UNIVERSITY OF EDUCATION, WINNEBA

THE IMPACT OF ACTIVITY METHOD ON TEACHING INTEGRATED SCIENCE AT A SELECTED JUNIOR HIGH SCHOOL

ADELAIDE MENSAH

2015

UNIVERSITY OF EDUCATION, WINNEBA

THE IMPACT OF ACTIVITY METHOD ON TEACHING INTEGRATED SCIENCE AT A SELECTED JUNIOR HIGH SCHOOL

ADELAIDE MENSAH

7110130013

A DISSERTATION IN THE DEPARTMENT OF SCIENCE EDUCATION, FACULTY OF SCIENCE EDUCATION, SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES, UNIVERSITY OF EDUCATION, WINNEBA IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR AWARD OF THE MASTER OF EDUCATION (SCIENCE) DEGREE.

OCTOBER, 2015

DECLARATION

STUDENT'S DECLARATION

I, Adelaide Mensah, declare that this dissertation, with the exception of quotations and references contained in published works which have all been identified and dully acknowledged, is entirely my own original work, and it has not been submitted, either in part or whole, for any other degree elsewhere.

SIGNATURE:.....

DATE:.....

SUPERVISOR'S DECLARATION

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

NAME OF SUPERVISOR: Dr. Emmanuel K. Oppong

SIGNATURE:.....

DATE:.....

ACKNOWLEDGEMENTS

This work has been possible due to the support from certain personalities and the necessary appreciation should be accorded them.

My greatest thanks go to the Almighty for his guidance and protection.

The researcher wish to express her sincere gratitude to her supervisor, Dr. Emmanuel. K. Oppong of the Department of Science Education, Winneba, whose guidance, advice and support made this thesis successful.

The researcher is also grateful to her family especially for their care and understanding.

To the Head teacher and staff of Ampabame No 1 Roman Catholic Junior High School, May God richly bless you.

DEDICATION

This thesis is dedicated to my creator, I give Him all the glory, He has brought me to this far and my children for their love and support.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

Figure **Page**

ABSTRACT

This study aimed at investigating how pupils of Ampabame No 1 Roman Catholic Junior High School in the Asokwa sub-metro performance can be enhanced through activity based approach. Fifty (50) Junior High School form three pupils were purposively sampled for the study. The nature of the study was an action research. The pre-test and the post-test research design was used, the same participants were pre-tested and post tested to find the effects of the intervention(i e practical activity),five science teachers were selected for the research. The instruments used for the study were test, observation, questionnaire and interview. Data were analyzed with the aid of the Statistical Package for the Social Science (SPSS) version 16.0. Descriptive statistics were used to analyze the data, in terms of frequencies, mean percentages, and standard deviation. The pre-intervention and post-intervention findings revealed a remarkable improvement in pupils' performance. The findings of this research indicated that, practical activity improves pupils' understanding of science concepts. Observation of pupils revealed that they were highly excited when taught using activities. It is recommended that teachers consider the use of activity method during instructional period more than the lecture method to sustain pupils' interest as well as enhance performance in science.

CHAPTER ONE

INTRODUCTION

Overview

This chapter deals with the: Background to the study, Statement of the problem, Purpose of the study, Objectives of the study, Research questions, Significance of the study, Limitation and Delimitation of the study.

1.1 Background to the Study

The teaching and learning of science is to adequately equip students with the requisite knowledge and skills in order to understand science concepts. By definition, science is the knowledge acquired through observation, inquiry, experiment and evaluation of information gained. The knowledge of science is gained by continuous process of investigation and experimentation of problems and to project the understanding of the natural world.

UNESCO (1995) defines science as an approach to the teaching of science in which concepts and principles are presented so as to express the fundamental unity of scientific thought stress on the distinction between the various scientific fields. So science imparts in the students the basic concepts of unity of science nature. Science opens students' minds in order to acquire in-depth knowledge about the role and function of science in day to day affairs and the world in which they live.

The influence and the impact that science has on the environment as well as life in general, lives a great task on the educational system of the country. It is in view of this that science

was enshrined in the school curriculum right from the basic level up to the tertiary level of education to help expose all students to the basic facts and knowledge of science. The application of science ideas to practical situation in the areas of technology have grown significantly, hence the teaching of science at all levels of the educational ladders helps students acquire; scientific concepts and principles to solve problems on their own, skills in the manipulation of scientific apparatus equipment and materials, ability to interpret scientific information and findings in order to make inference, skills in handling and interacting with things in the environment and curious minds investigative attitudes towards the study of science as a whole (Blough & Schwartz, 1990).

Ultimately, students understand and learn well by performing activities in and out of the classroom, science students learn differently when they are exposed to different methods of teaching and learning such as observing what is being demonstrated, working in groups, interacting with teaching aids and listening attentively to the teacher, thus, the teacher needs to design and look for appropriate practical works for students to exhibits their talents.

Teachers often use teaching methods which cater for different learning styles to help students to retain information, or knowledge and also to strengthen their understanding. For effective teaching to take place good method must be adopted by teachers to help student to see, touch and understand what is being taught. Both teachers and students need to work in collaboration to make teaching and learning very interesting and sustaining. This implies students interaction and involvement in lessons are vital items in the transfer of knowledge from teacher to students these activities incorporated in lessons proved to be effective tools in an educational environment.

Science as a product in the use of scientific knowledge acquired through activities to produce something beneficial to life. Science as attitudes deals with certain basic characters and habits. All these are coined out of the fact that science is seen as a process product, and attitude. Science teaching follows a process approach which deals with observation, analysis, classification, hypothesizing and drawing conclusion. All these and many more can be achieved by allowing students to perform more practical activities.

Promoting the learning of science in the country, various workshops and programs are organized to enhance effective teaching and learning of science such as the Unilever Ghana Limited Programme, Science Technology and Mathematics Education (STME). The program me is used to educate both boys and girls to undertake science projects and achievable goals in science.

After a critical look at the students notebooks and exercise books and through interaction with some of them, definition of formulas, concepts and calculations were some complaints they put across, the researcher also observed lack of interest in the subject when it is time for science period, some students dodge the class, and some pretend to fall sick but the same students become active after the period is over. Students' negative attitude towards homework, tests, class assignments and date of submitting homework for marking were also observed.

It is now well understood that students are by nature curious and eventually build upon their own repertoire of concepts in science (Gyimah, 1986).

It is because of this background that researcher wanted to undertake this study to find out the effect of activities method in science teaching at the Junior High School level and also

to find out intervention measures to help arouse and sustain the interest of students by use of activity method to improve upon their performance.

1.2 Statement of the Problem

Over the years, personal interactions with some teachers and pupils have shown that pupil's performance in science at the B E C E has fallen. Considering the Ghana Education System, the contact hours for integrated science is quite inadequate, so most teachers mostly use the lecture method in impacting knowledge, hence most pupils have shown little competency in mastering the application of concepts taught in the classroom. It is in the light of poor performance of pupils in science that Anderson and Helms (2001) and Huber and Moore (2001) suggested that pupils at the basic level should be provided with experience to "learn science by doing". The underlying question is can the activity approach in science instruction influence pupil's performance positively in integrated science at the basic level?

1.3 Purpose of the Study

The purpose of this study was to assess the effect of activity method of teaching science at the Ampabame Roman Catholic Junior High School in Asokwa Sub-Metro.

1.4 Objectives of the study

The objectives were to:

i. examine pupils' understanding of scientific concept of acids, bases and salts before activity class.

ii. Find out the effect of activity method on pupils" understanding of scientific concepts.

iii. instruct and observe pupils on scientific concept of acids, bases and salts using activity method and determine whether prompt feedback to pupils can sustain their interest in science.

iv. examine the effect of activity base instructions on pupil's performance of scientific concept of acids, bases and salts based on sex of the pupils

1.5 Research Questions

The following questions guided the study.

1. How do pupils of Ampabame Roman Catholic Junior High School understand the scientific concept of acids bases and salts?
2. Is there an effect of activity method on teaching and learning of science?
3. Is there an effect of activity method on pupils of Ampabame Roman Catholic Junior High School understanding of the concept acids, bases and salt?
4. Are there differences in the use of activity method on gender?

1.6 Significance of the Study

The study would serve as a guide to science teachers to be very practical in their approach to teaching and to select appropriate teaching and learning materials and models for activity lessons. Success of science education depends mainly on the appropriate methodologies used by the science teachers to enhance students understanding of various science concepts.

It is also the view of the researcher that, the findings and the recommendations made in this study will go a long way to help pupils to apply basic concepts in science to the world outside the schools. This study will also serve as a source of reference for those who wish to carry out research into similar issues on how well is science taught and learnt in schools.

It is also the researcher's belief that, the outcome of this study will serve as a basis for the Ministry of Education (M.O.D) Ghana Education Service (GES) Curriculum Research and Development Department (C..R.D.U) and other stakeholders associated with science education in Ghana to make certain changes in the science education curriculum in junior high schools to encourage the inclusion of more practical activities in the teaching and learning of science.

1.7 Delimitation of the study

The researcher's subjects were limited to only Ampabame number 1 Roman Catholic Junior High School three pupils not involving J .H .S one and two because Acids Bases and Salts is a form three topic according to the syllabus and they had just completed it.

The study took place within a period of three months (3). It could have gone beyond that but due to time frame.

1.8 Limitation of the study

The study took a period of time; the significance of the study was discussed with the pupils for them to remain in the study till the end to avoid being discouraged.

The study could not detect whether the answers that were given by the pupils in the bio-data section of the questionnaire were true or otherwise. In view of this they were

encouraged to be sincere and give out their best. Also permission was sought from the head teacher and the teachers whose periods maybe affected.

CHAPTER TWO

LITERATURE REVIEW

Overview

This section reviews some of the contributions, ideas and studies that have been undertaken by some earlier researchers and authors. The literature related to this study is reviewed under the following sub headings: Nature of science, Importance of Science, Theoretical and conceptual framework, Constructivist perspective of teaching and learning, How students learn, The role of pupils' prior knowledge in teaching and learning, Hands-on activities, Arousing and sustaining student's in learning, Gender issues in science education, activity methods of teaching science, using teaching and learning materials, the effects of activities methods in science teaching, action research.

2.1 Nature of Science

Science has two structures-the conceptual structure and the methodological structure. The conceptual structure is also known as the product of science and consists of the ideas, facts, theories, hypothesis etc which scientists generate as they work (Gega, 1990). The methodological structure of science which is also known as *the* process of science is the method scientists use to collect data. This method comprises experimentation, classification, observation, reporting, communication, plotting etc. Irrespective of the level at which science teaching and learning occurs, it should reflect the procedures scientists adopt in order to make discoveries Apart from using approved approaches in their work

scientists are also required to adopt certain dispositions in their work. These dispositions according to Eminah (2004) are known collectively as the scientific attitude and include the following attributes:

(i) open-mindedness

(ii) being critical in thought and observations

(iii) respect for other viewpoints

(iv) curiosity

(v) objective

(vi) freedom from superstition

(vii) belief in cause and effect relationship

(viii) honesty

(ix) use of systematic problem solving procedures

(x) willingness to change one's views in the face of new evidence

(xi) suspended judgment

(xii) belief that all scientific knowledge is tentative

(xiii) utilization of different instead of fixed problem-solving techniques

(xiv) selection and use of recent and accurate material related to problems

(xv) seeking facts and avoiding exaggerations. (pp. 383-385)

Scientists who possess the above dispositions are expected to attack problems, even in unfamiliar areas, in the same way.

