the content materials, which will help the child attain scientific literacy at the end of the course work. The content of the JHS integrated science curriculum covers the basic sciences and include topics in health, agriculture and industry. The syllabus specifies the instructional materials that are needed and the instructional approaches to adopt for the teaching and learning of science. The syllabus has been designed to offer a body of knowledge and skills to meet the requirements of everyday living and provide adequate foundation for those who want to pursue further education and training in science and science- related vocation.

The acquisition of general scientific literacy by every Ghanaian citizen is a requirement for successful living in modern times. Scientific culture develops and this aligns with the country‘s strategic programme of achieving scientific and technological literacy in the shortest possible time. This scientific culture is the antithesis to superstition and a catalyst for faster development.

The focus of the study of Science is to understand the natural world. There are generally two main goals of Science education. First, it inculcates scientific literacy and culture for all, so that people can make informed choices in their personal lives and approach challenges in the workplace in a systematic and logical order.

Second, it aims to produce competent professionals in the various scientific disciplines who can carry out research and development at the highest level. For meaningful scientific education, it is important for pupils to be trained in the investigative process of seeking answers to problems. This requires pupils to physically explore and discover knowledge within their environment and in the laboratory to be able to contribute new scientific principles and ideas to the body of knowledge already existing in their culture. The integrated science syllabus is a conscious effort to raise the level of scientific literacy of all students and equip them with the relevant basic integrated scientific knowledge needed for their own survival and for the development of the country. It is also expected that scientific experiences in junior high school will cultivate in pupils an interest and love for science that will urge some of them to seek further studies in science as preparation for careers in science. The study of science will also provide excellent opportunities for the development of positive attitudes and values.

## 2.4 General Aims of the Integrated Science Syllabus

The syllabus was designed to help the pupil to:

1. develop a scientific way of life through curiosity and investigative habits
2. appreciate the interrelationship between science and other disciplines.
3. use scientific concepts and principles to solve problems of life.
4. use basic scientific apparatus, materials and appliances effectively.
5. take appropriate measures for maintaining machinery and appliances used in everyday life.
6. acquire the ability to assess and interpret scientific information and make inferences.
7. recognize the vulnerability of the natural environment and take measures for managing the environment in a sustainable manner.
8. appreciate the importance of energy to the living and non-living things and adopt conservation methods to optimize energy sources.
9. take preventive measures against common tropical diseases
10. live a healthy lifestyle.

## 2.5 Organization of the JHS Integrated Science Syllabus

The syllabus covers three years of junior high school education. Each year‘s work is organized under five themes or sections. The themes are: Diversity of matter (living and non- living things), Cycles, Systems, Energy and Interactions of matter (living and non- living things). Under each theme or section are a set of units or topics. The knowledge, understanding as well as the activities and range of process skills presented in each theme have been extended at the different class levels. The focus of each theme is provided below.

***Section 1 - Diversity of matter***

The study of diversity of matter should enable pupils to appreciate that there is a great variety of living and non-living things in the world. It also aims at helping pupils to recognize that there are common threads that connect all living things and unifying factors in the diversity of non-living things that help to classify them. Topics under this theme include: Matter, Measurement, Nature of Soil, Hazards, Water, Element, Compound and Mixtures, Metals and Non- metals, Chemical Compounds, Acids, bases and Salts and Soil and Water conservation.

***Section 2 – Cycles***

Cycles help pupils to recognise that there are repeated patterns of change in nature. Examples of these cycles are the day and night cycle, life cycles of living things, the recycling of resources and the cyclic nature of agricultural production. Pupils learning these cycles help us to predict events and processes and understand the Earth as a self-sustaining system. Topics included: Life cycle of flowering plants, Vegetable crop production, Fish culture, carbon cycle, Climate, Life cycle of mosquito and Animal production.

***Section 3 - Systems***

The study of systems enables pupils to recognise that a system is anything that consists of parts that work together to perform a function. Pupils will recognise systems in nature as well as artificial systems. Topics include: Digestive and respiratory systems, Farming systems, Reproduction and growth in humans, Heredity, Diffusion and osmosis, Circulatory system in humans, Solar system and Dentition in humans.

***Section 4 – Energy***

Energy help pupils appreciate that energy affects both living and non-living things and therefore realise the need to conserve it. Topics include: Food and nutrition, Sources and forms of energy, basic electronics, Light energy, photosynthesis, Electrical energy and Heat energy.

***Section 5 – Interactions of matter***

The study helps pupils appreciate the interactions between living and non-living things within systems helps humans to better understand the environment and the roles they should play in it. By studying the interactions between humans and the environment, pupils can better appreciate the consequences of their actions. Topics treated under this theme include: Ecosystem, Physical and chemical changes, infections and diseases, pest and parasite, force and pressure, machines, magnetism, technology and development

***Suggestions for Teaching the Syllabus***

According CRDD (2007), for effective teaching and learning of the JHS integrated science syllabus, it is recommended that schools should have science equipment and materials. As much as possible, the social relevance of all science concepts taught must be made clear e.g. their application to agriculture and industry.

Teaching of the subject can only be most effectively achieved when teachers create learning situations and provide guided opportunities for pupils to acquire as much knowledge and understanding of science as possible through their own activities. There are times when the teacher must show, demonstrate, and explain. But the major part of a pupil's learning experience should consist of opportunities to explore various mathematical situations in their environment to enable them make their own observations and discoveries and record them. Teachers should help pupils to learn to compare, classify, analyze, look for patterns, spot relationships and come to their own conclusions/deductions. Teachers should discourage rote learning and drill-oriented methods and rather emphasize participatory teaching and learning in their lessons.

A suggestion that will help pupils acquire the capacity for analytical thinking and the capacity for applying their knowledge to problems and issues is to begin each lesson with a practical problem. The selection of a problem for a lesson must be made such that pupils can use knowledge gained in the previous lesson and other types of information not specifically taught in class.

**2.6 The Importance of Teachers' Qualifications and Areas of Specialisation**

Ferguson (1992) concluded from his research in Ghana that ―Good teachers have distinguishable impacts on students examination score" Sander (1988) Wenglinsky (1992) found that the simple largest factor affecting academic growth of population of students is differences in effectiveness of individual classroom teachers. He further propounded that a highly qualified teacher, is able to achieve better in his or her teaching profession.

The major manpower saddled with the responsibility of impacting the concepts considered fundamental to science and technology is the teacher. The teacher therefore should be well qualified to be able to handle science at that level. This was why Adeniyi (1993) noted that a country‘s manpower development depends on the quantity of her well-qualified teachers.

The issue of professionalism in teaching has been on course for quite some decades ago. Scholars argued the necessity of skilled teachers for effective learning. Ngada in

Fajonyomi (2007) emphasized that the success or failure of any educational programme rests mainly on the adequate availability of qualified (professional), competent and dedicated teachers. Agyeman (1993) reported that a teacher who do not have both the academic and the professional teaching qualification would undoubtedly have a negative influence on the teaching and learning of his/her subject. Academic qualification is considered one of the predictors of teachers‘ ability to understand and teach a subject effectively (Lingred, 1976). Similarly, educational qualification is said to be an important aspect of how a teacher perceives areas of difficulty in teaching (Uche &Umoren, 1998).

According to Subahan, Lilia, Khalijah and Ruhizan (2001), teachers of various educational backgrounds teaching science subjects are common in most schools. As a result, teachers with various subject major backgrounds were often required to teach science subjects for which they were not trained. Though these teachers might have used various kinds of coping strategies in their teaching, they are in dire need for in-service training courses in order to teach science meaningfully and effectively whilst filling the gaps of content knowledge and pedagogical content knowledge in the subject that they are required to teach.

Antwi (1992), in Ghana, noted, that the teaching profession was still in the process of building up a specialized and systematic education based on intellectual training. Consequently, some people with various levels of education, including those with no professional qualification have been employed as teachers. Probably some of the science teachers currently on the field are not professionally qualified (Parku, 2012) Among all academic- based professions, it is only in teaching that non-professionals or those without the requisite professional qualifications and training are allowed to teach subjects which are not of their special areas (Antwi, 1992, p.132, 133).

Probably these findings apply to the teachers in this study. For this reason, an attempt will be made to determine whether the teachers in the present study have the requisite qualification in science and whether they had undergone any in-service training.

Druva and Anderson (1983) found that students‘ science achievement was positively related to the teachers‘ course background in both education and in science. According to Hawk, Coble and Swanson (1985), the relationship between teachers training in science and students‘ achievement was greater in higher level science courses.

Adu, Akinloye and Adu (2015) noted that the success of educational system depends mainly on the quality of teachers employed and their training is quite inevitable because of the explosion brought about by technological innovation which make the whole world a global village (Taiwo, 1983). Teachers interpret the aims, goals and plans of education and ensure that the students are educated in the direction of the aims and goals. He gave an advice that adequate number of teachers should be employed, so as to cope with the constant increase in school enrolment at different levels, and in addition are sufficiently trained and selected for their duties.

In this study teachers‘ area of specialisation is used to encompass the teachers‘ qualifications (certificate, diploma or degrees obtained by the teachers), their subject majors and years of teaching experience.

Teachers‘ qualifications also measure the educational attainment (education level) of the teachers. That is the highest qualification obtained by the teachers in any subject. It was categorized according to the highest qualification the teachers obtained, namely Certificate, Diploma, Bachelors, Masters or Doctoral degrees. A number of studies have examined the ways in which teachers‘ highest qualifications are related to students' achievement. Many of the studies found that teachers' qualifications corresponded positively with students' achievement. For instance, Betts, Zau, and Rice (2003) found that teachers' highest degree correlated positively with students' achievement. Rice (2003) found that when teachers have an advanced degree in their teaching subjects, it will have a positive impact on the students' achievement.

Greenwald, Hedges, and Laine (1996) conducted a meta-analysis of studies that examined the relationship between school resources and student achievement; they found that there was a significant and positive relationship between teachers' qualification measured as having a master's degree or not having a master's degree and students' achievement. Goldhaber and Brewer (1996) indicated that an advanced degree that was specific in the subject taught was associated with higher students' achievement.

Many studies have established that inexperienced teachers (those with less than three years of experience) were typically less effective than more senior teachers. The benefits of experience appeared to level off after about five years, especially in non-collegial work settings (Rosenholtz, 1986).

In the research area, there is no empirical evidence of the overall quality of the integrated science teachers and its effect on the pupils' performance. This knowledge gap is intended to be filled by this study.

### 2.7 The Need for Teachers' Professional Development

Teachers' professional development refers to the opportunities offered to practicing teachers to develop new knowledge, skills, approaches and dispositions to improve their effectiveness in their classrooms (Loucks-Horsley, Hewson, Love, & Stiles, 1998). In other words, it is advancement/enhancement of teachers' knowledge of the students, the subject matter, teaching practices, and education-related legislation (The Professional Affairs Department, 1999). It includes formal and informal means of helping teachers not only to learn new skills but also develop new insight into pedagogy and their own practice, and explore new or advanced understanding of content and resources.

Professional development is defined as ―the process of improving staff skills and competencies needed to produce outstanding educational results for students" (Hassel, 1999). As Guskey (2000, p. 4) states, ―One constant finding in the research literature is that notable improvements in education almost never take place in the absence of professional development." Professional development is key to meeting today‘s educational demands.

The issue of professionalism in teaching has been on course for quite some decades ago. Scholars argued the necessity of skilled teachers for effective learning. Fajonyomi (2007) emphasized that the success or failure of any educational programme rests majorly on the adequate availability of qualified (professional), competent and dedicated teachers. Seweje and Jegede (2005) noted that the ability of a teacher to teach is not derived only from the academic background but also on the outstanding pedagogical skill acquired. Ngada (2008), while remarking on teachers‘ quality, observed that over 80% of respondents in a survey research were of the view that teachers are carriers of weaknesses. These weaknesses include, among others, inadequate exposure to teaching practice, poor classroom management and control, shallow subject-matter knowledge and lack of professionalism.

The education of pre-service and in-service science teachers is meant to help the individual teacher grow and develop as a person, provide him or her with the skills and professional abilities to motivate children to learn, assist them in acquiring the right types of understandings, concepts, values and attitudes to manage classroom instruction and be productive members of the society in which they are born, grow and live (Lawal, 2003).

Yusuf‘s (2002) view is that the main objectives of teacher education are to develop awareness, knowledge, attitudes, and skills, evaluate ability and encourage full participation in the teaching and learning process.

According to Willis and Dubin (1990, p. 3), professional competence involves the ability to function effectively in the tasks considered essential within a given profession—in comparison to job competence that is more concentrated to a specific organization and job. Professional competence is reflected in the performance of the professional, and observing the professional‘s performance assesses the level of competence. Wenglinsky (2000) found a positive correlation between professional development activities aimed at the needs of special education students, and students‘ higher-order skills and laboratory skills in science. More recently, Harris and Sass (2007) identified what they call the ―lagged effect of professional development,” that is, the larger effect of teachers‘ professional development on student outcomes not becoming apparent until three years after the teachers had completed their courses. The interpretation of the positive effect of participation in teacher professional development activities is not clear cut, as this variable is confounded with other teacher attributes, that is, teachers who participate in these activities are also likely to be more motivated and, usually, more specialized in the subjects they teach.

Professional development is an intensive, ongoing, and systemic process that aims to enhance teaching, learning, and school environments (Fenstermacher & Berliner, 1985; Elmore, 2002). Effective professional development programs are sustained over a period of time and provide clear and consistent linkage to the subject matter and the core ways in which students learn (Zemelman, Daniels, & Hyde, 2005).

In fact, research has repeatedly shown that the most important variable in student achievement is the quality of the teacher in the classroom (Block, 2000; Darling-Hammond, 2000; Haycock, Jerald, & Huang,2001).

Undoubtedly, the ultimate goal of professional development is to increase student achievement (Mundry, 2005; Porter, Garet, Desione, & Birman, 2003; Quick, Holtzman, & Chaney, 2009), and instructionally-focused professional development supports teachers toward that goal.

Research shows that the more time teachers spend engaged in professional development, the more likely their teaching practice is to improve (National Staff Development Council, 2009; Porte, Garet, Desimone 2003; Quick, Holtzman & Chaney, 2009).

Effective professional development is coherent because it is connected to clear goals such as a school improvement plan or state learning standards (King & Newmann, 2004). When teachers‘ varying professional development experiences are related to each other as well as to school goals or state learning standards, they are able to see the ―big picture”. This causes teachers to perceive their learning experiences as more valuable (Quick, Holtzman & Chaney, 2009), which makes them more likely to change their teaching practice to positively affect student outcomes (Porter, Garet, Desimone 2003).

Professional development is understood and described in different ways. Joyce, Howey and Yarger, 1976, p. 6), for example, defined professional development as ―formal and informal provisions for the improvement of educators as people, educated persons, and professionals, as well as in terms of the competence to carry out their assigned roles." Gall and Renchler (1985, p. 6) described professional development more specifically as ―efforts to improve teachers‗ capacity to function as effective professionals by having them learn new knowledge, attitudes and skills."

Accodding to Ramatlapana (2009), the mandate of in-service training is to improve the quality of teaching by supporting teachers through training programmes that enable them to take ownership of their professional development. For instance, Rosenholtz (1986) found that in schools where teachers met regularly to examine their practice and learn strategies to improve it, students had better academic progress.

Day‗s (1999, p. 27) definition perhaps best highlights teachers' continuous professional learning within the broader context of change and its interconnected elements. According to Day, professional development consists of all natural learning experiences and those conscious and planned activities which are intended to be of direct or indirect benefit to the individual, group or school, which constitute, through these, to the quality of education in the classroom. It is the process by which, alone and with others, teachers review, renew and extend their commitment as change agents to the moral purposes of teaching; and by which they acquire and develop critically the knowledge, skills and emotional intelligence essential to good professional thinking, planning and practice with children, young people and colleagues throughout each phase of their teaching lives.

If Junior High School children are to have satisfactory science experiences, then teachers have to be preparing to provide for them. Good undergraduate methods course in the colleges will not equip the teachers enough. Too many teachers are already out there teaching. These teachers must be reached through in-service training. The question is not should there be in-service training, but what kind of in-service training will really affect the teacher and what she does with the child in the classroom? (Dormalee, 1971). Presently in the research area, professionally development was not carried out frequently for teachers to upgrade their knowledge in order to improve the quality of integrated science teaching and learning in the JHS This study would help bridge the situation at stake.

**2.8 Teaching and Learning Approaches: Importance and Utility**

Methods of teaching is a means or procedures that a teacher uses to aid pupils in having an experience, mastering a skill or process, or acquiring knowledge as attested by Gutek (1988). There are various applicable approaches for teachers in teaching science. In general, the selection of the approaches depends on the objectives of the teaching. Influencing factors caused by students are the preparation of students' capability, class capacity and students' background knowledge. Marson (1998) has pointed out that science is dynamic process. Hence, learners are to be encouraged to think and act like scientists through approaches that cater for individual differences. Therefore, science teachers should select approaches that would enable students to probe and question situations and be able to collect, classify and analyse simple scientific data. These practices in a long run, enhances the students to discover facts and concepts for themselves.

According to Orlik (2006), to carry out with success the objectives of the educational system, the science teacher must have deep knowledge of the modern methodology to employ well all methods, depending on the objectives on the classes, type of classes, topic of course, preparation of students and other factors, that influence directly and indirectly the results of the educational work. Teachers must master the knowledge of all the modern active teaching methods theoretically and practically to be able to apply them appropriately in their classroom. Therefore, in conducting a lesson effectively, teachers should not focus solely on one particular teaching approach. Instead, teachers should utilize and integrate various approaches in their lessons to achieve the best learning of students. It appears to be different in the area under which this study is carried. Lack of teaching and learning materials in the JHS has compelled science teachers to use lecture method instead of practical activities to teach science.

According to Chayter (1975), often the way science was taught was misleading. Teachers lay emphasizes on rot learning and acquisition of knowledge rather than developing a total child, for the child to realize the relevance of what he/she learns in his environment.

Bell, Blair, Crawford and Lederman, (2003) and Germann, Haskins and Ausl (1996) claimed that developing scientific literacy for the citizens required engaging learners in scientific inquiry for them to develop broad knowledge and understandings of the processes and nature of science.

Lawson (1995) further indicated that through inquiry-oriented teaching teachers could help learners to build their interest in the materials and activities. this encourage their thinking, questioning and discussion for a variety of investigatory paths which fits the lesson content and learners‘ intellectual level which is applied in everyday social problems.

Literature in science education describes three levels of inquiry-based teaching and learning. These include structured inquiry, guided inquiry and open inquiry (Colburn, 2000; Hackling & Fairbrother, 1996). Colburn (2005) describes structured inquiry as one that involves the teacher engaging students in problem-solving activities and providing them with the procedures and materials to discover and generalize on their own from data collected. Essentially, the approach prescribes what students are to observe and which data they are to collect. Guided inquiry on the other hand involves the teacher providing only the materials and problem to investigate while the students manipulate the materials and solve the problem on their own. Open inquiry is similar to guided inquiry with the addition that students also formulate their own problem to investigate. Open inquiry in many ways, is analogous to doing science and a typical example of student open inquiry being the science fair or science talent search projects (Hackling, 1998; Hackling & Fairbrother, 1996).

Shulman (1987) underscores the need for adequate pedagogical content knowledge, which is the knowledge about how to teach in particular disciplines, as an important characteristic of an effective instructor. He argued that the knowledge of a particular subject will not be sufficient to teach effectively. The phrase pedagogical content knowledge was introduced by Shulman (1986, 1987) to refer to the ability to represent important ideas in a way that makes them understandable to students.

Over the years, research in science education has compared inquiry-based and traditional teaching and learning approaches in science ( Chang & Mao, 1998; Kaiser, 1996; Lott, 1983; Shymansky, 1984). A typical example is that of Lott (1983). Lott conducted an analysis of 39 studies involving expository and inquiry-oriented approaches in science and found that teachers who encourage inquiry approaches in their teaching have students who perform better than those taught using traditional approaches when higher-level cognitive processes were emphasized, but performed equally well on low-level cognitive processes. Thus the inquiry-based approach helps to develop higher-level cognitive skills in learners and improves learning outcomes among students.

Both the content and pedagogy of science learning and teaching are being analysed, and new standards intended to shape and refresh science education are emerging (National Research Council 1996 and 2000). Teacher guidance and instructions have ranged from highly structured and teacher centered to open Inquiry. The terms have sometimes been used to include investigations or projects that are pursued for several weeks, sometimes outside the school, while on other occasions they have referred to experiences lasting 20 minutes or less.

The National Science Education Standards (1996) reaffirmed the conviction that inquiry in general and inquiry in the context of practical work in science education is central to the achievement of scientific literacy. Inquiry-type laboratories have the potential to develop student‘s abilities and skills such as posing scientifically oriented questions.

According to Lawton (1997), students who were exposed to an inquiry approach to science express a more positive attitude to learning in all areas, show increased enjoyment of school, and have increased skill proficiency in many areas, including independent thinking abilities, than those students taught the traditional way (Lawton, 1997).

The question then, is, if amazing benefits can be gained from using an inquiry approach to science teaching in the elementary classroom, why is there not more of it? Probably because teaching science using hands-on activities in the classroom is harder, more hectic and requires better management skills. Other worrisome barriers to implementing an inquiry-oriented approach to teaching science includes teachers‘ uncertainty about not only factual information but hands-on methods, discomfort with the subject of science itself, a lack of available resources and sometimes limited science content knowledge that many elementary level teachers seem to possess.

Bonwell and Eison (1991) define active learning instructional strategies as approaches that ―involve students in doing things and thinking about the things they are doing" (p.2). In this environment, students are actively participating in the learning process, and they contribute to the information and knowledge exchange in the classroom.

According to the Prosser and Trigwel (1999), active learning is a student-centered approach and the most effective way for students to learn. In addition, Meyers and learning strategies; and teaching resources. As asserted by Sivan, Leung, Woon, and Kember (2000), beyond the increase of students' success, active learning helps students to create a sense of curiosity, have ability to apply knowledge, develop independent learning skills and be prepared for their future careers.

Pell and Jarvis (2001) found that children preferred practical activities over non-practical activities in science, and Murphy, Beggs, Carlisle and Greenwood (2004) found that increasing the amount of practical, investigative work in primary science increased enjoyment of science experienced by pupils.

But where facilities and resources are available, a qualified and motivated science teacher will deploy methods that center on the learner. Such an approach emphasizes practical activities and has the pupils experimenting, solving problems, discussing with each other and involved in practical hands-on-activities. This approach stimulates curiosity, imagination and critical thinking. It keeps the lessons exciting and captivating to the young people, particularly girls (American Association for the Advancement of Science (1990, project 2061).

Traditionally, teachers used the lecture format to teach children about science. One of the drawbacks to the lecture format is that it does not engage students in their learning. This teaching technique encourages rote memorization and note-taking instead of excitement about the world of science. Peer-to-peer teaching is when the students actually get involved in teaching each other about science. This is an active learning method that encourages students to discuss scientific topics, develop questions about the material, and work in teams to learn new information.