According to Herbert (1970), scientists use extensive experimentation and observation as the basis for the development of conceptual structures. These conceptual structures evolve

out of the regularity they find in the phenomena explore during the experiment. The value of these structures is the degree to which they lead to successful predictions about the further behavior of nature. These predictions are the basis of further observations and experimentations and so the whole process is a self-renewing, never-ending one which continuously builds new concepts and structures through experimentation.

However, Manson (1990) sees science as a process of dynamic interaction of rational inquiry and creative play. According to him, scientist probe, poke, handle, observe, question, think up theories, test ideas, jump to conclusion, make mistake, revise, synthesize, communicate, disagree and discover. The primary science syllabus is geared basically towards the development and acquisition of process skills, scientific attitudes and concepts for further use both in and out of school.

2.2 The Importance of Science

Science as described by Blough and Schwartz (1990) is essential to understand the world that we live in and it is about learning how to take care and protect the things in it. They also described science as the method of gathering knowledge through observation and recording the knowledge gathered by using them to find answers to questions that humans ask every day. It has been recognized globally that development and application of science and technology are vital for a country's economic development strategy and policy aimed at improving the living conditions of its people (Avoka, 2000). In general, science helps man to understand the natural environment by interacting with living organisms and also to help eradicate ignorance in the areas of superstition and other progress and development (Blough & Schwartz, 1990).Another aspect of science is that it helps people to develop the

ability to operate simple appliances and gadgets that are commercially used in our everyday lives. It also helps people to acquire the spirit of science attitude and to promote our agriculture by developing early and high yielding varieties of crops (Quarm, 2001).

2.3 Theoretical and Conceptual Framework

The question of what constitutes reality has bothered scientists for a very long time, with several theories springing up on the subject. The epistemological paradigm called positivism maintains an objective view of reality (Savasci, 2006).

Reality exists outside the individual, it is discovered, and in independent from the observer (Martin, 2000). Reality is therefore out there to be captured by going through the unique scientific method. Positivists believe that ontologically, we do make the world; the world is given and we find the meanings which are already inherent in the reality. (Sipe & Constable, 1996).

This study is based on an alternative view called constructivist paradign. This view holds that individuals construct their own subjective reality which is based on the individual's own personal observations, reflection and logical thought. Constructivism in the classroom is therefore based on the premise that pupils construct their own perspective of the world, through individual experiences and schema. Constructivism therefore aims at preparing a learner to solve problems in ambiguous situations.

Bartlett (1932) pioneered what became the constructivist approach (Good & Brophy, 1990). Constructivists hold the belief that learners construct their own reality or at least interpret it based upon their perceptions of experiences, so an individual's knowledge is a

function of his/her previous experiences, mental structures, and beliefs that are used to interpret objects and events. What a person knows is based on his/her perception of the physical and social experiences which are comprehended by the mind (Jonasson, 1991).

Moshman (1982, as cited by Etkina and Mestre, 2004), describes three types of constructivism which suggest that construction of knowledge is directed from outside, from within, and a combination of internal and external directions. Externally directed knowledge construction occurs as learners make a representation of the outside world. Information processing approaches to cognition allow for such construction, as learners must always construct their own representation from "given" knowledge or experiences. Knowledge construction that is internally driven requires the learner to utilize existing knowledge to transform, organize, and reorganize existing knowledge. Social constructivism describes knowledge construction that occurs as a result of both internal and external directions and is the result of the reciprocal interaction between individual knowledge construction and the external direction of the outside world.

From the above, constructivism can be seen to be fall into two main groups as social constructivism and individual constructivism.

Different views have been expressed by many scholars to the question of whether knowledge is mainly individual or social construct.

Scholar such as von Glaserfeld (1989, 1993); Wheatley (1991); Driver, Asoko, Leach, Mortimer and Scott (1994); Duit and Treagust (1998); Tobin (2002) seem to consider knowledge to be mainly an individual's construct. They maintain that individuals' knowledge is actively constructed by oneself.

To others such as Vygostsky (1962), Greeno (1996), Wells (1999) and, Packer and Goicoechea (2000) knowledge is mainly a social construct. They also maintain that learners construct their knowledge is mainly a social construct. They also maintain that learners construct their knowledge through interactions with teachers, other learners, materials, and through observing and exploring things.

Even though there are a wide variety of constructivist models, this study is in consonance with the views of Salomon and Perkins (1998) who consider knowledge to be equally an individual and a social phenomenon.

The constructivist view of teaching and learning has brought about calls for a dramatic change in classroom environments away from the traditional transmission model of teaching toward one that is much complex and interactive (Prawat & Floden, (1994). This change in classroom environment is often characterized by problem-oriented activities, visual formats and mental models, collaborative learning, learning through exploration and authentic assessment. On the other hand however, research shows that there has not been extensive change in that direction and teacher-centered activities are still dominant in science classrooms (Davis, 2003; Weiss, 1997).

It is the responsibility of every good teacher with constructivist view of teaching to create a learnable environment to facilitate learning. According to Brooks and Brooks (1999, as cited by Savasci (2006) the following are the summarized characteristics of the constructivist teacher,

i. Constructivist teachers encourage and accept student autonomy and initiative.

ii. Constructivist teachers use raw data and primary sources, along with manipulative, interactive, and physical materials.

iii. When framing tasks, constructivist teachers use cognitive terminology such as classify, analyze, predict, and create.

iv. Constructivist teachers allow student responses to drive lessons, shift instructional strategies, and alter content.

v. Constructivist teachers encourage students to engage in dialogue, both with the teacher and with one another.

vi. Constructivist teachers encourage student inquiry by asking thoughtful, open ended questions and encouraging students to ask questions of each other.

vii. Constructivist teachers engage students in experiences that might engender contradictions to their initial hypotheses and then encourage discussion.

viii. Constructivist teachers provide time for students to contract relationships and create metaphors.

ix. Constructivist teachers nurture students' natural curiosity through frequent use of the learning cycle model (pp.103-113).

This study therefore sets out to investigate teachers' epistemological beliefs about science and science teaching and learning in relation to the theory of constructivism.

2.4 Constructivist Perspective of Teaching and Learning

Constructivist teaching and learning approach is in sharp contrast to the traditional approaches of teaching and learning (Ritchie & Cook, 1994). For constructivists,

knowledge is not an object representation of an observer-independent world. Knowledge refers to conceptual structures that individuals consider viable (Yager, 1995).

Contrary to the traditional approach, constructivism recognizes that, rather than being transmitted from one individual to another, knowledge has to be constructed by each individual thought his or her active engagement with the physical and/or social environment (Roth, 1993). Learning is accomplished by constructing and elaborating schemes based on experiences (Wheatly, 1991). In a constructivist classroom, students are encouraged to take responsibility for their own learning as they take on the role of an explore (Wheatly, 1991).

The classroom is no longer a place where the teacher ("except") pours knowledge into passive students, who wait like empty vessels to be filled. In the constructivist model, the students are urged to be actively involved in their own process of process of learning. The teacher functions more as a facilitator who coaches, mediates, prompts, and helps students develop and assess their understanding, and thereby their learning. One of the teacher's biggest jobs becomes asking good questions.

In the classroom where the constructivists teaching pedagogy is used, both teacher and students think of knowledge not as inert factoids to be memorized, but as a dynamic, ever-changing view of the world we live in and the ability to successfully stretch and explore that view.

However constructivism and other "progressive" educational theories have been most successful with only children from privileged backgrounds who are fortunate in having outstanding teachers, committed parents, and rich home environments. They argue that

disadvantaged children, lack such resources, and can benefit more only lessons when the teacher gives more explicit explanations or descriptions of all concepts taught.

On the contrary activists of constructivism maintain that, constructivism seeks to promote social and communication skills by creating a classroom environment that emphasizes collaboration and exchange of ideas. Students learn how to articulate their ideas clearly as well as to collaborate on tasks effectively by sharing in group projects. Students therefore "negotiate" with others and evaluate their contributions in a socially acceptable manner. This is essential to success in the real world. Since they will always be exposed to a variety of experiences in which they will have to cooperate and navigate among the ideas of others.

As Wilson (1995) stated, "a constructivist classroom is a place where learners may work together and support each other as they use a variety of tools and information sources in their pursuit of learning goals and problem-solving activities" (p.27). Students can construct their understanding by sharing ideas with each other in small or a large group discussion.

The acquisition of knowledge is an act of change in the pattern of thinking brought about by experiential problem-solving situations. This view assumes that meaningful learning occurs as a result of personal actions on data derived from active engagement in activities in which students discuss ideas and problems with their peers, manipulate equipment, work independently, listen to the teacher in whole-class settings and respond to teacher questions (Tobin, 1990).

Constructivist teaching and learning is student-centered (Duit & Confrey, 1996). According to Duit and Confrey, other approaches may claim this approach but

constructivist approaches are student-centered in a specific way. They use subject-matter as a vehicle for interactive engagement with students. Ideas are embedded in student oriented challenges and the classroom climate supports and encourages active exchange, debate, and negotiation of ideas. In constructivist classrooms, learning is negotiated between teacher and students, and the number of activities controlled by the teacher decreases (Hand, 1996). Student autonomy, initiation, and leadership are encouraged and accepted in constructivist teaching and learning (Yager, 1995). As Saunders (1992) indicated, in constructivist classrooms, the active cognitive involvement of students is encouraged.

2.5 How Student Learn

Learning a course is more complex than merely remembering what student have read or been told, students do not necessarily learn by one explaining to them how to solve a problem. In fact, it is frustrating to work out a problem elegantly, explaining all the steps clearly, and then find out that hardly any of the students has mastered the steps.

Many informal learning theories guide teaching approaches. Some theories of learning are well defined and have recognizable names such as behaviorism or cognitivism. In describing how student learn or think, theories of learning serve as a bases for theories of instructions that draw conclusions about how instructions should carried out (Romberg & Carpenter, 1986).

What happens in a particular course can be viewed as an interaction between the teacher's goals for what students should learn, views of students' characteristics and abilities, theory of how students learn, and assumptions about how students should be taught.

Today, this is the guiding theory for much research and reform in ICT education. Constructivists view students as bringing to the classroom their own ideas rather than 'receiving' materials in class as it is given, students restructure the new information to fit into their own cognitive frameworks. The learner-centered teaching approach observed in Junior High School science classrooms was 'question and answer method' with the teachers always asking or posing the questions and the pupils supplying the answers. Teaching and learning materials were rarely used during lesson delivery (Osei, 2004).

2.6 The Role of Pupil's Prior Knowledge in Teaching and Learning

Cognitive research has shown that learners construct knowledge and that the knowledge they already posses affects their ability to learn new knowledge. If new knowledge conflicts with prior what will be taught. To ignore learners' prior knowledge will most likely mean that the message intended by the teacher will not be the message understood by the students.

Prior knowledge influences how the teacher and students interact with the learning materials as both individuals and a group. It is the proper entry point for instruction, which should build on what is already known, and a major factor in comprehension – that is, making sense of our learning experiences. (Kujawa & Huske, 1995)

Instructional strategies that help students construct knowledge for themselves work better than strategies that keep learners passive. Approaches where students discuss science, do science, teach each other science, and offer problem-solving strategies for evaluation by their peers facilitate construction of science knowledge. This is not to say that lecturing should be abolished. Research suggests that students can reap significant benefits from lecturers, after they have been primed to learn from them.

2.7 Hands-on Activities

Science exploration and discovery can take place almost anywhere! When learners are actively engaged in science activities, they often gain better understanding of scientific principles, have better retention, and enjoy the learning process more than when they are taught through passive techniques Brooks & Brooks, (1993) as cited in the North Central Region Education Laboratory (NCREL, 1993) reported that a new vision of science learning is emerging, one that calls for instructional conceptualizations. The new paradigm for learning science emphasizes engagement and meaning in ways that are not consisted with past practices. The anticipated outcome of this new approach to teaching is a higher level to pupil's achievement in science. It calls for learning that hands-on, and authentic. This approach to teaching and learning of science enables students to participate in a community where the teacher is not the only source of knowledge and information. It encourages full involvement in a community of learners that includes other students, parents, teachers and outside experts.

2.8 Arousing and Sustaining students' interest in learning (Motivation).

`One factor that contributes significantly to how learning takes place is motivation. Elliot and Carol (2000), 'motivation is an internal state that arouses us to action, pushes us in a particular directions and keeps us engaging in such activities'. This means that a person feels no impetus or inspiration to act is thus characterized as unmotivated, whereas someone who is energized towards an end is considered motivated.

Learning and motivation synchronize to achieve a zenith performance. Learning enables us to acquire new knowledge and skills whiles motivation provides the impetus for showing what we have learnt. Motivation is an important psychological construct that affect learning and performance in some ways which includes the following: Research in science education shows the difficulties students have in acquisition of scientific concepts such as balancing chemical equations due to its abstract nature. These in turn have had adverse effect on the students' performance and attitude towards science particularly chemistry.

2.9 Gender issues in science education.

Science is an activity that is designed to gather data about things in the environment in order to generate understanding of nature. Berube (2008), said that it is a system of knowing about the universe through data collection by observation and controlled experiments. Science is seen as a product and as a process and that principles, facts, knowledge, ideas are derived at and based on them human problems are solved. Science can generally be observed as 'problem solving', and in human institutions, solutions are always needed for our daily problems. A country's development therefore rests on science and its application irrespective of gender. In his address to the British Association and

Advancement of Science (BASS), in Duke of Argyll stated among others that what is expected of teachers is that they should teach the young ones to appreciate science and that they should not rely so much on the results. There is the need to start the teaching and learning of science at early stages of every individual and by the objectives of the policy, science is taught as a core subject at the Basic, Secondary and college levels in Ghana's Educational System. Knowledgeable and resourceful teachers are therefore needed to lay good foundation for science in these young ones, but unfortunately despite the government drive to draw more students to science, especially at the second cycle level more students' mainly female keep running away from it.

The importance of female education was underscored by one of Ghana's eminent educationist in the person of Dr. Kwegyir Aggrey that when a woman is educated, it means a society has received education in contrast to when a man receives education. This saying was born out of the family structures of the Ghanaian society whereby women are seen to nurture the women dominate the teaching profession. It is an undeniably fact that one's success in later academic pursuits largely depends on what one received at the initial stages of education.

2.10 Methods of Teaching Science at the Basic Schools

There are many different ways teachers employ in presenting instructions to their pupils. Even though teachers adopt different styles in their presentation, they all strive to achieve the same results. Teaching methods thus refers to the manner in which a teacher effectively and efficiently interacts within the classroom environment to bring about quality learning of a subject matter among pupils. Woods (1995) identified two teaching styles such as:

discipline-centred or teacher-centred and pupil-centred which is also referred to the activity method.

2.10.1 Teacher – Centred Approach

This teaching method emphasizes more on the subject matter. The intention is just to teach the content base prescribed in the syllabus or textbook irrespective of whether it meets the needs of pupils or not. Erinosho (2008), proposed that the focus of this teaching style is the teacher, who acts as "the power house of knowledge" by passing on information to the passive pupils who merely regurgitate the content. The methods include lectures, demonstrations and illustrations.

The discipline-centred style which is sometimes referred to as the Lecture Method is a theoretical approach and traditional technique which involves verbal delivering of a body of knowledge according to pre–planned scheme (Brown, Oke & Brown, 1982). It is again referred to as "textbook controlled lesson", because the teacher prepares and gives out information verbally to pupils without pupils' participation in the lesson. The pupils therefore listen, take down notes and memorize facts and concepts (Birke & Foster, 1993). This approach to science teaching makes pupils get bored during science lessons. Students also see scientific concepts as abstract and difficult (Reisman & Payne, 1987). According to Reisman and Payne (1987), most of the teachers who use lecture method are able to finish a lot of topics within the shortest possible time, but at the disadvantage of the learner. However, Brown *et al,* (1982), see lecture method as only preparing the learner to be a good listener, memorize facts and concepts.

Wadsworth (1989) was with the view that people followed the theoretical approach due to limited knowledge of science that the pupils possessed. In modern times, Wadsworth (1989) implied that science is seen more to be practically oriented or activity based. Students enjoy science lessons when they are involved in activities concerning the topic. There is therefore the need to adopt the activity–based and inquiry methods in the teaching of science especially at the basic and secondary levels (Reisman & Payne, 1987). This method according to Reisman and Payne (1987) is against the principle of learning by doing. Lecture method reduces teacher-pupils' interaction. However, this method of teaching is economical because no laboratory and expensive apparatus are required. It also encourages efficiency in time management since a single teacher can teach any number of students at a time (Brown *et al*, 1982).

2.10.2 Activity – Method or Pupil Centred Approach in the Teaching and Learning of Science at the Basic Level

According to Woodworth (1974), activities are ideal means to getting students acquire facts, ideas and understanding of a concept. He explained that most students enjoy child centered activities because it arouse their interest and delight especially when the scientific phenomenon involved is not familiar to them. The Junior High school science teaching syllabus suggests that science should be students-centered and activity oriented. The teacher should therefore act as a facilitator (CRDD 1998). Activity methods of teaching according to Petty (2001) are methods of teaching in which the teacher involves the learners in a series of tasks. Brown (1985) gave some examples of activity methods of teaching as discussions, demonstrations, enquiry, questions and answers, role play etc.

Demonstration as explained by Balogun (1984) is mainly used when a teacher wants learner to learn a skill such as using a living semi-permeable membranes to demonstrate osmosis or using disserted animals to demonstrate the various parts of the alimentary canal. Balugun continues that students who do not perform activities in the field of study ever attained a high degree of mastery in that field. Farrant (1990), see demonstration as a valuable tool in explaining the 'how' and why' of a process, as well as in motivating students to develop certain skills such as dissection.

Farrant continues that when the teacher uses the same material, equipment and processes that student will employ in the laboratory; it helps to enhance students' potential for success. Displaying the steps in the process and explaining each step accurately, clearly and definitively while demonstrating expedites learning and encourages the students to compare and evaluate their own products. Another researcher Farrant (1986) asserts that demonstration can be done for a whole class, but in groups when the class is large. After the teachers demonstration he / she can let some of the students also demonstrate to get them involved. The teacher then supervises as learners practice the skills learnt. Demonstrate to me is the act of using equipment or arrangement of equipment to show how it works or how it explains a process.

Farrent (1986), suggested that the best method of teaching science is the enquiry method. Here the students are involved in activities to find solutions to problems themselves. These enable students to find out facts, and establish relationship and infer from these facts and relationships. He who sees science as a method of enquiry would not presents his or her students with facts as a body of knowledge, but will provide the opportunity for them to find out by doing. Thus in teaching science, it is better the concepts at stake, for the

understanding principles of the concepts to be seen and understood. Students must therefore be actively involved in the lessons as they learn best through their involvement, remember easily and apply the knowledge gained in other situations.

For effective science lessons, teachers should make use of a lot of activities. TLMs and also ensure that all students are actively involved in the lessons Reasoning is definitely of importance in the study or learning of scientific concepts and reasoning is generated as a result of doing.

Carvin (1985) also argued that science as a special discipline cannot be taught or studied verbally or theoretically for the learners to grasp the various scientific concepts effectively. Utilizing the appropriate methods of teaching would allow for a better understanding thereby improving student's performance.

Science as a discipline is taught using varied teaching methods which makes use of relevant and appropriate TLMs to appeal to learner's senses so as to improve their performance and to achieve aims and objective of the subject. Balugun (1984) is of opinion that science teaching should therefore be backed by intensive practical activities to expose learners to acquired varied experiences. "Science is experiment and experiment is science' He conducted.

In practical, students are made to put into practice the theory learnt practical activity according to Tillery (1991), makes the students acquire skills and mastery in his field of study. He continued that practical lessons are efficient and beneficial to students when the class is under supervision of their teacher with specific instructions. Tillery continued that

research has shown that students are enthusiastic about practical work as it provides opportunities for the decision making discovery.

Practical activities serve two main purposes in teaching and learning of science. These are: they allow the observation of new facts and they determine whether a working hypothesis fits the world of observed facts. The connotation about the above statement is that students should be made to handle and use science apparatus and equipment during science lessons which will help equip them with the requisite skills needed to discover new scientific facts taught or learnt.

The activity–based method is a teaching strategy that attempts to assist pupils to discover their own knowledge through an activity (Mensah, 1992). According to Mensah (1992), in addition to acquisition of knowledge, the approach also leads to acquisition of process skills such as measuring, recording, analyzing and interpretation of data. Activity–based method is more of a child-centred approach, as such; pupils may learn better and faster when they are taught through activities (Reisman & Payne, 1987). When a pupil performs an activity as an individual, the learner easily understands and never forgets (Jenkins, 1998).

The activity method is used to teach science in which the pupil is placed at the centre of the learning process and made to manipulate materials and experience things for him or herself (Mensah, 1992). In this method, the pupil discovers concepts and facts either unaided or with minimum teacher interference. The teacher is less active, a facilitator, co-learner and a guide. The activity method takes full advantage of the learner's natural

tendency to explore the familiar environment. The advantage of this method is that pupils learn to use their hands and minds.

Again pupils learn to organize, observe and become more curious to manipulate and carefully handle equipment during activity-based method. The activity–based method of learning science is also related to the doing of experiments or practical exercises with scientific apparatus (Reisman & Payne, 1987). This method according to Reisman and Payne (1987) takes full advantage of the pupils' individual differences and abilities. However, the method is time consuming. It is also very expensive, since it involves the use of more materials. Erinosho (2008) identified other suitable methods that can be used for the activities in teaching science at the basic school to include: discussion Method, demonstration Method, questioning and Answer Method, concept Maps, field Trip, cooperative Learning and simulation method.

Chayter (1975) points out that most often the way science is taught is misleading. Teachers lay emphasis on rote learning and acquisition of knowledge rather than developing a total child which will help the child realize the relevance of what he/she learns to his/her environment.

If our children are to change their attitude towards the study of science, then, teachers also need to change their way of teaching the subject to make it fun especially for young children.

There are several methods of teaching science, for example the inquiry method, observation method, discussion laboratory method, discovery and activity methods. The inquiry approach is one of the many ways through which ideas and concepts are transmitted

to children Mechel and Oliver (1983). Inquiry is what scientist to do when they observe, predict, hypothesis, collect, data, analyze and draw conclusions. If children are to behave like scientist then, it is important that teachers ensure that all the children are involved in hands-on investigations during science lessons. Inquiry promotes doing science by children. During inquiring learning, children are involved in observing, classifying, communicating and using other science process skills which help to prepare them towards thinking objectively. Primary science lays emphasis on children doing their own learning rather teachers demonstrating or children reading only about science.