Bloom (1956) wrote that just as there was no single method through which new concepts are learned, there is no single method of teaching which fits all learning situation. Yong (1986) emphasized that in science education, the teacher should guide the students to find out information for themselves through activity method rather than being fed with information. He went further to say that when students are encouraged to do much of the talking and much of the activities during lessons, they learn to be creative and inquisitive. Inquisitiveness leads to posing of problems and seeking solutions to them. These processes help students to use all their senses to learn. Tobin (1990) wrote that ―Laboratory activities appeal as a way of allowing students to learn with understanding and, at the same time, engage in a process of constructing knowledge by doing science".

Hofstein and Lunetta (1982) and Lazarowitz and Tamir (1994) suggested that laboratory activities have the potential to enhance constructive social relationships as well as positive attitudes and cognitive growth.

Woolnough (1991) underscored the importance of practical work in science and suggested that, science teaching and learning should be practical and must involve the use of scientific apparatus with learning ideally taking place in the science laboratory.

In its real sense, a room set aside solely for science teaching and learning could serve the purpose. If the view of Woolnough is considered very important, then there is no effective teaching and learning of science and other practical subjects like pre-technical and pre-vocational skills in the Sunyani Municipal, since all the schools lack laboratories. Dinko (1998) observed that, to satisfy the demands of the JHS curriculum, it is evident that a lot of teaching materials will be needed. In view of this teachers need textbooks, reference materials, basic science equipment and chemicals to organize practical lessons through which pupils are expected to develop process skills and scientific concepts.

The topics in the JHS syllabus deal with issues requiring practical skills, knowledge and attitudinal change. Teachers must therefore use methods that can assist pupils to develop critical thinking, desirable attitudes and scientific values. The activity-centred methods are preferable. Teachers must also realise that the use of the teacher-centred methods of teaching, in other words, is not the best. This is because, these methods are not effective in the teaching and learning of most of the topics in the integrated science syllabus (CRDD, 2007).

**2.9 Importance of Instructional Materials in Science Teaching and Learning.**

The different teaching aids or apparatus which a classroom teacher employs to facilitate his or her teaching for the achievement of the stated objective is called instructional materials. Educative curriculum, curriculum materials designed to address teacher learning as well as student learning, is one potential vehicle to effective teaching and learning (Ball & Cohen, 1996). According to him teachers are also use to using such materials to plan and structure student activities.

Agun (1992) defined instructional materials as those materials which are helpful to the teachers and students and which maximize learning in various areas. Instructional materials are the devices developed or acquired to assist or facilitate teachers in transmitting organized knowledge skills and attitudes to the learners within an instructional situation (Nwachukwu, 2006). Teachers use different instructional materials to motivate pupils during instructions.

Instructional materials help teacher to meet individual differences of the learners in the class by using aids that appeal to different senses (Morohunfola, 1983). Instructional materials are used in place of verbal explanation of concepts or any description so that the lesson could be real to the students. Instructional materials are very important because what students hear can easily be forgotten but what they see cannot be easily forgotten and last longer in their memory.

In the contribution of Abimbola (1999) to the importance of instructional materials to teaching and learning process, he stressed that the primary purpose of instructional materials is to make learning more effective and also facilitate it. He averred further that teachers would not be able to do much where these materials are not available; therefore, improvisation becomes necessary.

Ainley (1981) stated that the standard of equipment and materials should be of great importance in the teaching and learning process. According to him, they helped to foster science teaching activities which involved students in a variety of stimulating activities.

Frazer, Okebukola and Jegede (1992) stressed that a professionally qualified science teacher no matter how well trained, would not be able to put his ideas into practice if the school setting lacked the equipment and materials necessary for him or her to translate his/her competence into reality.

Fakomogbon and Adegbija (2006) posited that instructional media or materials can be used by lecturers to overcome noise factors, such as misconception, referent confusion and daydreaming.

Allwright(1981), argues that materials should teach students to learn, that they should be resource books for ideas and activities for instruction/learning, and that they should give teachers rationales for what they do.

The success in the skill and knowledge acquisition in an instructional situation depends on the suitability of the instructional material, adequacy and effective utilization of the available materials (Olaitan & Aguisiobo, 1994).

As Adedeji and Owoeye (2002) indicated, availability of physical material resources is of importance to any educational endeavour. Teachers often make use of textbooks, charts, models, graphics, realia as well as improvised materials. Instructional materials are very important because what students hear can easily be forgotten but what they see cannot be easily forgotten and last longer in their memory. Instructional materials are used to supplement verbal explanation of concepts or any description so that the lesson could be real to the students. Omosewo (1999) ascertained that in a modern Science curriculum programme, students (male and female) need to be encouraged to learn not only through their eyes or ears but should be able to use their hands and head to manipulate apparatus.

According to Oladeja, Olosunde, Ojebisi and Isola (2011), instructional materials could be classified variously as audio or aural, visual or audio-visual. Thus, audio instructional materials refer to those devices that make use of the sense of hearing only, like radio, audio tape recording, and television. Visual instructional materials on the other hand, are those devices that appeal to the sense of sight only such as the chalkboard, chart, slide, and filmstrip. An audio-visual instructional material however, is a combination of devices which appeal to the sense of both hearing and seeing such as television, motion picture and the computer. Among the instructional materials the classroom teacher uses, the visuals out-numbered the combination of the audio and audio-visual. These visual and audio-visual materials are materials that when a teacher used can appeal to student sight and hearing. These can be electronically operated materials like Television, Radio, Film, Slide motion; Computer and non-electronic ones such as Chalk board, Charts, Burners, Models and many more.

Teaching resources/materials are the items the teacher uses to make lessons interesting and for students to easily understand lessons and should therefore be provided in the right quantities for effective teaching and learning (Sekyere, 2002).

Bajah (1986) in his study, found a significant relationship between teachers, facilities and schools' academic performance. Adequate provision of instructional materials is an important method that science teachers can use in promoting skills acquisition, in consonance with the objective of developing manipulative skills in students (Eshiet, 1987).

Ogunyemi (1990) found out that when physical and material resources are provided to meet the needs of a school system, students will not only have access to reference materials maintained by the teacher but individual students will also learn at their own pace. The net effect is that it increases the overall academic performance of the students. Bassey (2002) reported that students taught with standardized instructional materials had the highest achievement in the end of course examination.

Gamoran (1992) noted that school resources and books in the library alone, had little impact on students' achievement once student background variables are taken into account. This meant that before such students could perform well at the higher educational level, they must be supplied with the requisite educational materials at the basic level to propel them to higher achievement.

In the opinion of Amankrah (1996), most schools lacked teaching and learning resources/materials and even where they were available, they were few or limited. This situation is not different from what is happening in the research area. This study will help bridge the present lapses.

## 2.10 Empirical Framework

Related studies on the teaching of science were reviewed. One of these is; a study by Akinyemi and Orukata (1995) which revealed that the performance of Nigerian students in Ordinary Level Biology was generally poor. This was attributed by the authors to many factors of teaching, of which availability of teaching aids was considered as an important factor. In addition, Jegede, Okota and Eniayelu (1992), reported factors responsible for students‘ poor performance in science, technology and mathematics are poor laboratory facilities, inappropriate teaching methods and inadequate numbers of learning facilities in schools as against consistent increase in the number of students. Teachers‘ use of instructional materials in teaching is paramount to students‘ improvement in academic performance. Findings reveal that a good number of sampled schools lacked basic instructional aids; where they are available, they are too few to go round and often in bad shape.

Ferguson (1992) carried out a study on the effect of instructional methodology on students‘ performance. These instructional methods he referred to as technical skills of teaching. At the end of the study, he found that only effective method(s) of teaching can bring about effective learning, hence teachers creative should be and dynamic in this regard to ensure that there is an increase in average students‘ performance in their subject areas.

A study conducted by Parku (2012) on a survey of some aspects of the teaching and learning of integrated science in junior high schools in the Central Region, came out with the findings that majority of the integrated science teachers had Senior Secondary School Certificate Examination/ West Africa Senior Secondary Certificate Examination and ordinary level certificates as their highest academic qualification. This was an indication that only few of the teachers have higher academic certificate such as diplomas, degrees and postgraduate degrees. It came out that a majority of the integrated science teachers were qualified professional teachers but few had degrees in either science or education. None of the teachers had Masters Degrees in either science or education. It was realized that more than 50% of them specialised in science related subject and only 9.5% specialized in integrated science. On professional development programmes participated by integrated science teacher, it was revealed that the majority of the integrated science teachers had not participated in any form of in-service training.

Dzieketey (2010) in his study on the factors that hindered integrated science practical lessons in some selected Senior High Schools in the Yilo and Manya Krobo District of the Eastern region of Ghana, concluded that most of the teachers (about 90%) considered the lecture method as an effective method of teaching integrated science. Baidoo (2010) in his study on the factors that militated the against teaching of integrated science at the junior high school level observed that 70% of the teachers he sampled used the lecture method frequently, 20% used the demonstration method, whilst only 10% of the respondent used the learner- centred methods.

Adongo (2011) in his study on the aspect of the state of teaching and learning science in the JHS in the Bolgatanga Municipality came out with some findings that the best teaching strategies for effective teaching and learning of science at the basic level of education is the activity method. Activity method encourages hand-on activity that enhances comprehension and supplement learning either by lecture which is a traditional way of teaching. He also indicated that most teachers teaching science at the basic level did not specialized in science during their training and therefore had no requisite skills and knowledge area of specialization and teaching strategies.

From the above reviewed literature, it could be realised that some factors influence the quality of teaching and learning of science and pupils‘ performance in an educational institution. It is therefore important that school authorities and administrators should take the necessary measure to curb the situation by frequently giving professional training to teachers and also providing teaching and learning resources for use in the various institutions.

## 2.11 Summary

Studies in science education have identified some factors that affect the teaching and learning of science e.g. Oladeja, Olosunde, Ojebisi and Isola (1992) reported factors responsible for students poor performance in science, technology and mathematics are poor laboratory facilities, inappropriate teaching methods and inadequate numbers of learning facilities in schools as against consistent increase in the number of students. Teachers‘ use of instructional materials in teaching is paramount to pupils‘ improvement in academic performance. Findings reveal that a good number of sampled schools lacked basic instructional aids, when they are even available they are too few to go round and are often in bad shape.

Other researchers‘ (Dzieketey, 2010; Baidoo, 2010; Adongo, 2011; Parku, 2012) carried out similar studies in other research areas in Ghana, but did not considered all the three instruments (Observation, questionnaires and interviews) used by the researcher to collect the data in the study area. The three instruments used enriched the data.

From the literature reviewed, some of them need some filling in. For instance, a study by Akinyemi and Orukota (1995) revealed that the performance of Nigeria students in O/L Biology was generally poor. This was attributed by the author to many factors of teaching, of which teaching aids itself was considered as an important factor. Though this is true, it cannot be said to be the only reason to the poor performance of the children. The instructional approach of the teacher and even the ability of the teacher to make lessons activity oriented (to introduce capacity enhancing activities) can influence the negative performance. Jegede, Okota and Eniayelu (1992) did report that factors responsible for pupil‘s poor performance in science, technology and mathematics are poor laboratory facilities, inappropriate teaching methods and inadequate numbers of learning facilities in schools as against consistent increase in the number of pupils, could be a factor.

It is also important to note that among the many related literature, especially in Ghana, no researcher seems to talk of the difficulties both teachers and pupils encounter during science lessons. Large class size, pupils or teacher absenteeism, truancy on the part of some pupils, lateness and lack of teacher motivation, lack of funds to buy materials, lack of skills by the teacher in improvising materials and lack of skills in using the limited materials among others can hinder the efficiency and quality of teaching and learning of science. And this can adversely affect the overall output or performance of pupils in the long round.