Inquiry approach encourages children to identify a problem, form their own opinion on how to collect relevant data with a view to finding solutions to their problems, Jacobson (1981) explains that inquiry method helps children to identify content-related problems, formulate their hypotheses, gather information from different sources, analyze this information, evaluate and draw conclusions Children also acquire a model to follow in solving problems in their environment and this serves as intrinsic motivation and increases the memory of the children.

A child's attitude towards the teacher and the subject matter as promoted pointed out by Elser and Esler (1988), is closely related to the type of learning activities organized. The child will help the teacher to collect science materials and help set up the science room, if he/she is involve by the teacher this whip up the child's interest. A teacher who does all the talking and also does all other tasks related to the learning is likely to alienate the children. In view of the opportunities inquiry methods offers to young children to develop scientifically, science educators recommend the use of inquiry approach to teaching at primary school level.

Agboola (1984) has indicated the roles of practical or activity based method in science as follows:

(i) to encourage accurate observation and careful recording

(ii) to promote simple, common-sense, scientific method of thought;

(iii) to develop manipulative skills;

(iv) to give training in problem solving;

(v) to verify facts and principles already taught;

(vi) to educate on theoretical work as an aid comprehension;

(vii) to be an integral part of the process of finding facts by investigation and arriving at principles;

(viii) to arouse and maintain interest in the subject.

According to Bloom (1956), just as there is no single method through which fits all learnt, there is no single method of teaching which fits all learning situations. The teacher must accept his/her procedure to the situations as she finds it and modify her procedures in accordance with changing demands of the situation. The teacher method should be a combination of almost all the method of teaching. Each teacher should be an inventor of method suitable for the circumstances in which she finds him/her. Whatever method a teacher uses in teaching science should evoke the use the scientific methods; or processes e.g. observations, classification, measurement, inference experimenting, manipulating skills etc at appropriate stages in the teaching/learning process.

Sharma (1995) noted that achievement of modern science is due to the application of the experimental method. Practical work must therefore be made a prominent feature in any

science lesson. Schwab (as cited by Chiappetta and Koballa, (2002) reported that during major science curriculum reform, some science educators felt that considerable amount of practical/laboratory work should lead rather than lag behind.

2.10.3 Discussion Method

Discussion as a teaching strategy is one of the best ways of helping pupils to understand and learn ideas (Hake, 1993). The method involves pupils- pupils or teacher-pupils interactive dialogue, where they talk together or share ideas about a topic(s) in order to find supporting evidence to a claim or solution to a problem. Discussion could involve a whole class or in organized smaller groups to enable both the teacher and pupils exchange opinions based on valid reasoning. Hake (1993), was with the view that when pupils are given the chance to talk about things, it becomes easier to find out their knowledge in that topic.

In order that learners see clearly how an idea applies to everyday life, they must be given the opportunity to use the discussion approach, and that the teacher only acts as a catalyst during the interaction among the students (Akpan, 1992). The focus of a discussion can be on either content-specific issues or general science-society-related topics just to provoke pupils' thought and stimulate them to fully participate in the lesson and also boost their confidence to express their opinions (Erinosho, 2008).

According to Graves (1985), in situations where class discussions are frequent, each student develops self-confidence since he realizes that he is contributing something. This method provides an excellent opportunity for pupils to practice their oral communication skills. It also encourages critical and evaluative thinking (Graves, 1985).

2.10.4 Demonstration Method

The demonstration method as another type of pupil-centred lesson, involves the teacher doing or presenting something (a lesson) to the entire class or pupils in order to illustrate a principle to them or show pupils a procedure of accomplishing a task. The goal of this strategy is to help pupils acquire skills. In some cases, the teacher does it first and later asks pupils to try their hands on or perform another task. Some science educationists like Smith (1990) agreed to it that demonstration method is an essential aspect of science teaching. According to Gall, Borg and Gall (1996), once the concepts are firmly established, the other higher-order varieties of learning like problem solving can also take place.

2.10.5 Question and Answer Method

Question and Answer method of teaching science is also an important teaching strategy used to develop in pupils the essential attributes of scientific inquiry. Research finding by Walsh and Satters (2005), point to the positive effect of pupils-teacher classroom interaction through questioning. This means that questioning is the entry point to problem formulation in inquiry, promote participatory learning, good communication skills, and confidence building in pupils' learning process. One good strategy of engaging pupils in science lesson is by prompting them to answer questions or ask questions. This would then help the teacher to resolve misconceptions and check understanding. Questioning could arise as a spontaneous activity during instruction, or could be pre-planned.

Although questioning technique is a valuable instructional strategy, badly formed or faulty questions can impede learning. A faulty question is vague (difficult to pin down the answer); not logical (not asked to follow a sequence that helps to build up knowledge); unconnected with instructional materials (asked without reflection); confusing (unclear wording or one that entails multiple tasks); and not adequately challenging to provoke thinking (focus on recall).

2.10.6 Concept Mappings

The idea of concept mapping as a learning tool was developed by Novak (1991) when he was exploring the changes in children's knowledge of Science. This idea was derived from Ausubel's (1968) cognitive theory which places central emphasis on the connection of pupils' existing knowledge as the anchor for subsequent meaningful learning. Concept map is a useful tool for organizing and visually representing interrelated structure of concepts within a domain of knowledge.

Concept mappings are very useful tools for helping pupils learn about the structure of knowledge, and tie new knowledge to current experience. They are valuable tools for stimulating pupils' thinking process and representing knowledge in meaningful learning patterns. Concept maps are also useful for cooperative learning, to make pupils support each other and strengthen their understanding of a subject matter, and as members of a group, to bring their thought processes to bear on the interpretation of concepts and relationships. In the learning of new ideas in science, concept mapping enhances pupils' achievement and improves their attitude. Danmole and Femi-Adeote (2004) found out that when concept mapping approach is employed in the teaching and learning of science at the

basic level, it helps to reduce rote learning, and again help the teacher to negotiate meaning with pupils.

2.10.7 Field Trip

Another strategy which is rarely used in science education is the field trip or excursion (Akpan, 1992). It involves organizing a group of pupils to visit companies or industries where things taught in theory can be seen practically. According to Akpan (1992), field trip or excursion can be likened to a visit to another laboratory away from the school's premises, which is equipped with instruments and materials that the school's laboratory does not and cannot contain.

Those places they visit can serve as science resource centres, to allow the students to acquaint themselves with principles and phenomena which had been hitherto abstract to them. Field trip enables learners to see those things they have learnt theoretical and makes learning real (Reisman & Payne, 1987). According to Reisman and Payne (1987), it becomes very difficult for learners to forget what had been learnt and seen in field trip. This method is therefore recommended for students at the basic level since they easily remember things they have been taught and seen (Akpan, 1992).

2.10.8 Cooperative Learning

This is another form of collaborative learning technique that permits pupils to benefit from one another's abilities and knowledge as they interact in a small group within a non-imposing, non-threatening and non-competitive environment. Cooperative learning places

emphasis on getting pupils to work together on a problem or task in small heterogeneous groups in order to achieve a common goal and support one another.

Hartman and Glasgow (2002), working on cooperative learning among pupils observed that, pupils can work together to review a test or do a quiz, carry out a laboratory activity, solve a problem, or work on a project. The positive impact of cooperative learning as a pedagogical strategy on academic achievement have been confirmed by Driver et al (1985, who argued that the method develops in pupils the affective outcomes like inter-group relations, self-esteem, and a good classroom climate. In addition to promoting group work among pupils, Erinosho (2008) identified that cooperative strategies are useful in science teaching because it promotes positive interdependence spirit, face-to-face interaction, individual accountability, social skills, and group learning process.

The benefits of Cooperative Learning for science students are well documented (National Institute for Science Education-College Level One, 1997; Springer & Stanne, 1999; Lord, 2001). Cooperative learning improves student achievement and enhances student enjoyment of and attitudes towards learning science (Springer & Stanne, 1999; Lord, 2001).

Cooperative learning works, because it is active, student centered and social (Johnson & Johnson, 1998). A cooperative learning activity might involve reading, writing, planning experiments, designing questions, or solving problems. This multi-layered approach toward student interaction with the content improves understanding and retention. Since, cooperative learning shifts emphasis from the instructor to the students, the latter have opportunities to build social support networks and to learn and practice many social skills,

such as leadership, communication, inquiry, and respect for diversity (Lord, 2001). The development of social relationships and skills helps students to build confidence as learners and to build trust in their teammates. This leads to improved attitudes toward the subject and often to the retention of underrepresented populations in science programmes.

Peer tutoring is a type of cooperative learning/instructional strategy. It is a personalized system of instruction which is learner rather than teacher-oriented. Studies have shown that this instructional strategy benefits both the students being tutored and the tutor, although the tutor is associated with greater cognitive gains than the student being taught (Annis, 1982; Bargh & Schul, 1980; Lambiotte et al., 1987). It has also been observed that when biology lessons are done in groups, students are allowed to make valuable decisions which together lead to a satisfactory accomplishment. Mary (1996) explained that group work during practical is a pervasive and an influential feature of the classroom ecosystem, which must be encouraged in the teaching and learning of biology in the senior high schools.

2.10.9 Simulation

Simulation technique involves initiating activity that resembles real life situations in teaching certain science concepts and ideas. Simulation technique can take the form of a role-play, games, and models (Yardley-Matwiejczuc, 1997). According to Erinosho (2008), pupils could act as scientists in a situation that requires a decision or planning to solve problem through role-play and develop basic /generic skills in pupils. Yardley-Matwiejczuc (1997), has observed that games and role-play helps pupils to develop analytical, communication, and decision-making skills, as well as to build confidence in discussions on science issues.

According to Wadsworth (1989) people followed the theoretical approach due to limited knowledge of science that the pupils possessed. In modern times Wadsworth (1989) stated that science is seen more to be practically oriented or activity based. Students enjoy science lessons when they are involved in activities concerning the topic. There is therefore the need to adopt the activity–based and inquiry methods in the teaching of science especially at the basic and secondary levels (Reisman & Payne, 1987).

2.11 Importance of Science Practical Work in Teaching and Learning of Science

Theories describe a well-verified body of abstract knowledge that has a large number of practical applications. Practical work can help students develop a better understanding of concepts and principles as a result of concrete experiences. Science practical work leaves a lasting impression on students. Practical work enhances concepts development and promotes scientific attitudes. It also breaks up the instructional period, which limit the amount of lecturing and adds a variety to the course (Chiapperra and Koballa, 2002). Sometimes, it is to link theory with practice, or to cultivate a scientific spirit in the students. If properly put to good use, it could lead to the acquisition of practical skills like planning, performing, observing and reasoning. Hence the major purposes of science practical work include the cultivation of science methods and the development of scientific attitudes. Shulman and Tamir (as cited in Ossei-Anto, 1999) observed that practical work has been the most distinctive feature of science instruction. Practical work motivates students to appreciate the distinction between science practical activities and the application of science and technology to real life cases. Practical work helps students to develop the ability to use one or more science process skills. It can also be used to improve students' awareness and competence in using skills that are related to scientific reasoning.

Science practical/laboratory work engages students in 'finding out' and' learning how' through first-hand experience. It is an integral part of good science teaching, which involves students in the scientific enterprise-questioning, observing, classifying, gathering data, explaining, experimenting etc. This type of work permits students to plan and to participate in investigation or to take part in activities that will help them improve their manipulative skills (Collete & Chiappeta, 1989). Practical work would help improve students' manipulative skills.