Also, though a number of the researchers, especially Parku (2012), pointed to and indicated a satisfactory academic and professional qualifications of science teachers, there are still a lot of deficiencies to that effect. Majority of the professionally trained teachers are either cert ‗A' or diploma teachers with no university degrees. The few first and second degree holders are either not professionally trained or are not adequately upgraded in terms of attending conferences, workshops, in-service training or even doing supplementary courses to support their certificates. The skills and interest to teach well must constantly be renewed through these fora – the conferences, workshops, seminars, sponsored activities, field trips, etc.- to boost effective teaching and to ensure good performance in students.

In a related development Jegede, Okota and Eniayelu 1992 and Ferguson, 1992 all talked of the inadequacy of instructional materials, learning facilities and even instructional methods in their works as contributors of poor performances which is recorded in the sciences on yearly basis.

There could be a single laboratory in a school for an unimaginable number of students in a particular school which is obviously bad, but some teachers would worsen the case by not utilizing it at all. At least practical lessons could be conducted in batches, at least once a week; but some teachers would rather hide behind this problem and not conduct practical lessons at all. Some too are afraid to use the apparatus in the laboratories for fear of spoiling them. There are yet those who are less resourceful as in how to use certain equipment though they are the ones solely in charge, hence such equipment are not utilized at all when they should have been used. In the case of the other facilities like textbooks, the furniture, the apparatus, the classrooms and other instructional materials or learning facilities a similar practice hold for them. It is not strange to find books heaped up in offices and yet such books are said to be inadequate in those schools, or to see furniture mishandled in schools when they are not even enough.

This project therefore seeks to place more emphasis on the maximum utilization of the inadequate instructional materials and learning facilities in schools to help curb the menace of poor performance in science subjects.

# CHAPTER THREE

# METHODOLOGY

## 3.1 Overview

This chapter explains the research methodology used in this study. It begins with the description of the research design, followed by population, sample and sampling techniques and the research instruments. Validity and reliability of the instruments, as well as the data collection procedure and data analysis are discussed. This study was conducted to find out the importance of JHS integrated science teachers qualifications and area of specialisations. The studies explore the importance of available instructional materials in the JHS for the teaching and learning of integrated science. The study was conducted to find the impact of in-service training of the integrated science teachers on the teaching of integrated science in the JHS The study looked at the instructional approaches teachers used during integrated science lessons at the JHS  Finally it found out the problems the integrated science teachers and pupil encountered during the teaching and learning of science in the JHS.

## 3.2 Research Design

The study utilized the descriptive survey design. The purpose of the descriptive survey research was to enable the researcher to observe, describe, and document aspects of situations as they occurred naturally (Amedahe &Asamoah, 2001). Both quantitative and qualitative data gathering approaches were used to investigate the status and quality of science in the selected junior high schools in the Sunyani municipality. This enabled triangulation of data to increase the quality and validity of findings especially as advocated by Patton (2002) and Creswell (2009).

The qualitative research methods enabled the investigator to gain an insight into the teaching and learning of science in the classroom. Descriptive statistics such as frequency and percentages were employed to ascertain the prevailing conditions in the teaching and learning of science. Three instruments (observation, questionnaires and interviews) were used to collect data for the study. The use of the descriptive survey design enabled the researcher to tap the views of a greater variety of research subjects and over a wider research area than would have been possible with a single case study.

### 3.3 Population and sampling procedures

A target population is classified as all the members of a given group to which the investigation is related, whereas the accessible population is looked at in terms of those elements in the target population within the reach of the researcher (Pole & Lampard, 2002). The target population for the study is made up of pupils in the JHS and teachers who teach science in the JHS of the Sunyani Municipality. The accessible population in this study was science teachers and pupils in the selected JSH in the Sunyani Municipality of the Brong-Ahafo region.

According to Sidhu (2003), sampling is the process of selecting a representative unit from a population. A sample is a subset of the population and a representative sample must have properties that best represent the population so as to allow for accurate generalization of results.

According to Van Dalen (1979), a survey should contain at least ten to fifteen percent of the target population. In line with this ten out of forty JHS schools were selected from the Sunyani municipal of the Brong Ahafo region for in-depth study. The convenience sampling technique was used to select the ten schools. Convenience sampling is a kind of non-probability or non-random sampling in which members of the target population, as Dörnyei (2007) mentions, are selected for the purpose of the study if they meet certain practical criteria, such as geographical proximity, availability at a certain time, easy accessibility, or the willingness to volunteer.

The researcher considered 20 science teachers from the ten schools, two teachers from each school to form the sample. The simple random technique was also used to select 100 pupils. Ten pupils from each JHS formed the sample.

### 3.4 Instrumentation

Three main instruments were used to collect data for this study. These include questionnaire, observation schedule and interviews were combined and it is most suitable for purposes of triangulation. As Cohen, Manion and Morrison (2007) state, triangulation is the use of two or more methods of data collection techniques in a study while Brenner and Marsh (1985) asserted that triangulation techniques in social sciences attempt to map out or explain more fully, the richness and complexity of human behaviour by studying it from more than one standpoint.

### 3.5 Observation Schedule

Observation is one of the research instrument used in my data collection. McMillan and Schumacher (1993) define observation as a particular kind of data gathering tool in which the researcher observes, visually and auditory, some phenomenon and systematically records the resulting observations. Sidhu (2003) also explains that observation seeks to ascertain what people think and do by watching them in action as they express themselves in various situations and activities.

For the purpose of this study, the researcher adapted a modified form of the Barbados workshop instrument used by Eminah (2007). The Barbados instrument was originally developed in 1986 at a workshop held in the University of Liverpool, England. The instrument was first used at a workshop in 1987 in Barbados to test for school pupils‘ process skills in science. The observation instrument is made of three forms; 1, 2, and 3. The original instrument was modified by Eminah (2007) according to the procedural principles of the JHS science course. In the observation instrument the observer was required to show the layout of the classroom, taking into considerations the pupils‘ desk, teacher‘s table, chalkboard, doors, and windows of the classroom. The class size was recorded as well as the teaching and learning materials used by the teacher and pupils during the teaching and learning process. The pupils‘ and teachers‘ verbal and non-verbal behaviours was coded every one-minute interval. The form 1 was made up of both verbal and non-verbal behaviours of teachers which were categorised under $A_1$-$A_7$, $B_1$-$B_7$ as verbal activities and $C_1$-$C_7$ as non-verbal activities of the teachers. The form 2 was made of the pupils‘ verbal and non-verbal activities which is categorised under $D_1$-$D_6$ as verbal activities and $E_1$-$E_7$ as non-verbal activities respectively. The form 3 records the size of groups for practical activities and materials used in the practical lessons.

### 3.6 Questionnaire

According to McMillan and Schumacher (1993), a questionnaire is an instrument which is presented to solicit reactions, beliefs and attitudes. Nworgu‘s (1991, pp. 93–94) characteristics of a good questionnaire were applied in designing the questionnaire for this study. The characteristics are: relevance, consistency, usability, clarity, quantifiability and legibility. A closed ended questionnaire was administered in person to two science teachers whose lessons were observed and two pupils each in all the ten (10) schools. The teacher‘s questionnaire contains 20 items which was divided into four sections. Each section addresses each research question. Section A is made of 3 items, seeking the views of the respondent on their professional qualification and area of specialisations. Section B sought the views of the respondents on instructional approaches, section C seeks respondent views on in-service training and the last section that is D also considered the views of the respondent on instructional materials. The pupil questionnaire was also a follow up of the teachers. It was made up of 10 items.

### 3.7 Interviews

Interviews were also used to collect information to find out whether the respondents views were consistent with their questionnaire responses on the topic. It also enhances the interpreting and explaining the research findings. The interviews also enhance the quality of the data gathered. The pupil interview schedule was made up of seven items of which three items were close-ended demanding yes or no responses and four items demanded open responses. The teachers‘ interview scheduled consisted of eight items. The interview schedule was made of four close-ended and four open-ended questions. The interview sought to find out the availability of resources for teaching and learning integrated science, the pupils‘ attitudes towards integrated science and some challenges the integrated science teachers and pupils encounter in teaching and learning integrated science.

### 3.8 Validity of the main Instruments

Validity refers to whether the instrument accurately measures what was intended. To ensure the face and content validity of the instruments, the instruments were given to my supervisors and senior lecturers in the Department of Science Education, University Of Education, Winneba, to determine the content validity, identify any ambiguities and also make the necessary clarifications to items. This was to ensure whether the items reflected the intent of the instruments. Some items were removed after a thorough review by these supervisors.

### 3.9 Reliability of the main Instrument

To ensure the reliability of the research instruments, the classroom teaching observation was carried out on three different occasions in each of the ten sampled schools. This is in agreement with Adar and Fox (1971).

To determine the reliability of the questionnaire for both students and teachers pilot-test was conducted in one of the JHS in the Sunyani West District. The reliability of the teachers' questionnaire was determined to be 0.67 and that of the pupils' questionnaire was 0.77. According to George and Mallery (2003) a reliability coefficient of 0.70 or greater is acceptable for research purposes. The observation instrument was also determined to be 0.9 (Appendix F & G). The above reliability coefficient estimates indicated that the instruments used for the study were reliable.

### 3.10 Data Collection Procedure

Before the data collection began, the researcher used one week to visit each of the selected schools to meet the selected teachers and pupils. The visits were meant to enable the researcher establish rapport with all the respondents. The familiarization was done to enable the researcher explain the purpose of the study to the respondents and to elicit their maximum co-operation so that the objectives of the study could be achieved. The classroom teaching observations was also scheduled with the teachers concerned before it was carried out. Three classroom teaching observations was conducted in each of the ten schools in the Sunyani Municipality.

The researcher administered the questionnaire personally to the sampled teachers and pupils under study. This was to ensure that the questionnaire got to the actual targeted respondents. These questions were then answered instantly for the researcher to collect after the teaching observation was conducted. One integrated science teacher each from all the ten schools was interviewed.

### 3.11 Data Analysis

According to Osuala (1993), data analysis is the ordering and breaking down of data into constituent parts and the performing of statistical calculations with the raw data to provide answers to the questions initiating the research. Data collected through observations were subjected to narrative descriptions in answer to the various research questionnaire. The data collected through the administration of questionnaire were first coded and the SPSS version 16.0 enhance the analysis. The frequency counts of the coded data were taken after which they were converted into percentages and used to answer the research questions.

# CHAPTER FOUR

# RESULTS AND DISCUSSION

## 4.1 Overview

This chapter focuses on the empirical data presentation, interpretation and analysis of responses from the sample under the study. Tables were provided to illustrate and support the findings. Descriptive statistics were used to analyse the data. Frequency distribution tables, with percentages, based on the questionnaire were constructed. Qualitative analysis of the observation was also done. Data collected were analysed to answer the specific research questions. The presentation was done in the order in which research questions were presented in the chapter one. Discussion of the data was also carried out in this chapter.

**Background Data on the Teacher Research subjects**

The ten selected schools were listed as school A, B, C, D, E, F, G, H, I, J while the selected teachers were identified as T1, T2, T3, T4, T5, T6, T7, T8, T9, T10. Table 1 shows the male and female teachers selected for the study.

**Table 1: Background data on the research subjects**

| School | Teacher | Sex |
|---|---|---|
| A | T1 | M |
| | T2 | M |
| B | T3 | M |
| | T4 | F |
| C | T5 | F |
| | T6 | M |
| D | T7 | M |
| | T8 | F |
| E | T9 | M |
| | T10 | M |
| F | T11 | M |
| | T12 | M |
| G | T13 | F |
| | T14 | M |
| H | T15 | F |
| | T16 | M |
| I | T17 | M |
| | T18 | F |
| J | T19 | F |
| | T20 | M |

## 4.2 Presentation of the Results by Research Questions

### Research Question One

**To what extent are the teachers academically and professionally qualified to teach science?**

The responses on integrated science teachers' qualification and area of specialization were considered using items 1, 2, and 3 of section A of the questionnaire (Appendix A)

The data collected focused on the professional and academic qualifications of the teachers as well as their years of teaching experience. The result showed that out of the 20 teachers, 35% of them had 0-5 years of experience while 65% had above 5 years teaching experience. This indicated that there were more experience teachers teaching integrated science in the Municipality. The result is seen in Table 2.