Practical work including hands-on activities, scientific inquiries, or experiments, always cited as the most powerful approach to helping students understand scientific knowledge. At the same time, Hodson (1992) argued that the skills-based approach of practical work was philosophically unsound, educationally worthless, and pedagogically dangerous. A holistic view of assessment to promote valid process learning, especially emphasizing the role of creativity in the data analysis process is necessary (Yager & McCormack, 1989). Torance (as cited in Penick, 1996) describe creativity as a process of becoming sensitive to problems, deficiencies, gabs in knowledge, missing elements, and disharmonies. Creativity identification of the problematic, the research solutions, the generation of guesses, or the formulation of hypotheses about the deficiencies; testing and retesting the hypothesis and the potential modification and retesting; and last the communication of the result. The role of guessing as the basic element of creativity is stressed by Science Technology and Society of the United States of America. When students are viewing natural phenomena, to stimulate their creativity and interpretation of results, they should be encouraged to present wild guesses to generate diverse perspectives (Yager & MaCormack, 1989).

2.12 Using Teaching and Learning Materials (TLMs)

Teaching materials are described as aids materials used in teaching for illustrative purposes. Its ultimate goal is to facilitate and demonstrate an understanding of a lesson (Amoatey, 2000) Teaching and learning materials may be defined to include materials which can be seen or heard and contribute to the teaching and learning process. Learning is done through the use of five senses. Any medium which gives learners the opportunity to use many senses as possible is the best medium in learning (Atiku, 2004).

The use of teaching and learning materials arouse the interest of students in what is being taught and make understanding and remembering concepts easily. Teaching and learning materials also serve the teacher the trouble of explaining at length hence the teacher talks less and also encourages students to find more on their own and thereby stimulating self-learning.

Teaching and learning materials are divided into three groups; these are audio materials, those that appeal to the sense of learning. Examples are radio, cassette recorders, drum etc. Visual materials are those that appeals to the sense of sight, examples are real objects (relia), chalks, textbooks, charts. The last group is the audio-visual materials which appeal to both the sense of sight and hearing; examples films, video, television etc. (Amoatey, 2000).

The use of teaching and learning materials in science lesson delivery brings variety, curiosity and interest among students to assist retention and recall. Students tend to forget what they hear easier than what they see. Confucius gave a practical statement on how the

human mind approaches the learning process: I hear and I forget, see and remember, I do and I understand (ITE Teachers Conference Report, 2005).

One of the best ways to understand something is to get ones hands on it and actually experiment with it. Therefore, the use of teaching and learning materials must be encouraged in the teaching and learning process during science lessons in the Junior High Schools.

Ossei-Anto (1995) again asserted that, science teaching and learning will definitely be better done if the issue of inadequate supply of science equipment and materials is tackled with zeal. He further explained that, learning by doing is one of the cardinal principles of teaching science. Experimentation has put many theories on a sound footing and has also resulted in the rejection of many. History reveals that many beliefs and superstitions were trashed out from the minds of people as a result of experimentation.

2.13 Effects of Activity Methods on Students Understanding of Science Lessons

Blough and Schwartz (1990) analyzed the role of practical work in teaching and learning science. In their study, they pointed out that practical work and demonstration help to improve students understanding and performance in science lessons.

Practical work is necessary for acquisition of skills and that students enjoy science lessons through practical work. In practical lessons, students handle apparatus and carry out experiments themselves and when this happens the experience is impressed more firmly in their minds than if they listen to or see from distance.

Students are usually found doing things themselves so the use of practical activities in teaching science is psychologically sound as it satisfies their natural edge for activity. The

young are curious to know about how events occur in the laboratory and it helps to improve their understanding of science lessons if they observe or perform experiments.

Activities carried out during science lessons, broaden student's knowledge and boost their interest. It also helps to consolidate theoretical knowledge. Activity based lessons help students to develop independent ability to work and interpret scientific problems and solution (Talabi, 2007).

Activity-based methods proved to be more superior to content based traditional approaches in terms of students understanding of scientific method and creativity. So practical work or activity-based method, when well organized has an immense influence on students' retention and performance.

The activity oriented teaching of science is an important skill, technique and methods of science such as handling of apparatus, demonstration and investigative type of learning. The development of the useful scientific process skills can only be achieved through activity- based methods.

According to Talabi (2007), students tend to remember more what they see, hear and touch. instructional materials create interest which helps reinforce students' interaction with learning experience as the Chinese proverbs says what I see, I remember.

2.14 Action Research

Action research is defined as the study of a social situation with a view to improving the quality of action within it (Elliot, 1991). It is a self-reflective inquiry of our practice with a view to understand and improve it through the introduction of an intervention. This

definition directs attention to one of the most essential motivation for doing action research. It gives the will to improve the quality of teaching and learning as well as the condition under which the teaching and learning take place.

Action research is currently emerging as one of the most popular methods of professional development of teachers. It provides a practical way for teachers to uncover some challenges facing the teaching and learning process and thereby improves upon the quality of their students. According to Cohen and Manion (1994), action research is a small scale intervention in the functioning of the real world and close examination of such intervention.

The purpose of Action research is to bring a change to the lives of students, teachers and the society as a whole. It deals with the reflecting of one's present educational practice or in groups. It identifies specific contextual problems and develops and implements approaches or interventions that will lead to the solution of the problems.

2.15 Intervention Measures

The nature and content of science syllabus in the Junior High School appears to compel teachers to use the lecture method often in teaching. The lecture method often neglect other useful methods as student-centered approach, inquiry, questions and answers techniques, laboratory experiments, demonstrations and discussions.

During teaching, one has to create a student centered learning environment to make students make maximum use of the teaching methods such as demonstration, exploration, discussion and laboratory experiment methods. The methods when appropriately used help to create students-centered environment. An integrated approach of teaching science makes

use for such methods like demonstration, exploration, laboratory, experiments, field trips and discussion methods.

Applin (1995), said that science is the process of finding out how and why things happen to nature. This helps in providing answer to some of the major problems and challenges encountered by mankind.

The importance of science to students and the nation is seen in the inclusion of the subject to the curriculum at all levels of education nationwide. Students at the Junior High School levels perceived science as full of laws, and theories thus seeing science as being abstract. This according to them makes science as a subject difficult to learn let alone to understand the various scientific concepts as compared to learning other subjects.

Science as a process involves practical and experimental procedures to acquire knowledge from which theories and laws have evolved. History of science shows that scientists have adopted and continue to use various practical or experimental procedures in their attempts to find solution to problem faced by mankind.

Due to the foregoing reasons, it is very proper for a teacher to reinforce theories taught with practical activities as well as involving students in the activities of the lessons and to use relevant and appropriate teaching methods to enable students comprehend and grasp the content of what is being taught.

According to Young (1990) science is learning by doing, this implies that in teaching science the integration of theory and practical as well as the involvement of the students makes learning both meaningful and relevant to the learner. to make learning of science more meaningful and exciting for students understand and appreciate the concept taught,

this research work focuses on the assessing the effects of using activity methods of teaching and the use of teaching and learning materials effectively to improve on students' performance in the teaching and learning of science in the Junior High School level.

CHAPTER THREE

METHODOLOGY

Overview

This chapter provides a description of the different research methods used in conducting the study. It explains research design, population, sampling techniques, instrumentation, intervention design and implementation, data collection procedure, validity and reliability, administration of research instrument and how data was analyzed.

3.1 Research Design

Research design is a scheme, outline or plan that is used to generate answers to research problems (Kombo & Delno, 2006). It is also a detailed documentation of plan for the collection, measurement, and analysis of data. Research design is the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose. It constitutes the blue print for the collection, measurement, and analysis of data (Saunders, Lewis & Thornhill 2007). This is used to structure the research, show how all the major parts of the research project, the samples or groups, measures, treatments, and methods of assignment work together to address the central research questions.

The research design used in this project is an Action Research. Action Research is a study which is concern with finding an immediate solution to a local problem.

Action Research does not only focus on generating new knowledge but also enable the participants to develop appropriate interventional strategies aimed at finding solutions identified in the teaching learning situation.

This design has been chosen for the study because of its holistic and in-depth investigative approach; specifically designed to enable more meaningful study of assessing the effect of activity method in science teaching at Ampabame number. 1 Junior High School form three in Asokwa sub-metro. The researcher solicits other pupils' views to solve a problem. These approaches were aimed at improving the related situations through changes.

3.2 Research Process

The problem for this action research was diagnosed when 1 was posted to the sub-metro, precisely Ampabame No. 1 Junior High School. Pupils were assessed through the use of test, class exercises and observation during lessons. A remedy was put in place by considering plausible strategies to solve the problem identified. Activity method was selected and used in the course of the teaching and learning process. After the implementation of the intervention strategies, students were assessed on regular basis through the use of class exercises, assignments class tests and data collected.

3.3 Population

The research was conducted at the Ampabame No.1 Junior High School Form three pupils in Asokwa Sub-Metro in the Kumasi Metropolitan Assembly. The total number of the form three students was one hundred and nineteen (119) comprising seventy one (71) boys and forty eight (48) girls but only 50 was selected for the study.

The researcher's target population covered pupils and teachers, the pupils were made up of boys and girls.

3.4 Sample and Sampling Procedure

According to Johnson and Christensen (2008), sampling is the process of drawing a sample from a population .The study involved the instruction of the form three pupils using the activity method of teaching. In order to have a manageable class for the study, a simple random sampling method was used to select fifty (50) JHS three pupils from the 119 pupils in the Ampabame number one school. Numbers were assigned to all the JHS three pupils in the school from which the required numbers were selected for the study and were picked without replacement using random numbers. This was to ensure that as much as possible biasness is removed or is minimized and a fair representation is obtained. Kusi (2012) opines that one of the factors that influence the selection of a reasonable sample size for studies located within the interpretive research framework is manageability. He posited that the aim of such studies is to explore a phenomenon for a better understanding and therefore it is necessary to select a sample size to achieve this purpose.

3.5 Research Instruments

The instruments used for the action research were questionnaires, tests and observation. These were supplemented by interviews.

3.5.1 Questionnaire

A questionnaire according to Patton (2002) is a self-report data collection instrument that each research participant fills out as part of a research study. In this study, questionnaire

was used to gather the bio- data of the participants. This data included the name of the school, age, form and sex. See appendix A for the questionnaire. Questionnaire was used for the bio-data collection because of its convenience of enabling respondents" consistency and uniformity to questions they answer. Again, with questionnaire, less time is required to collect data and confidentiality is also assured.

3.5.2 Test

Pupils were tested based on the topics treated. Gathered information from test was kept confidential from students' domain in order to avoid inconvenience that may upset any pupil who performed poorly. In the first stage of the study pupils were taken through a pre-test exercise after little interaction with them. The reason for the pre-test was to determine pupil's level of understanding of the concept acids, bases and salts. The question items as seen in appendix A.

In the second stage of the study, an intervention was introduced, pupils were given the post-test, post-intervention test which were similar to the pre-intervention test items. The post-intervention test items as seen in appendix B, this helped to measure the degree of change that occurred, hence pupil's level of understanding of the topic for comparative analysis

3.5.3 Observation

According to Elliot (2007), observation is a research instrument which data are collected by observing the subject of the study and recording the information that is being observed. observation is also referred to as taken a critical or close look at something or someone for

possible changes or behavioral attitudes Reasons for using observation as a means of collecting information on the students are, it helps to easily notice the students' reaction and intention behind their behavior, which may be positive or negative. Also, the effect of behavior on the outcome and subsequent events can be discerned.