**Table 2: Science teachers' teaching experience**

| **Teaching experience** | **Frequency** | **Percent** |
|---|---|---|
| 0-5 years | 7 | 35.0 |
| Above 5 years | 13 | 65.0 |
| **Total** | 20 | 100.0 |

The professional qualifications of the teachers are shown in Table 3. The results showed that majority (40%) of the respondent were Dip. Ed science teachers, 25% of the respondents were certificate _A' teachers and another 25% of the respondents were also B.Ed science teachers, while a low proportion (10%) of the respondents were pupil teachers.

**Table 3: Professional qualification of science teachers**

| Teacher Qualification | Frequency | Percent |
|---|---|---|
| *Non-professional | 2 | 10.0 |
| Cert' A | 5 | 25.0 |
| Dip Ed science | 8 | 40.0 |
| B.Ed. science | 5 | 25.0 |
| **Total** | 20 | 100.0 |

* HND, SSCE,

On areas of specialization, an appreciable proportion (60%) of the teachers specialized in integrated science, 10% of the teachers specialized in biology and another 10% also specialized in physics, while 20% of the teachers specialized in other areas of science such as agriculture science, mathematics, life skills etc. This is shown in Table 4. Hence a total of 80% are qualified to teach science at the JHS level.

**Table 4: Teachers' areas of specialisation**

| Variable | Frequency | Percent |
|---|---|---|
| Biology | 2 | 10.0 |
| Physics | 2 | 10.0 |
| Integrated science | 12 | 60.0 |
| *Any other, specify | 4 | 20.0 |
| **Total** | 20 | 100.0 |

*Life skills, mathematics, Agricultural science, Social studies

**Research Question Two**

**What difficulties do the teachers and pupils encounter during science lessons?**

The response of integrated science teachers and pupils on the difficulties they encountered during science lessons were covered by items 1, 2, 4, 6 of section D of the teacher's questionnaire and items 5 and 7 of the pupil's questionnaire (Appendix A)

Some of the difficulties teachers and pupils in the Municipality encountered were large class sizes, lack of laboratories, inadequate science textbooks, lack of science materials and equipment, teachers not being able to improvise teaching and learning materials, lack of teacher motivation, pupil's absenteeism, and the lack of funds to buy materials.

The availability of laboratories in the schools for science practical work was determined. The results in Table 5 showed all of the teachers responded ―No" to the availability of science laboratory. This indicated that schools in the Municipality do not have laboratories for science practical work.

The study also sought to find out whether the materials were enough for the organization of science practical activities. From Table 5, a high proportion (95%) of the number of the teachers responded ―No" and only 10% responded ―Yes", indicating that the teachers lacked the needed materials for science practical activities during instruction.

The table also showed that the equipment and materials were not enough to go round the pupils during practical lessons. The results showed that all the teachers responded ―No" to the item. This implies that materials used for science practical activities are not available.

**Table 5:Laboratories and materials availability in schools for science practical work**

| Variable | Frequency | Percentage |
|---|---|---|
| Laboratory | Yes (00) | 0.00 |
| | No (20) | 100.0 |
| Enough materials | Yes (19) | 95.0 |

| | | |
|---|---|---|
| | No (01) | 5.0 |
| Adequate materials/equipment | Yes (00) | 0.00 |
| | No (20) | 100.0 |

The study examined where the pupils normally had science practical lessons. The results showed that the majority (55%) of the respondents conducted practical activities in the classrooms, whereas a few (15%) conducted practical activities in laboratories. It was found that 30% of the respondents did not conduct practical lessons. The results have been summarised in Table 6.

**Table 6: Where pupils normally have practical lessons**

| Variable | Frequency | Percentage |
|---|---|---|
| No place | 6 | 30.0 |
| The classroom | 11 | 55.0 |
| Laboratory | 3 | 15.0 |
| **Total** | 20 | 100.0 |

Table 7 showed the results of what happened when equipment and materials were not enough to go round the pupils during practical lessons. The results showed that 45% of the respondents improvised materials, 45% of the respondents put the pupils into groups during practical lessons, whilst 10% of the respondents performs demonstration of practical lessons. This indicated that the inadequacy of the materials caused teachers to resort to different methods of teaching that may not be appropriate in all case

**Table 7: What teachers' do in the absence of materials and equipment**

| Variable | Frequency | Percentage |
|---|---|---|
| Improvisation | 9 | 45.0 |
| Demonstration | 2 | 10.0 |
| Group work | 9 | 45.0 |
| **Total** | 20 | 100.0 |

The study also sought to find what happens during science lessons without the availability of government science textbook. The results showed that 50% of the pupils did not get access to the science textbooks. While 30% of the pupils responded that the teacher alone used the textbook, 20% of them responded that they sat in groups and shared the textbooks. This showed that the unavailability of textbooks hindered the study of science in the selected schools. This is shown in Table 8. The sharing of textbooks created difficulties for the teachers and pupils alike.

**Table 8: What happens during science lessons in the absence of government science textbook**

| Variable | Frequency | Percentage |
|---|---|---|
| We do not get access to the book | 50 | 50.0 |
| The teacher alone uses the book | 30 | 30.0 |
| we sit in groups and share the textbook | 20 | 20.0 |
| **Total** | 100 | 100.0 |

**Research Question Three**

**What instructional materials are available for science teaching and how are they used during lessons?**

The responses of the integrated science teachers and pupils on the available instructional materials for science teaching were tapped using items 1, 2, 3, 4, 5, 6 of section D of the teacher‘s questionnaire and items 3, 4, 5, 7 of pupil‘s questionnaire (Appendix A)

The study sought to find out the availability of government science textbooks. From the results it was found that 80% of the respondents said there were no textbooks in schools, whilst 20% said there were textbooks for use. The results have been summarised in Table 9.

**Table 9: Availability of government science textbooks**

| Variable | Frequency | Percentage |
|---|---|---|
| No | 80 | 80.0 |
| Yes | 20 | 20.0 |
| **Total** | 100 | 100.0 |

The study also investigated the types of materials available for teaching integrated science in the in the selected schools. It was enquired from the teachers whether they had kit boxes with equipment but all the teachers responded ―no" and from Table 10 it was realised that two schools out of the ten schools had equipment (P), five out of ten schools had apparatus (Q), one school had chemicals (R), and four schools were able to improvise (S) materials for use during practical lessons. It was also realised that only two schools had glassware (T). In schools which had the materials, the materials were not sufficient to go round the pupils during practical lessons. This may be the reason why the teachers did not conduct hands-on activities during practical lessons but rather preferred demonstrations and used lecture method of teaching integrated science.

**Table 10: Science materials present in the selected schools**

| School | Material | | | | |
|---|---|---|---|---|---|
| | P | Q | R | S | T |
| A | - | + | - | + | - |
| B | - | + | - | + | - |
| C | - | - | - | + | - |

| | | | | | |
|---|---|---|---|---|---|
| **D** | + | - | - | - | - |
| **E** | - | - | - | + | - |
| **F** | + | + | - | - | - |
| **G** | | + | - | - | + |
| **H** | - | - | + | + | - |
| **I** | - | - | - | + | - |
| **J** | - | + | - | - | + |

**Note: Key***P =Equipment,*Q = Apparatus,*R = Chemicals,*S = Improvised,*T = Glassware

(+) = materials present (-) = materials not present

**Research Question Four**

**What are the predominant instructional approaches utilized by the teachers during science lessons?**

The responses of the integrated science teachers on instructional approaches were tapped using items 1, 2, 3, 4, 5, of section B of the teacher‘s questionnaire and items 1, 2, and 6of the pupil‘s questionnaire (Appendix A)

From Table 11, the results showed that about 60% of the respondents used the activity method, 30% used demonstrations while a low proportion (10%) used lecture method. This shows that the activity method was used in teaching science in the selected schools. When pupils are engaged in activities they are well motivated to learn and understand concepts better.

**Table 11: Methods of teaching utilised in the teaching and learning of science**

| Variable | Frequency | Percentage |
|---|---|---|
| Lecture | 2 | 10.0 |
| Demonstration | 6 | 30.0 |
| Activity | 12 | 60.0 |
| **Total** | 20 | 100.0 |

Table 12 showed how often teachers organized practical activities. From the table, the data indicated that a few teachers (10%) organized practical activities three times a week, 20% of the teachers organized practical two times a week, 30% of the teachers organized practical once a week while 40% of them did not organise practical activities. The results in totality showed that practical activities were not performed as regularly as required by the developers of the JHS science programme.

**Table 12: How often do teachers organise practical activities**

| Variable | Frequency | Percentage |
|---|---|---|
| None | 8 | 40.0 |
| Once a week | 6 | 30.0 |
| Twice a week | 4 | 20.0 |
| Thrice a week | 2 | 10.0 |

| | | |
|---|---|---|
| **Total** | 20 | 100.0 |

**Research Question Five**

**What science teacher capacity enhancing activities are organised in the municipality and how are these rated by the teachers?**

Items 1, 2, 3, 4, 5, 6, of section C of the questionnaire (Appendix A) were considered in answering this question.

This question sought to find the types of in-service training undergone by the selected integrated science teachers. A few (10%) of them responded ―No" and a high number responded ―Yes". This finding is shown in Table 13, indicating that in-service training were not usually organized for science teachers.

**Table 13: In-service training for teachers teaching of integrated science**

| Variable | Frequency | Percentage |
|---|---|---|
| Yes | 18 | 90.0 |
| No | 2 | 10.0 |
| **Total** | 20 | 100.0 |

The study also sought to find out the organisers of the in-service training programmes. From Table 14, it was found that 5% of the in-service training were organised by the STME, 85% were organized by G.E.S. while 10% were organized by other bodies.

**Table 14: Organisers of the in-service training programme**

| Variable | Frequency | Percentage |
|---|---|---|
| Any other specification | 2 | 10.0 |
| STME | 1 | 5.0 |
| GES | 17 | 85.0 |
| **Total** | 20 | 100.0 |

Table 15 also explained the number of times in-service training programmes were organized every year. From the Table the results showed that a high proportion (85%) of teachers attended once a year, 10% attended twice a year while 5% attended thrice a year. This implies that in-service training was not organized regularly for science teachers

**Table 15: In-service training organised every year**

| Variable | Frequency | Percentage |
|---|---|---|
| Once | 17 | 85.0 |
| Twice | 2 | 10.0 |
| Thrice | 1 | 5.0 |
| **Total** | 20 | 100.0 |

Data on in-service training programmes attended in a year by science teachers was obtained. Only 10% of the teachers did not attend in-service training in a year with a high percentage (75%) of teachers attending in-service training once a year and 10% attended in-service training twice a year. The finding indicated that science teachers did not get the opportunity to attend in-service training as regularly as possible. The results have been summarised in Table 16.

**Table 16: In-service training programmes attended in the year**

| Variable | Frequency | Percentage |
|---|---|---|
| None | 2 | 10.0 |
| Once | 15 | 75.0 |
| Twice | 2 | 10.0 |
| Thrice | 1 | 5.0 |
| **Total** | 20 | 100.0 |

The results summarised in Table 17 shows that most of the integrated science teachers in the municipality did not get the opportunity to attend capacity enhancing activities.

It was inferred from the table that either these capacity enhancing activities were not organised frequently in the municipality or the teachers were not motivated to take part. Another reason may be laziness on the part of some teachers. Such teachers refused to make good use of these capacity enhancing activities.

**Table 17: Capacity enhancing activities teachers attended**

| School | Teachers | Capacity Enhancing Activity | | | | |
|---|---|---|---|---|---|---|
| | | Q | R | S | T | U |
| A | T1 | - | + | - | - | - |
| | T2 | - | - | - | - | + |
| B | T3 | - | + | - | - | - |
| | T4 | - | - | - | - | - |
| C | T5 | - | + | - | - | - |
| | T6 | - | - | - | - | - |
| D | T7 | - | - | - | - | + |
| | T8 | - | - | - | - | - |
| E | T9 | - | - | - | - | - |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **T10** | - | + | - | - | - |
| **F** | **T11** | - | + | - | - | - |
| | **T12** | - | - | - | - | - |
| **G** | **T13** | - | - | - | - | + |
| | **T14** | - | - | + | - | - |
| **H** | **T15** | - | - | - | - | + |
| | **T16** | - | - | - | + | - |
| **I** | **T17** | - | - | - | - | - |
| | **T18** | - | - | - | + | - |
| **J** | **T19** | - | + | - | - | - |
| | **T20** | - | - | - | - | + |

**Key: note*** Q = Seminars, R = Workshops, S = Field trips, T = Sponsored activities, U = Conferences (+) = Attended capacity enhancing activity (-) = did not attend capacity enhancing activity

The results of the observations conducted are shown in Table 18. It was found that none of the pupils could make voluntary contributions to the lesson, performs practical activities and ask for help about procedure. Again there was no distribution of materials and equipment to pupils during the lessons observed. It was also observed that pupils did not record activities in their note books since activities demanding them were not done. From Table 18, it can be seen that pupils could recall facts, ideas, principles and definition to some extend (at least 7.9%) compared to the ability to restate or paraphrase information (4.2%) indicating the difficulty students had in terms of restructuring ideas on their own. Application of pupil‘s previous ideas to new situations is about 4.4% which is not encouraging. It can also be seen from the Table the response of pupils to the teachers‘ questions were 16% a figure that is highly significant indicating that pupils were actively involved in the lesson since 15.8% of the observation showed that pupils copied notes from the chalkboard compared to the dictation of notes by teacher (0.9%). Teachers reading textbooks in class is 2.6% compared to pupils reading science textbook during the lessons observed is 0.9% an indication that few textbooks exist that is why a lower percentage is recorded. It is also observed that from the Table 18 that pupil asking questions on the topic was low, about 0.4%. This may be due to language barrier or pupil could not express themselves in the English language. Lessons demonstration recorded as low as 5.1% suggesting that, the lecture method of teaching science was used more. It was observed that chances to handle equipment was not encouraging, (0.2%). This indicated non availability of materials for experiments. Again opportunity for pupils to write or solve problem on the chalkboard is below expectation, 0.9%. From the table commendations to pupils in class is 2.4% meaning that few pupils always respond to questions in class.

**Table 18: Table on observation**

| Item | Frequency | Percentage |
|---|---|---|
| A1. Recall facts, ideas, principles and definitions | 36 | 7.9 |
| A2.Restate, retell, summarize or paraphrase Information | 19 | 4.2 |
| A3. Apply previous ideas to new situations | 20 | 4.4 |
| A4. Make logical deductions from observations | 3 | 0.7 |
| A5. Design experimental procedure; make hypothesis; produce new arrangement | - | - |
| A6. Compare and contrast date/information | 8 | 1.8 |

| | | |
|---|---|---|
| A7. Answer from direct observation | 3 | 0.7 |
| B1. Gives information/ideas | 47 | 10.3 |
| B2. Gives hints/instructions on procedure | 9 | 2.0 |
| B3. Explains meanings of words/terms | 35 | 7.7 |
| B4. Answer pupils' questions | 8 | 1.8 |
| B5. Read from textbooks | 12 | 2.6 |
| B6. Dictates notes | 4 | 0.9 |
| B7. Commends | 11 | 2.4 |
| C1. Writes on blackboard | 47 | 10.3 |
| C2. Performs demonstration/experiment | 7 | 1.5 |
| C3. Demonstrates activity/what to do | 2 | 0.4 |
| C4. Distributes material/equipment | - | - |
| C5. Gives class exercise | 9 | 2.0 |
| C6. Calls students to solve questions on the chalkboard. | 5 | 1.1 |
| D1. Answer teacher's question | 74 | 16.3 |
| D2. Ask questions on the topic | 2 | 0.4 |
| D3. Ask questions not related to the topic | - | - |
| D4. Ask for help about procedure | - | - |
| D5. Make voluntary statements to contribute to the lesson | - | - |
| D6. Read science book | 4 | 0.9 |
| E1. Performs practical activities/experiments | - | - |
| E2. Records activities in notebook | - | - |
| E3. Copy notes from blackboard | 73 | 16.0 |
| E4. Copy notes as teacher dictates | 6 | 1.3 |

| | | |
|---|---|---|
| E5. Do class exercise | 6 | 1.3 |
| E6. Handle materials/equipment | 1 | 0.2 |
| E7. Write on the blackboard | 4 | 0.9 |

Keynote: A1-A7 and B1-B7 Verbal activity of teachers; C1-C2-Non-verbal activity of teachers; D1-D6-Verbal activity of pupils; E1-E7-Non-Verbal activities of pupil

## 4.3 Discussion of Results

### Teachers' Qualification and Areas of Speacialisation

The research sought to find out the extent to which teachers were professionally and academically qualified to teach integrated science at the JHS level in the Sunyani Municipality. It was realized that 65% of teachers who took part in the study (see Table 2, had taught the subject for more than five years with 40% of such teachers possessing (holding) Diploma in Science Education (Dip Ed Science) (see Table 3). The percentages in teaching experience and professional qualifications indicated that personnel with the requisite academic qualifications taught science within the Sunyani municipality. This was about 40%. This finding was similar to that reported by Parku (2012), a survey that showed that only few teachers of Integrated Science in the Central Region of Ghana in the junior high schools hold a Diploma or Degree in integrated science. According to Parku (2012) out of the 50% of the specialized teachers sampled, only 9.5% specialized in integrated science, a figure that is insignificant as far as integrated science is concerned. This issue must be addressed to ensure that the right personnel with integrated science background taught the subject to lay the needed foundation for the study of pure science at the SHS level.

**Difficulties Teachers and Pupils Encounter During Science Lessons**

Again, the researcher attempted to find out from the study the difficulties teachers and pupils encountered during science lessons. In this sense, the research was narrowed down to the availability of laboratories in the selected schools within the Sunyani municipality. From Table 6, it is observed that 15% of the selected schools had a place designed for practical activities. Schools without venues for science practical was 30% and 55% of school undertook science practical in classrooms. This finding agrees with those made by Jegede, Okatota and Eniayelu (1992). They reported that one major factor responsible for poor performance in science was poor laboratories for the study of science. In this sense, when the facilities are poorly furnished leading to poor performance, then one can conclude that basic schools without science laboratories was like a teacher without teaching aid for a lesson. This situation encouraged rote learning on the part of pupils and the use of the lecture method on the part of the teachers.

Agun (1992) noted that the use of instructional materials was being helpful to teachers and students to maximize learning. Woolnough (1991) maintained that science teaching and learning should be practical and must involve the use of apparatus for learning which should take place in the science laboratory. Woolnough further maintained that in a real sense, a room should be set aside solely for science teaching and learning that is a laboratory. Generally, if the laboratories did not exist at all, then, pupils in the basic school within the municipality and the nation at large will still fear to pursue science programmed at the senior high school level. This is because pupil learned science without having the opportunity to have practical to investigate scientific concepts taught in class. This will in away, continue to deepen the erroneous perception pupils have about science and thus prevent them from taking keen interest in the subject at the senior high school level. It is also important to note that the poor performance in science must not be blamed on teachers especially at the junior high school level, since the unavailability of laboratories is a major hindrance to their work.

**Instructional Materials for Science Teaching and Learning**

The research also sought to find out the instructional materials available for teaching science. The data in Table 5 indicated that only few (5%) of the teachers said the available materials were sufficient for teaching integrated science at the JSH. This implies that materials are not sufficient at all in the majority of the schools. About 95% of the teachers responded ―No"- a significant value showing that teachers had to teach science at the JHS level without the needed tools and equipment to make lessons more meaningful to the pupils. In such cases the teachers engaged in lengthy explanations instead of practical lessons. In my view, this could account for why pupils get frightened when the subject science is mentioned to mean it is a ―special" group of pupils who must study science and not the ―ordinary" pupil. This perception has deepened due to the fact that pupils at the JHS level are not exposed to the rudiments of science in order to lay the prerequisite foundation for its continuation at the senior high level. It can also be inferred from Table 5, that the little equipment and materials available did not go round. All (100%) of the teachers noted that the materials were not sufficient for science practical activities. To address the issue of non-availability and inadequacy of materials, the teacher must improvise materials for teaching. But most teachers resorted to demonstration which may not be appropriate for all the topics to be taught. It can be inferred from Table 7 that 45% of the teachers resorted to improvisation as a means of trying to ensure that some pupils were not left out as far as the usage of materials concerned. The teachers who resorted to improvisation were not many indicating that there were instances where the teachers could not improvise and the pupils will not benefit from the lesson as expected. Again, to forestall the problem of inadequacy most integrated science teachers in this study resorted to group work showing that teachers tried their best to ensure that some pupils were not left out during practical lessons. But group work has its own challenges.

In group work some pupils may be dominated by their intelligent and hardworking colleagues. So, the ideal situation is getting all hands on deck as the lesson unfolds if there were adequate materials for learning. From Table 8, one can say that 50% of pupils who learned science in the JHS within the municipality did not have access to text books whilst 20% of them sat in groups to share the limited textbooks: In some cases, (30%), the teachers used the textbooks while the pupils looked on. The pupils did not get access to the textbooks because they were not enough or were not available. A situation like this will result in the lecture method of teaching which is not desirable at the JHS level. This finding agreed with that of Baidoo (2010) on factors militating against the teaching of integrated science at the JHS. In Baidoo‘s study, 70% of the teachers used the lecture method due to the non-availability of the needed materials to teach science.

**Instructional Approaches Utilized by the Science Teachers**

The research also focused on the predominant instructional approaches utilized during science lesson by teachers. The teachers stated that the activity method as well as demonstrations were the most predominant teaching approaches for the teaching of science at the JHS level. From Table 11about two-thirds (60%) of the respondents supported the use of the activity method while 30% supported the use of the demonstration method. Only a few, (2%) of the respondents considered the lecture method. The low (2%) percentage indicated that the activity and demonstration method were regularly employed in the teaching of science. Similar findings were reported by Adongo (2011), who in a study conducted in the Bolgatanga Municipality found that the teachers mostly utilized the activity method in their lessons. This approach appeared to appeal to Woolnough (1991) who contended that science lessons should be learner-centred and activity-oriented. This was meant to ensure that science lessons incorporated a blend of minds-on and hands-on activities. This apart, Pell and Jarvis (2001) also found out in a study that children preferred practical activities to verbal activities in science. All these attested to the fact that demonstrations and activity oriented methods should be used in the teaching of science at the JHS level with less emphasis on the lecture method. From Table 12, when the teachers were asked about how often they organized practical activities, an appreciable proportion (40%) stated that they did not conduct practical activities. This meant that the pupils these teachers taught did not experience science as a practical activity. On the other hand, a low proportion (10%) of the teachers stated they organized practical activities thrice a week. This meant that these teachers provided ample opportunities for the pupils to utilize the process skills of science during lessons. The finding that 30% and 20% of the teachers respectively organized practical activities once and twice weekly showed that at least some of them made some attempts at mediating the literacy approaches to science teaching in their schools.