The researcher employed unscheduled methods of observing the students which closely monitoring of students during class activities, inspecting students exercises, assignments and contribution and participation in class during lesson delivery to find out how far their progress in science subject in order to know the appropriate intervention measures to be put in place

3.6 Content Validity

In considering content validity, experts in the research such as supervisors and lecturers with specialization in test and measurement, were consulted. Some form of validity was established by giving the pilot questionnaires to them to read through and offer constructive criticisms. This is because validation is based on expert advice (Best & Khaw, 1993). Senior academics who are experts in the field offered constructive criticisms which helped to improve item quality.

Appropriate modifications were made to the questionnaire based on expert advice; wrong and ambiguous questions were discarded. Questions which needed modifications as suggested by my supervisor and other experts were corrected while appropriate ones were retained.

Reliability according to Cohen, (2003) means that scores from the instrument are stable and consistent. Scores should nearly be the same when researchers administer the

instruments multiple times and on different occasions. Reliability of instruments was established through pilot study.

With this suggestion in mind the instrument(s) were pilot – tested on two different occasions. This helped to ascertain their reliability and validity; it also helped to ascertain the effectiveness of the content and structure of the instruments. Some of the questionnaire instruments were pre-tested to establish the reliability the reliability and internal consistency of the instruments. The reliability co-efficient of the total items was 0.85. A reliability co-efficient of 0.8 and 0.9 inclusive is considered appropriate (DeVelliers, 1991). This indicated that the items are sufficiently reliable to be administered in the final study.

3.7 Validity and Reliability of Instruments

I administered copies of my pilot study questionnaires to my course mates who are pursuing Masters in Science Education. Some of them corrected a few points and almost every one of them gave recommendations concerning this item. It helped me to discard wrong and ambiguous questions and helped me to shape up my questions well, thus improving the face validity of the instrument.

Prior to using the instruments, their validity and reliability were assessed to determine their accuracy and consistency. According to Cresswell (2005) the goal of a good research is to have measures that are reliable and valid. Validity is concerned with whether the findings are really about what they appear to be about (Robertson, 2002). According to Cohen, Marion and Morrison (2003), it is based on the view that a particular instrument measures

what it purports. The issue of validity was addressed through triangulation. Triangulation involves the use of multiple sources to enhance the vigor of the research

3.8 Data Collection Procedure

Permission was sought from the headteacher of the school to carry out an action research using the J H S 3 pupils which was granted. Since the researcher is a teacher in the school, there was no need for an introductory letter to the school authorities. The researcher met the group of fifty (50) pupils between the hours of 1.00pm to 2.00pm when the respondents were expected to be getting ready for closure of school and gave them orientation on the purpose and benefits of the study. The researcher again briefed the pupils on how the various items were to be responded to.

The researcher personally administered the test items (appendix A) to the pupils in a classroom. After collecting the bio-data, the pre-intervention test was administered and given two (2) hours to complete the test items.

Interview was granted and supplemented with notes taken, it was important to take notes because, though interviews hold the truth on the tape, according to Powney and Watts (1987), gestures, facial expressions and postures, are important characteristics which provide additional information to the meaning of what is spoken. However, these are not captured on the tape. This situation could lead to lose of vital portions of the data. Besides, the tape may develop technical or mechanical faults hence the need to take notes to supplement the audio recording of the interview to collect data in this study.

3.9 Intervention design

The intervention design outlines the various practical activities that were carried out to achieve the aims and objectives of the research. Interventions were made of the use of research instruments that made the teaching and learning of science interesting, participatory, attractive and improved student performance. The following techniques were used as intervention to help solved the problems that were laid bare as well as the research questions: Demonstrations, group work, assignments and discussions were used as activity methods for selected topics.

3.10 Data Analysis

Data analysis is the process of simplifying data in order to make it comprehensible (Cohen *et al*, 1996).In this research, descriptive analysis was the method for the analysis of the data collected. All the answers to the questions were edited and statistical tables and frequencies were prepared to arrive at percentages corresponding to absolute figures. The responses from the interview schedules were all stated in the text to support the discussion of the results.

The data collected from pre-intervention and post-intervention activities were analyzed using frequencies and percentages. Pair sampled T-test was used to analyze research question three. To establish that males and female pupils did not differ in their performance in the post-test activity as indicated by research question four, the independent T-test was performed to compare mean scores of the performance of the pupils in the post-test activity by male and female farmers in the study area. An alpha level of 0.05 was set to test the significance of research questions three and four.

CHAPTER FOUR

RESULTS AND DISCUSSION

Overview

The chapter describes the demographic characteristics of the participants and the respondents used in the study. Included is the analysis and interpretation of data on whether the use of practical activity improves pupils' performance and understanding of concepts in science. This is then followed by analysis and interpretation of data on whether a significant difference exists in the performance of boys and girls in science taught through activity based learning.

4.1 Demographic Data of Pupils and Teachers

4.1.1 Frequency distribution of sex of pupils

The questionnaire to the pupils sought to find out the gender distribution of the respondents used for the study. The sample for the study covered both males and females' respondents as shown in Table 4.1 and Figure 4.1 below.

Table 4.1: Frequency distribution of sex of pupils

Sex of participants	Frequency	Percentage
Males	31	62.0
Females	19	38.0
Total	50	100

Source: Fieldwork data (2015).

The results as presented in Table 4.1 and Figure 4.1 show that majority of the pupils who participated in the study were males (62.0%) whilst minority were females (38.0%). This is because there were more males in the population as compared to females.

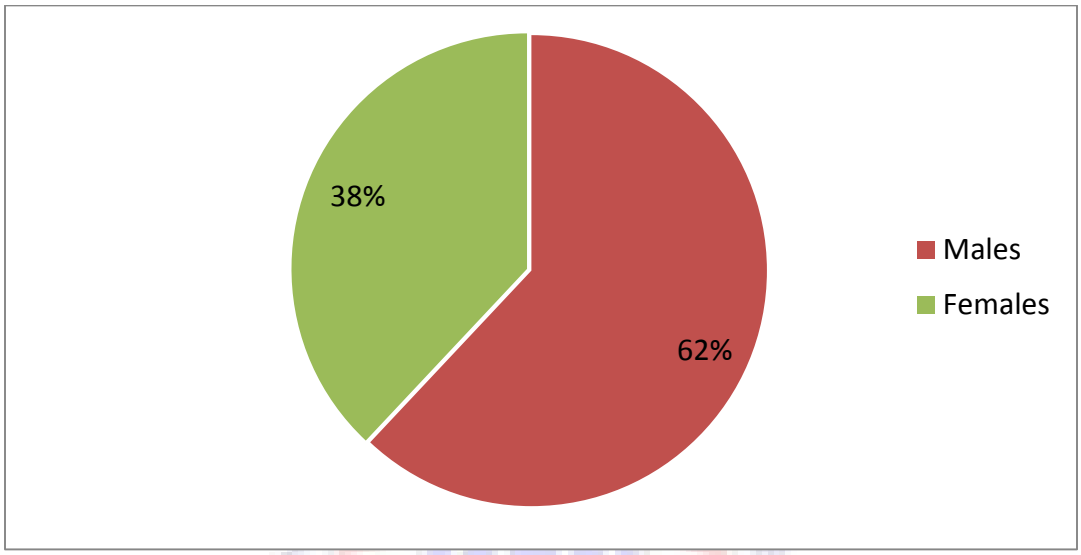


Figure 4.1: Frequency Distribution of Sex of Pupils

4.1.2 Frequency distribution of age of pupils

The ages of the pupils ranged from 14 years to 16 years. Out of the pupils who took part in the study, 23 were14 years old, 18 were 15 years old and 9 were 16 years old. The distribution of the ages of the pupils is shown in Table 4.2, Figure 4.2.

Table 4.2: Frequency distribution of age of pupils

Age of participants (years)	Frequency	Percentage
14	23	46.0
15	18	36.0
16	9	18.0
Total	50	100.0

Source: Fieldwork data (2015)

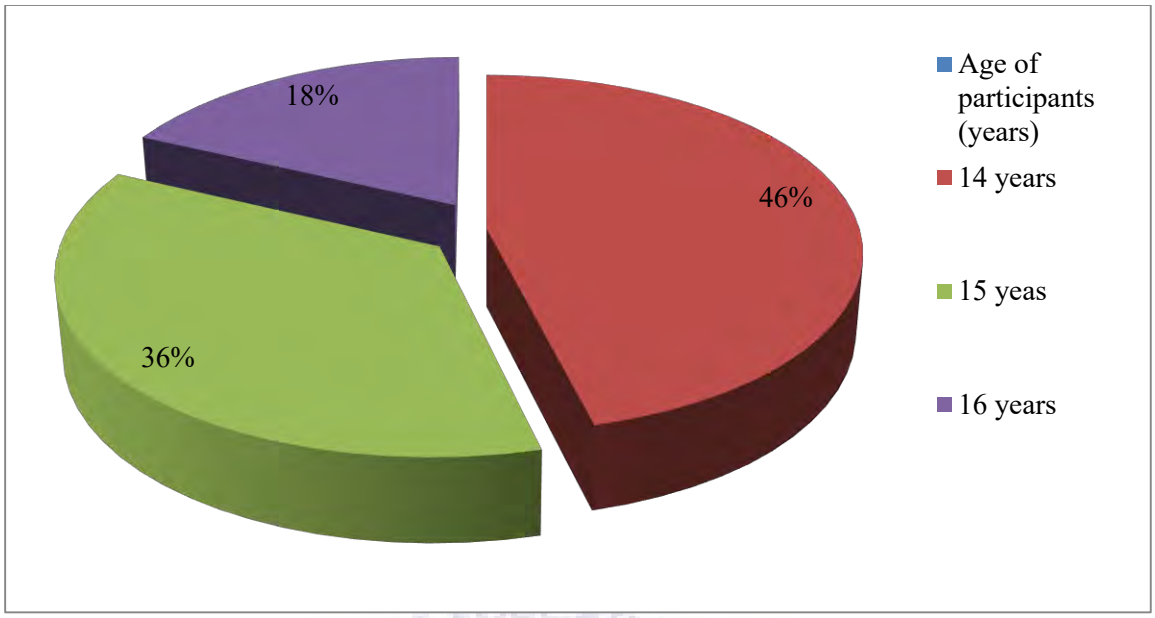


Figure 4.2: Frequency Distribution of Age of Pupils

4.1.3 Frequency distribution of sex of teachers

The sample for the study covered both males and females' teachers as represented in Table 4.3 and Figure 4.3 below.

Table 4.3: Frequency distribution of sex of teachers

Sex of Teachers	Frequency	Percentage
Males	3	60.0
Females	2	40.0
Total	5	100

Source: Fieldwork data (2015).

Table 4.3 and Figure 4.3 shows that five teacher participated in the study out of which three were males and two being females.