**Capacity Enhancing Activities for Science Teachers**

The research also considered capacity enhancing activities organized for teachers within the municipality technically known as in-service training in the teaching of science at the JHS level. The research sought to find out the organization of in-service training, the organisers of the training, the number of in-service training programmes attended in a year and the improvement of in-service training in the teaching of integrated science. The findings emanating from the issue of capacity building is alarming. From Table 13, 90% of the respondents have not experienced in-service training with an insignificant 10% who have had in-service training. Furthermore, Table 15 indicates that 85% of the science teachers at the JHS level attested to the fact that training is done once in a year. About (90%) of the respondents (science teachers) confirmed that in-service training was organized in the municipality. From Table 16, 75% of the teachers said they attended in-service training once in a year, 5% attended in-service training three times in a year. Again 10% of the respondents did not attend any workshop at all within a year in the municipality. The revelation in this research is worrying as far as in-service training is concerned. This is because teachers of integrated science at JHS level may not be able to deliver sufficiently. According to Ramatlapana (2009) the purpose of in-service training is to improve the quality of teaching by supporting teachers through training programmes that enables them to take ownership of their professional development. Generally, if such a capacity building activity is missing or not regularly done, teachers may not be abreast with current changes in terms of methodology and requirement for best practice as far as teaching science at the JHS is concerned.

Again Loucks-Horsley et al. (1998) concluded that teachers‘ professional development referred to opportunities offered to practicing teachers to develop knowledge, skills, approaches and dispositions to improve their effectiveness in classrooms. The means practicing teachers will need constant professional development to be able to deliver as expected. Therefore, in-service training must be regularly organized for science teachers to improve their proficiency in the teaching of science at the JHS level.

**Discussion on Lesson Observations/ Interviews**

The researcher also employed observations and interview to enhance the understanding of the findings obtained. In all, 20 science teachers from the ten schools were observed. The teachers were interviewed as well. It was observed that pupils could recall facts, ideas, principles and definitions to some extent. But the paraphrasing of information on the ideas and principles given to pupils was a problem. It was further observed that pupil‘s application of ideas to new situations was not encouraging, let alone making logical deductions from some observations in class. Teaching science was expected to be purely practical and experimental in outlook but the situation was different from the observations made relating to the verbal activities of the teachers observed in the schools for the research. It was observed that teachers actually gave the relevant information and took pains to explain ideas. The pupil‘s responses to questions were not encouraging. Teacher 1 (T1) for instance explained concepts, dictated notes and used commendations where necessary but the whole class activity was hinged on a selected few pupils in the class who could answer questions. Teacher‘s chalkboard illustrations were clear but demonstrations and experiments were poorly conducted as observed. Equipment or materials were not distributed to the pupils to use and follow the procedures so the handling of equipment by pupils was not experienced.

A lesson on soil was observed. A few materials like, beakers, funnels and cotton wool were shown to the pupils and brief descriptions of the soil profile were done by the teacher. The pupils were not given the opportunity to perform the experiment on their own but observed the demonstration done by the teacher. Only three pupils could go to the chalkboard to solve problems. The pupils could not answer the teacher‘s questions properly or not at all. Again, pupils could not make voluntary contributions to the topic, neither could they ask for the procedure for the experiments on soil. What students could do most was the copying of the teachers note on the chalkboard and reading the limited textbooks available. No meaningful group work was organized in all the schools observed.

Teacher (T1) for instance was interviewed afterwards on why pupils could not repeat the procedure for the experiment performed. He answered by attributing all the problems to the lack of adequate equipment and a place (laboratory) to undertake practical activities. Again on why few pupils responded to questions, the reason given was that most of the pupils were timid to talk in class because they were not fluent in the English language but were able to write responses when it is in the form of exercises. The teacher attributed the lack of group work to the fact that the classroom for practical lessons is not spacious enough and conducive for practical lessons.

Teacher (T2) was also observed when teaching mixtures. The lesson was taught without demonstrations or activities. He used the lecture method of teaching. Even though a few pupils were able to give responses to the teacher‘s questions, the class was dull. The lesson could have been better presented by involving the pupils in practical activities. After the lesson when the teacher was interviewed on why he did not use the activity method to teach. His reason was that the class size was too large and there were no materials to conduct the lesson using practical activities. He also said he could not afford to improvise for such a large class. Some few pupils were also interviewed on the lesson. Some had a problem with the English language, they said they could not interact fluently in the English language. This prevented them from asking questions on the topic in class during lessons. They also said they will be happy if the teacher will organise practical activities in science.

The classroom observation was done in 10 schools and what was observed was that only two schools conducted demonstration lessons. Some teachers said that materials were not available. Others of them said they had large class sizes and could not improvise materials and that there was the need to teach to cover the syllabus before the BECE commenced.

These observation or findings explained why the teaching of science at the JHS level was poorly done in the schools, resulting in the poor performance of some pupils in the BECE. Since the pupils performed poorly in science at the JHS level, they feared the subject even at the SHS level. This might be due to the fact that right foundation was not laid at the JHS level

# CHAPTER FIVE

# SUMMARY OF FINDINGS, CONCLUSIONS, RECOMMENDATIONSAND SUGGESTIONS FOR FURTHER RESEARCH

## 5.1 Overview

This chapter focuses on the research findings, identifies implications, and gives recommendations on how to handle the teaching and learning of science at the JHS level in the Sunyani municipality and finally makes suggestions for future research.

## 5.2 Summary of major findings

To sum up, the teachers were professionally and academically qualified to teach science at the JHS level. The difficulties teachers and pupils encountered during science lessons, the instructional materials available for teaching and learning science and how they are used in science lessons, as well as the predominant approaches utilised by the science teachers were stated. And finally teacher‘s capacity enhancing activities organised in the Sunyani municipality for science teachers were taking note.

**Academic and professional competency of the selected science teachers at the JHS level in the Sunyani municipality.**

The main findings in relation to the academic and professional competencies were:

(i) On the average 40% of the teachers teaching science at the JHS were academically and professionally competent to teach science. About, 65% of teachers teaching science in the selected schools have taught science for more than five years.

**Difficulties teachers and pupil encountered during science lessons**

(i) It was found that 55% of the schools used their classrooms as laboratories and, 30% of the schools had allocated places for science but did not meet the standard of science laboratories and 15% of the schools have not ever planed of getting a laboratory.

(ii) During the classroom observation and interviews it was found that, English language served as language barrier to pupils. This brought about difficulty in teacher-pupil interactions in the classroom.

**The availability of instructional materials and use during science lessons**

The main findings were:

(i) Most of the schools had insufficient materials for science teaching and learning.

(ii) 100% of the pupils responded ―No" to the availability of material to go round during practical lessons.

(iii) An appreciable proportion (45%) of the teachers improvised materials for their lessons.

(iv) Sixty percent of the pupils within the selected schools lack government textbooks in the municipality.

**The predominant instructional approaches utilised during science lessons**

The findings were:

(i) About 60% of the science teachers supported the use of demonstration and 30% practical activity.

(ii) Two percent of the respondents (science teachers) support the use of lecture method to teach science at the JHS level.

**Capacity Enhancing Activity Organised within the Sunyani Municipality for Science teachers in the selected schools**

The findings were:

(i) Ninety percent of the respondents (science teachers) confirmed that in-service training is not organized within the municipality for science teachers.

(ii) Only 10% of the teachers within the selected schools in the Sunyani municipality had attended in-service training once since they started teaching.

### 5.3 Conclusion

On the basis of the results obtained in this study the following conclusion were reached:

(i) The professional and academic qualifications of the selected JHS teachers were adequate for science teaching.

(ii) Most of the schools within the Sunyani municipality did not have standard laboratories for undertaking science practical, leading to the poor performance and the dislike of science at the SHS level.

(iii) Most schools within the Sunyani municipality did not have adequate instructional materials for teaching science at the JHS level- a situation most likely to be the same across other regions in the country. However, some teachers resort to improvisation to assist their teaching.

(iv) Some teachers still utilized the lecture method during science lessons.

(v) Capacity enhancing activities were not regularly organized for science teachers in the selected schools of the Sunyani Municipality.

## 5.4 Recommendations

Based on the findings and the conclusion from research, the following recommendations are made:

(i) Only teachers who are specialized in science should be posted to teach the subject in the selected schools and other schools in the Sunyani Municipality.

(ii) The Ministry of Education (M.O.E), Non- Governmental Organizations (N.G.O) and other stake holders in education must ensure the provision of well-equipped laboratories for the junior high schools in the study area to enhance the teaching and learning of science.

(iii) The government, P.T. A, N.G. Os, G.E.S, M.O.E and other stake holders of education must ensure that there are adequate teaching and learning materials at the JHS level for use by both teachers and pupils to make science interesting.

(iv) The G.E.S/M.O. E should ensure that capacity-enhancing activities are regularly organized for science teachers on rotational basis. This is to ensure that with time most teachers will be exposed to the new ideas and pedagogies in teaching and learning science.

## 5.5 Suggestions for further research

Based on the findings of the study, the following suggestions for further research have been made:

1. This study should be replicated using larger numbers of research subjects in the Sunyani Municipality.

2. A comparative analysis of science instructional approaches in selected private and public junior high schools in the study area should be conducted.

3. A survey of available science instructional materials (including textual materials) should be conducted in the research area.

4. A study on the instructional and content knowledge needs of JHS science teaching in the Sunyani Municipality should be undertaken.

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# APPENDIX A

**UNIVERSITY OF EDUCATION, WINNEBA.**

**DEPARTMENT OF SCIENCE EDUCATION**

**QUESTIONNAIRE FOR TEACHERS**

This questionnaire is designed to solicit information for academic purpose. Information collected would be kept as highly confidential as possible. The researcher will highly appreciate your genuine responses. Moreover, your anonymity is assured by neither writing your name nor indicating your school. Kindly read through each of the items carefully and indicate the opinion that is the nearest expression of your view on each of the issues raised.

***General instruction***

***Please tick [√] the appropriate bracket or column or fill in the blanked spaces where necessary.***

***SECTION A***

How long have you been teaching science?

(a) 0-5 years [ ] (b) Above 5years [ ]

1. What is your professional qualification?

   (a) B.Ed. science [ ]

   (b) Dip Ed science [ ]

   (c) Cert' A [ ]

   (d) Non- professional [ ]

   (e) Diploma Professional [ ]

2. What is your area of specialization?

   (a) Biology (b) Chemistry (c) Physics (d) Integrated science

   (e) Any other, specify ………………………………………………………

**SECTION B**

1. Which of these methods of teaching would you consider effective to the learning of science?

   (a) Activity [1]

   (b) Lecture [2]

   (c) Demonstration [3]

2.Which of the following methods of teaching science do you use when teaching science?

   (a) Activity [ ]

   (b) Lecture [ ]

   (c) Demonstration [ ]

3. Do you conduct practical lessons in science? Yes [ ] No [ ]

4. If yes, how often do you conduct practical lessons in a week?

   (a) Once a week [ ]

   (b) Twice a week [ ]

   (c) Three a week [ ]

5. Do students work in groups during practical lessons?

   Yes [ ] No [ ]

**SECTION C**

1. Have you ever had any in-service training in the teaching of integrated science?

   (a) Yes [ ]  (b) No [ ]

2. Who organized the in-service training programme?

   (a) GES [ ]  (b) STME [ ]  (c) GAST Organizers [ ]

   (d) Any other, specify …………………..