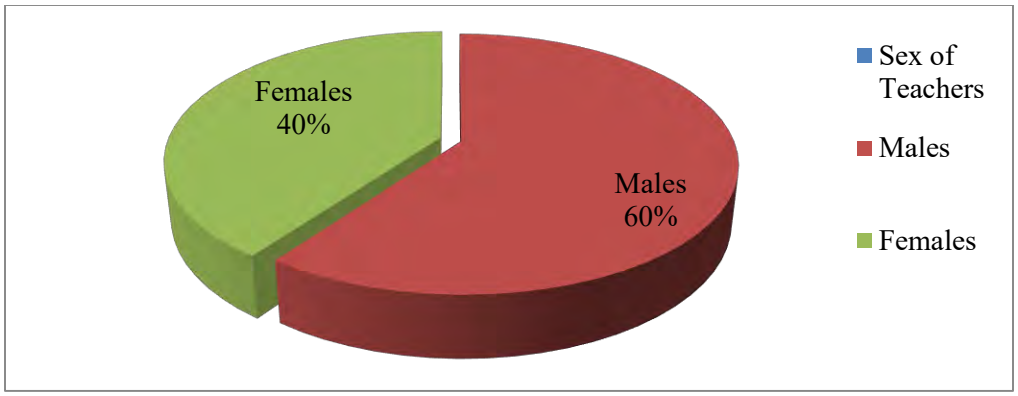


Figure 4.3: Frequency distribution of sex of teacher

4.1.4 Frequency distribution of age of teachers

Table 4.4: Frequency distribution of age of teachers

Age of Teachers (years)	Frequency	Percentage
20 – 29	1	20.0
30 – 39	3	60.0
40 – 49	1	20.0
Total	5	100.0

Source: Fieldwork data (2015).

The result as shown in Table 4.4 indicates that the ages of the teachers who participated in the study ranged from 20 years to 49 years. Majority (60%) were between 30 and 39 years. One each was between the ages of 20 to 29 years and 40 to 49 years respectively

4.1.5 Frequency distribution of professional qualification of teachers

Table 4.5: Frequency distribution of professional qualification of teachers

Professional qualification of Teachers	Frequency	Percentage
Degree	1	20.0
Diploma	2	40.0
3-year certificate 'A'	2	40.0
Total	5	100.0

Source: Fieldwork data (2015).

Table 4.5 shows the frequency distribution of the professional qualification of the teachers who participated in the study. One was a qualified Bachelor's Degree holder whilst two each were Diploma and 3-year certificates 'A' holders respectively.

4.1.6 Frequency distribution of teaching experience of selected teachers

Table 4.6: Frequency Distribution of Teaching Experience of Selected Teachers

Years of teaching experience	Frequency	Percentage
Less than 5 years	2	40.0
5 – 10 years	1	20.0
Above 10 years	2	40.0
Total	5	100.0

Source: Fieldwork data (2015).

The result as presented in Table 6 shows that the selected teachers have varied years of teaching experience ranging from 2 years to 11 years. Two teachers, representing Forty percent (40%) had taught for less than five years. One teacher represent ting (20%) had also taught for five years. Forty percent (40%) had teaching experience of between 11 and 13 years.

4.2 Analysis and Interpretation of Research Questions

Research question one: How do pupils understand the scientific concept of acids and bases?

Research question sought to find out the approach teachers use to teach science concepts, thus the topic acids, bases and salt was chosen to elicit their understanding since the topic had been treated already. In the pre-test participants were to answer questions orally. A pupil was deemed to have an understanding of the concept if he or she was able to give

correct explanation to the concept. Pupils' responses were grouped into "correct explanation" and "wrong explanation". Pupils with "correct explanation" were those who had understanding of the concept of acids and bases and those with "wrong explanation" were those who lack the understanding of the concept. The result is shown in Table 4.7, Figure 4.4.

Table 4.7: Pupils' understanding of the concept acids and bases

Response	Frequency	Percentage
Correct explanation	31	62.0
Wrong explanation	19	38.0
Total	50	100

Source: Fieldwork data (2015).

It can be seen from Table 4.7 and Figure 4.4 that 38% of the total pupils gave wrong explanations to the concept acids, bases and salt these pupils lacked the understanding of the concept and they were in the minority as compared to the 62% who were able to give correct explanations.

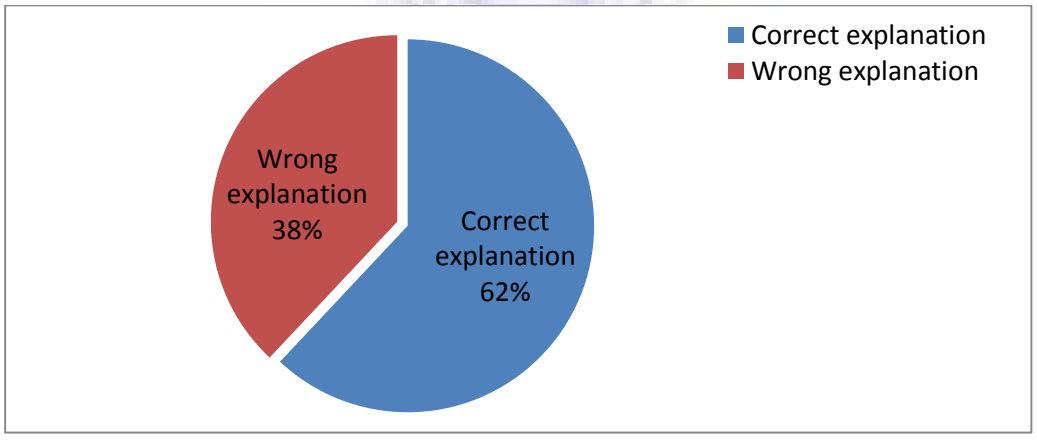


Figure 4.4: Pupils' understanding of the concept, acids and bases

4.2.1 Frequency Distribution of Pre-test Performance of Pupils

The results in Table 4.8 and Figure 4.5 present the frequency distributions of the pre-test performance of pupils in the study. Pre-test questions can be found in appendix B.

Table 4.8: Frequency distribution of pre-test performance of pupils

Marks	Frequency	Percentage
1 – 10	2	4.0
11 – 20	18	36.0
21 – 30	19	38.0
31 – 40	9	18.0
41 – 50	2	4.0
Total	50	100

Source: Fieldwork data (2015).

The mean score of the pupils in the pre-test was 24% with a standard deviation of 9.08. The performance of the pupils ranged from 10 to 45% with majority (92%) with marks between 11 to 45%. The results show that, the performance of the pupils for the pre-test was below average as revealed in the interview of the pupils before the test items.

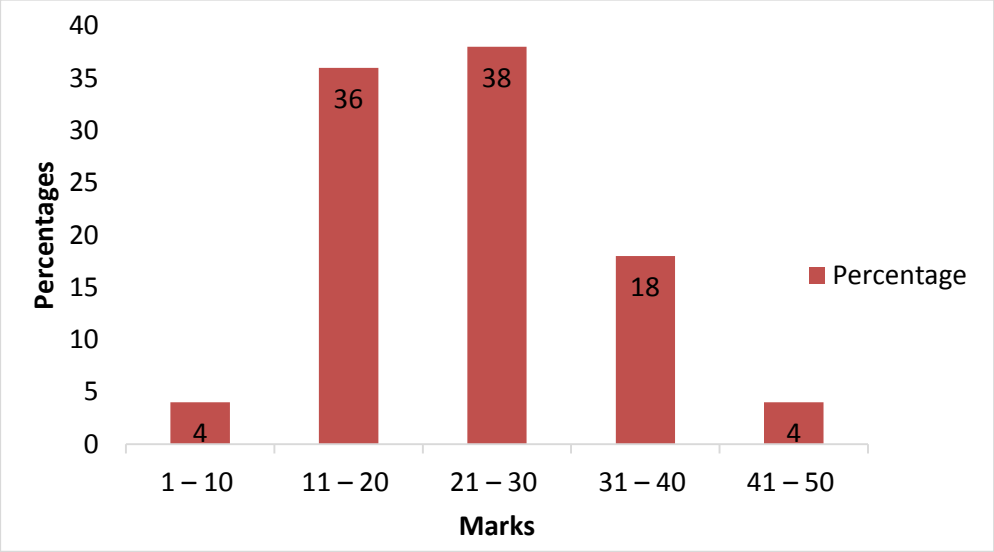


Figure 4.5: Frequency distribution of pre-test performance of pupils

Research question two: Is there an effect of activity method on teaching and learning of science?

This research question attempts to find out the effect of activity method on the teaching and learning of science. This was determined by analyzing the approach the pupils used during the pre-intervention test to answer the questions. From the analysis of the pupils' pre-intervention test responses, it was realized that pupils memorized it. An intervention (practical activity) was introduced; it was observed that pupils were actively involved in the lesson. This observation is in support of McKeachie (1994) who found out that activity method of teaching science assists learners to discover their own knowledge and also leads to the acquisition of process skills such as measuring, recording, analyzing and interpretation of data which the learners may need in the course of their schooling and working in future.

Research Question Three: Is there an effect of activity method on pupils understanding of the concept acids, bases and salt?

This research question sought to find out whether the activity method was able to help pupils in improving performance. In other words this research question seeks to determine whether pupils were able to perform better after they have been introduced to the activity method. This was done by comparing the scores of pupils in the pre-intervention test to the scores in the post-intervention test. In the pre-intervention test, pupils tried to memorize what they have been taught but there were wrong choice of words and spelling mistakes and some too were able to answer correctly.

4.2.2 Frequency distribution of Post-test performance of pupils

Table 4.9: Frequency distribution of post-test performance of pupils

Marks	Frequency	Percentage
1 – 25	0	0.0
26 – 50	22	44.0
51 – 75	26	52.0
76 – 100	2	4.0
Total	50	100

Source: Fieldwork data (2015). Mean = 54.34, S.D = 12.84 Range = 30 – 82

Table 4.9 and Figure 4.6 indicate the frequency distribution of the post-test performance of pupils. The results show that, the pupils' mark ranged from 30 to 82 percent, the mean mark was (54.34%) with a standard deviation of (12.84).

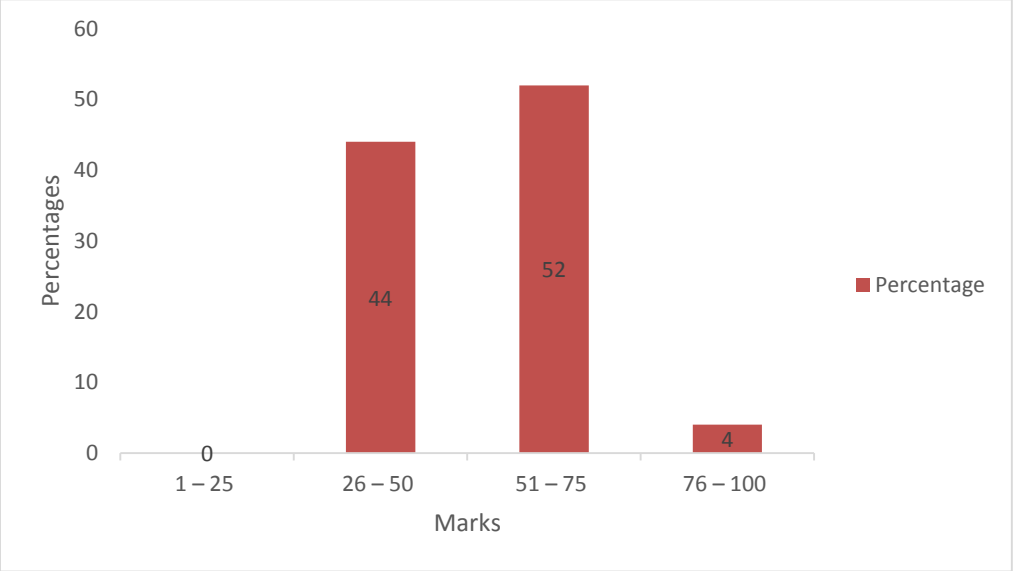


Figure 4.6: **Frequency distribution of post-test performance of pupils**

The findings revealed that majority, (56.0%) of the pupils scored more than above average in the post-test items after the intervention.