3. How many times are in-service training in science organized in the Municipality every year?

   (a) 1 [ ]  (b) 2 [ ]  (c) 3 [ ]  (d) 4 [ ]

3. How many in-service training programmes have you attended in the year?

   (a) 1 [ ]  (b) 2 [ ]  (c) 3 [ ]  (d) 4 [ ]

5. Has the in-service training improved your teaching in science?

   (a) Yes [ ]  (b) No [ ]

6. Should in-service training be organized often for science teachers?

   (a) Yes [ ]  (b) No [ ]

**SECTION D**

1. Do you have a laboratory in your school for science practical work?

   (a) Yes [ ]  (b) No [ ]

2. If no, do you have science kit boxes/ equipment and materials in the schools?

   (a) Yes [ ]  (b) No [ ]

3. If yes, is your school kit boxes equipped with materials necessary for teaching science? (a) Yes [ ] (b)No [ ]

4. Are these materials enough for the:

   (i) effective teaching and learning of science practical activities?

   (a) Yes [ ] (b) No [ ]

   (ii) organization of science practical activities

   (a) Yes [ ] (b) No [ ]

5. Are the equipment and materials adequate to go round all the pupils during practical activities?

   (a) Yes [ ] (b) No [ ]

6. If ―NO" to item 5, what do you normally do in such situation? ………………………………

## APPENDIX B

### UNIVERSITY OF EDUCATION, WINNEBA.

### DEPARTMENT OF SCIENCE EDUCATION

### QUESTIONNAIRE FOR PUPILS

This study is purely for academic purposes. You will be contributing to its success if you answer the item as frankly and honestly as possible. Your responses will be kept confidential. Kindly read through each of the items carefully and indicate the opinion that is the nearest expression of your view on each of the issues raised.

***General instruction***

***Please tick [√] the appropriate bracket or column or fill in the blanked spaces where necessary.***

1. Which of these methods of teaching do you like your teacher to use for your science lessons?

(a)Practical activity [ ]

(b) Lecture [ ]

(c) Demonstration [ ]

2. How often do your teacher organize practical activities?

(a) Once a week [ ] (b) Twice a week [ ] (c) Three a week [ ] (d) None

3. Do you all have materials to work with during practical lessons?

(a) Yes [ ] (b) No [ ]

4. Do you work in groups during practical lessons?

(a) Yes [ ] (a) No [ ]

5. Where do you normally have your practical lessons?

(a) The classroom (b) The laboratory (c) None of these.

6. Do you enjoy the science practical activities?

(a) Yes [ ] (b) No [ ]

7. Do you all have the government science textbooks?

(a) Yes [ ] (b) No [ ]

8. If no, what happens during science lessons?

(a) The teacher alone uses the book [ ]

(b) We sit in groups and share the textbook [ ]

(c) We do not get access to the book [ ]

# APPENDIX C

OBSERVATION INSTRUMENT

FORM 1

SCHOOL: Time:

CLASS: Topic:

VERBAL ACTIVITIES OF THE TEACHER

A. Teacher questions requiring pupils to:

| | |
|---|---|
| A1. Recall facts, ideas, principles and definitions | |
| A2. Restate, retell, summarize or paraphrase Information | |
| A3. Apply previous ideas to new situations | |
| A4. Make logical deductions from observations | |
| A5. Design experimental procedure; make hypothesis; produce new arrangement | |
| A6. Compare and contrast date/information | |

B. Teacher:

| | |
|---|---|
| B1. Gives information/ideas | |
| B2. Gives hints/instructions on procedure | |
| B3. Explains meanings of words/terms | |
| B4. Answer pupils' questions | |

| | |
|---|---|
| B5. Read from textbooks | |
| B6. Dictates notes | |
| B7. Commends | |

NON-VERBAL ACTIVITIES OF THE TEACHER

C: Teacher

| | |
|---|---|
| C1. Writes on blackboard | |
| C2. Performs demonstration/experiment | |
| C3. Demonstrates activity/what to do | |

| | |
|---|---|
| C4. Distributes material/equipment | |
| C5. Gives class exercise | |
| C6. Calls students to solve questions on the chalkboard. | |

FORM 2

VERBAL ACTIVITIES OF THE PUPILS

D: PUPILS

| | |
|---|---|
| D1. Answer teacher‘s questions | |
| D2. Ask questions on the topic | |

| | |
|---|---|
| D3. Ask questions not related to the topic | |
| D4. Ask for help about procedure | |
| D5. Make voluntary statements to contribute to the lesson | |
| D6. Read science book | |

NON-VERBAL ACTIVITIES OF THE PUPILS

E. PUPILS:

| | |
|---|---|
| E1. Performs practical activities/experiments | |
| E2. Records activities in notebook | |

| | |
|---|---|
| E3. Copy notes from blackboard | |
| E4. Copy notes as teacher dictates | |
| E5. Do class exercise | |
| E6. Handle materials/equipment | |
| E7. Write on the blackboard | |

FORM 3

SIZE OF GROUPS FOR PRACTICAL ACTIVITIES

| GROUPS | 2-5 PUPILS | 6-10 PUPILS | 11-15 PUPIL | 16-20 PUPIL | 21-25 PUPIL |
|---|---|---|---|---|---|
| 1 | | | | | |
| 2 | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | | |
| 6 | | | | | |
| 7 | | | | | |
| 8 | | | | | |
| 9 | | | | | |
| 10 | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

**MATERIALS/EQUIPMENT IN THE LESSON**

1. Textbooks
2. Test-tubes
3. Beakers
4. Funnels
5. Hand lenses
6. Spring balances

7. Stones
8. Tin cans
9. Cool pots
10. Others

# APPENDIX D

**Interview schedule for the pupils**

The purpose of this interview is to help to study some aspects of the teaching and learning of integrated science in the BrongAhafo region. Kindly answer the following questions. Your responses will be treated confidential. Thank you for your co-operation.

Items for interview

1. Do you have enough integrated science teachers in your school?
2. Do you have enough teaching and learning materials in your school?
3. Do you have laboratory for carrying experiments?
4. How many times do you perform experiments in a week?
5. Is your classroom environment conducive for the effective teaching and learning of integrated science?
6. Do you wish to pursue integrated science in future in the SHS why?
7. Do you have challenges with regards to the learning of integrated science?

## APPENDIX E

**Interview schedule for the integrated science teachers**

The purpose of this interview is to help to study some aspects of the teaching and learning of integrated science in the Brong Ahafo region. Kindly answer the following questions. Your responses will be treated confidential. Thank you for your co-operation.

Items for interview

1. Does GES organise professional development programmes like in-serving training for integrated science teachers regularly?
2. Is your school well – equipped with teaching and learning materials for the effective teaching of integrated teachers regularly?
3. Do you improvise materials for teaching? If no, why?
4. Do you think that the physical facilities in your school are good for the effective teaching of integrated science?
5. Does your school allocate part of its internally generated funds for buying materials for science teaching?
6. Do you sometimes ask pupils to contribute to buy materials for science experiments?
7. What are some challenges that you face in the effective teaching of integrated science?
8. In what ways do you think you can improve upon the teaching of integrated science in your school? State at least four.

# APPENDIX F

## Teachers Reliability Coefficient

### Case Processing Summary

| | N | % |
|---|---|---|
| | | |

| | | | |
|---|---|---|---|
| Cases | Valid | 20 | 100.0 |
| | Excluded[a] | 0 | .0 |
| | Total | 20 | 100.0 |

a. Listwise deletion based on all variables in the procedure.

**Reliability Statistics**

| Cronbach's Alpha | N of Items |
|---|---|
| .674 | 21 |

**Pupils Reliability Coefficient**

**Case Processing Summary**

| | | N | % |
|---|---|---|---|
| Cases | Valid | 20 | 100.0 |
| | Excluded[a] | 0 | .0 |
| | Total | 20 | 100.0 |

a. Listwise deletion based on all variables in the procedure.

**Reliability Statistics**

| Cronbach's Alpha | N of Items |
|---|---|
| .775 | 8 |

# APPENDIX G

**Reliability Coefficient of the Observation Instrument**

| Item (N) | Co-researcher | Researcher | XY | $X^2$ | $Y^2$ |
|---|---|---|---|---|---|

| | (X) | (Y) | | | |
|---|---|---|---|---|---|
| $A_1$ | 17 | 19 | 323 | 289 | 361 |
| $A_2$ | 9 | 10 | 90 | 81 | 100 |
| $A_3$ | 8 | 10 | 80 | 64 | 100 |
| $A_4$ | 2 | 1 | 2 | 4 | 1 |
| $A_5$ | - | - | - | - | - |
| $A_6$ | 4 | 4 | 16 | 16 | 16 |
| $A_7$ | 1 | 2 | 2 | 1 | 4 |
| $B_1$ | 23 | 24 | 552 | 529 | 576 |
| $B_2$ | 4 | 5 | 20 | 16 | 25 |
| $B_3$ | 16 | 19 | 304 | 256 | 361 |
| $B_4$ | 3 | 4 | 12 | 9 | 16 |
| $B_5$ | 5 | 7 | 35 | 25 | 49 |
| $B_6$ | 3 | 1 | 3 | 9 | 1 |
| $B_7$ | 5 | 7 | 35 | 25 | 49 |
| $C_1$ | 24 | 24 | 576 | 576 | 576 |
| $C_2$ | 3 | 4 | 12 | 9 | 16 |
| $C_3$ | 1 | 1 | 1 | 1 | 1 |
| $C_4$ | - | - | - | - | - |
| $C_5$ | 4 | 5 | 20 | 16 | 25 |
| $C_6$ | 2 | 3 | 6 | 4 | 9 |
| $D_1$ | 36 | 37 | 1,332 | 1,296 | 1,369 |

| | | | | | |
|---|---|---|---|---|---|
| $D_2$ | 2 | - | 2 | 4 | 16 |
| $D_3$ | - | - | - | - | - |
| $D_4$ | - | - | - | - | - |
| $D_5$ | 3 | 1 | 3 | 9 | 1 |
| $D_6$ | - | - | - | - | - |
| $E_1$ | - | - | - | - | - |
| $E_2$ | - | - | - | - | - |
| $E_3$ | 1,444 | 1,225 | 1,330 | 38 | 35 |
| $E_4$ | 3 | 3 | 9 | 9 | 9 |
| $E_5$ | 2 | 4 | 6 | 4 | 16 |
| $E_6$ | 1 | - | - | 1 | - |
| $E_7$ | 2 | 2 | 4 | 4 | 4 |

Where,

N = Total number of items considered

X = Items observed by co- researcher

Y = Items observed researcher

$\sum x$ = Total number of items observed by the co-researcher

$\sum y$ = Total number of items observed by researcher

R= Reliability Coefficient

$\sum_X = 218$ $\sum_Y = 235$ $\sum_{XY} = 4,775$

$(\sum_X)^2 = 47,524$ $(\sum_Y)^2 = 55,225$

$\sum X^2$=4.459 $\sum Y^2$=5,144

$$R = \frac{N\sum XY - \sum X \sum Y}{\sqrt{N\sum x^2 - (\sum x)^2}\sqrt{N\sum y^2 - (\sum y)^2}}$$

$$R = \frac{33 \times 4,775 - 218 \times 235}{\sqrt{(33 \times 4457 - 47,524)} \times \sqrt{(33 \times 1, 44 - 55,225)}}$$

$$= \frac{157,575 - 51,230}{\sqrt{(147,081 - 47524)} \times \sqrt{(169,752 - 55,225)}}$$

$$= \frac{106,345}{\sqrt{99,557} \times \sqrt{114,527}}$$

$$= \frac{106,345}{315.5265 \times 338.4183}$$

$$= \frac{106,345}{106770.9}$$

**Reliability co-efficient = 0.9**

# APPENDIX H

## INTRODUCTORY LETTER