The effect of the activity method of teaching science on the performance of pupils is presented in Table 4.10. The results show that the performance of the pupils improved after the test intervention.

Table 4.10: Effect of activity method of teaching science on the performance of pupils

Test	mean	S.D	Mean diff.	Standard Error mean	t-ratio	Df	p.value
Pre-test	24.00	9.08	-30.34	0.99	-30.43	49	0.00*
Post-test	54.34	12.84					

Source: Fieldwork data (2015). *p< 0.05. n = 50,

The mean marks of the pupils in pre-test was (mean = 24.0, S.D = 9.08) whilst the post-test was (mean = 54.34, S.D = 12.84). The paired-sample T-test of statistical difference, t = -30.43, df = 49, p = 0.00 (two-tailed), and mean difference = -30.34 shows that the performance of the pupils in this study improved after the intervention at 0.05 alpha level.

The finding is in support of Blough and Schwartz (1990) who pointed out that practical work and demonstrations help improve students understanding and performance in science lessons.

Research question four: Are there differences in the use of activity method on gender?

The research question sought to examine whether or not the activity method of teaching science influence the performance of the pupils based on gender.

4.2.3 Levine's Test for Equality of Variances

Table 4.11 presents the results of the Levine's Test for equality of variance between the two groups (male and female pupils) on their performance after the activity method of teaching science intervention.

Table 4.11: Levine's test for equality of variances

Test item	Test for Equality of Variances	F-ratio	p. value
Post-Test performance	Equal variance assumed	1.13	0.29

Source: Fieldwork data (2015).

The results show that (F = 1.13 and p-value = 0.29) which are greater than 0.05 alpha level of significance, indicates that the assumption of equal variances has not been violated; therefore the two groups assumed equal variance.

4.2.4 Independent Sample T-Test between Male and Female Pupils' Performance after Teaching Intervention

The result in Table 4.12, presents means and standard deviations of the performance by both male and female pupils in the study as well as an independent t-test between male and female pupils. The means of the performance of the pupils shows that both male (mean = 54.22, S.D= 013.99) and female (mean 54.52, S.D = 11.05) in the study was 'average'. However, female pupils' performance in the post-test items was a little bit more 'average' than males.

The independent T-test (Table 12), t = (-0.08), df = 48, mean difference = (-0.30), p = 0.94 showed that male and female pupils did not differ significantly in their performance in

post-test activities at 0.05 alpha levels. The results indicate that the performance of the pupils in the post-test activities was the same for both males and females who received the activity method of teaching science intervention.

Table 4.12: Independent sample t-test between male and female pupils' performance in the post-test activity

Test activity	Sex of pupils	n	Mean	S.D	Mean Diff.	t-ratio	df	p. value
Post-Test	Male	31	54.22	13.99	-0.30	-0.08	48	0.94
	Female	19	54.52	11.05				

Source: Fieldwork data (2015).

4.3 Discussion

Science learning is by doing, therefore a teacher should create varied opportunities for pupils to engage in doing activities that will enable them to make sense of the world around them; make new discoveries, solve interesting problems and develop skills. Effective practical exercises provide students with varying opportunities and experiences. (Hudson, 1990; Tobin, 1990; Huber & Moore, 2001, cited in Erinosho, 2008).

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Overview

This chapter deals with the summary of the main findings and conclusions derived from the study as well as recommendations and suggestions for further studies.

5.1 Summary of findings

The main findings were summarized below:

1. The study revealed that J HS three pupils of Ampabame No 1 Roman Catholic Junior High School showed a better understanding of science concepts after the introduction of practical activity.
2. Also the pupils performed better in the selected science topic following the introduction of practical activity.
3. Finally there was no significance difference in the performance of boys and girls in the selected topic.
4. It also came to light that most of the science teachers in the Ampabame No.1 JHS (A & B) in the Asokwa sub-metro hardly use activity method in the teaching of science but use more of the lecture method. They mostly copied plenty notes on the board for pupils.
5. Many science teachers in the sub-metro seldom use teaching learning materials to teach science lessons even though they sometimes discuss exercises with pupils. This has resulted in the loss of interest of the teaching and learning of Science since no major practical works are done in addition to theory.

6. The research also revealed that respondent's shared similar idea that, practical lessons lead to more understanding and better assimilation. This is to say that, when learners see, hear, touch, smell and if possible, taste whatever they are learning, they tend to understand it better.

5.2 Conclusion

Based on the findings the following conclusions were made:

The introduction of the intervention produced a significance improvement in pupils' learning and understanding of concepts in science as compared to the previous term.

Evaluation involves determining whether the theoretical effects of the intervention strategies were realized and the effects relieved the problem. From the results it can be said that intervention strategies were successful. It can be concluded that practical activity improved pupils' learning in science at Ampabame Roman Catholic Junior High School in Asokwa Sub-Metro. It helped pupils to understand scientific concepts.

Teaching science by the integration of theory and practical as well as the involvement of the students makes learning both meaningful and interesting. Moreover it also motivated pupils to learn and retain what they have learnt. The science teacher is therefore encouraged to expose pupils to many situations to reinforce pupils' learning.

5.3 Recommendations

The following recommendations were made based on the conclusions:

1. Teachers should provide pupils of Ampabame Roman Catholic Junior High School in Asokwa Sub-Metro the appropriate learning materials that will make them see, handle and manipulate real objects and materials rather than just telling or copying plenty science notes on the board as core points for pupils to take home.
2. Pupils should be empowered to become responsible for their own learning by creating opportunities that will actively involve them in the learning process. This can also be done by helping them construct their knowledge and organizing it in a way that can help them apply the need information correctly and improve upon their performance in science.
3. Integrated science teachers in all junior high schools should devote about 80% of their teaching method to activity based
4. Workshops, seminars and conferences on the importance of classroom activity should be organized for integrated science teachers to enable them prepare and develop themselves towards improving their achievements of their students.
5. Further study should be conducted over a longer period of time, maybe it could show different results on pupils' performance in science.

REFERENCES

Akpan, O. E. (1992). Towards creative science teaching and learning in West African alike. *The Science Teacher*, *58*(7), 45-49.

Amoatey, T. (2001*). Methods of teaching*. Accra: Rainbow Publishing

Anderson, R. D., & Helms, J. V. (2001). The ideal of standards and the reality of schools: Needed research. *Journal of Research in Science Teaching, 38*, 3-16.

Applin, D. (1995*). Keys in science*. London: Thomas Stone Publishers.

Atiku, Y. K. (2004). *The key to your success in education studies examination*. Accra: Good Name Computers and Photocopy Services.

Ausubel, D. P. (1968). *Educational psychology: A cognitive view.* New York: Grune and Stratton

Avoka, C. A. (2000). Poverty and the environment. In F. Dodds (Ed.), *Earth Summit 2002*: A New Deal. London: Earthscan.

Balugun, S. (1984). *Techniques of teaching junior science.* London: MacMillan Publishers

Bartlett, F. C. (1932). *Remembering: A study in experimental and social psychology.* London: Cambridge University Press.

Best, J. W., & Khan, J.V. (1993). *Research in education* (7th ed.). Englewood Cliffs, New Jersey: Prentice – Hall Booth, W.C.

Bigge, M. L., & Shermis, S. S. (1998). *Learning theories for teachers* (6th ed.). New York: Anderson Wesley Longman, Inc.

Birke, J. P., J. Foster (1993). The importance of lecture in general chemistry course performance. *Journal of Chemical Education. 70*(1), 180-182.

Blough, G. O., & Schwartz, J. (1990*). Elementary school science and how to teach it* (8th ed.). New York: FertWorth Holt, Rinehart and Winstory Inc.

Borg, W. R., & Gall, J. P. (1996*). Educational research*: An *introduction*, *(6th ed.).* White Plains, N.Y: Longman Publishers.

Brooks, J. G., & Brooks, M. G. (1993). *In search of understanding: The case for constructivist classrooms.* Alexandria, VA: Association for Supervision and Curriculum Development.

Brown, K. (1985*). How to teach children science.* Takoradi: Brown Publishing Company.

Brown, R. N., Oke, F. E., & Brown, D. P. (1982). *Curriculum and Instruction*: *An introduction to methods of teaching*. London. Macmillan Publishers Ltd.

Carvin, A. A. (1985*). Teaching modern science* (4th ed.). Columbus: Merrill Publishing Company.

Cohen, L, Marion, L., & Morrison, K. (2003). *Research methods.* (5th ed.). New York: Routledge Falmer.

Cresswell, J. W. (2005). *Educational research planning; Conducting and evaluating quantitative and qualitative research.* Upper Saddle River, NJ: Pearson and Merrill Prentice Hall.

Danmole, B. T., & Femi-Adeote, K. O. (2004). Effects of Concept Mapping Technique on Senior Secondary School Students' Achievement and Retention of Ecology. *Journal of Science Teachers' Association of Nigeria, 3*(1&2), 32-38.

Davis, K. S. (2003). Chicago is hard: What science teachers are telling us about reform and teacher learning of innovative practices. *Science Education, 87*(1), 3-30.

Driver, R., Asoko, H., Leach, J., Mortimer, E., & Scott, P. (1994). Constructing scientific knowledge in the classroom. *Educational Researcher*, *23*(7), 5-12.

Driver, R., Guesne, F., & Tiberghien, A. (1985). *Children's ideas in science.* Milton Keynes: Open University Press.

Duit, R., & Confrey, J. (1996). Reorganizing the curriculum and teaching to improve learning in science and mathematics. In D.F. Treagust, R. Duit, & B. J. Fraser (Eds*.), improving teaching and learning in science and mathematics* (pp.79-93). New York: Teachers Press College Press.

Duit, R., & Treagust, D. F. (1998). Learning in science- from behaviourism towards social constructivism and beyond. In K Tobin (Eds.), *International handbook of science education, Part 1.* Dordrecht, The Netherlands: Kluwer.

Elliot, J. (1991). *Action research for educational charge*: *Developing teachers and teaching.* Philadelphia: Open University.

Eminah, J. K. (2004). Rationale and approaches for improvisation in science. *UMYU Journal of Educational Research 1*(1), 131-134.

Erinosho, S.Y. (2008). *Teaching science in secondary schools*: *A methodology evaluating quantitative and qualitative research*. New Jersey: Pearson Education

Etkina, E., & Mestre, J. (2004). *Implication of learning research for teaching science to Non-Science majors.* Retrieved December, 2012 from http://www.sencer.net/assessmenttools.#cfm

Farrant, J. S. (1990). *Principles and practice of education* England. Harlow: McMillan Publishers.

Farrent, M. (1986*). Theories and practice in education.* London: McWilliams Publishers.

Gega, P. C. (1990). *Science in elementary education*. San Diego, CA: Macmillan Publishers

Good, T. L., & Brophy, J. E. (1990). *Educational psychology: A realistic approach,* (4th ed.) White Plains, NY: Longman.

Graves, W.S. (1985). *Techniques of attitude scale construction,* New York: Appleton-Century.

Greeno, J.G., Colins, A.M., & Resnick, L. (1996). Cognition and learning. In D. Berliner & R. Calfee (Eds.), *handbook of educational psychology* (pp.15-46). New York: Macmillan.

Grubern, H., & Voneche, J. (Eds). (1977). *The essentials piaget*. London: Routledge and Kegan Paul.

Gyimah, M. (1986). *Teaching science at primary schools*. Kumasi: Anteater Publishers.

Hand, B. (1996). Diagnosing of teachers' knowledge bases and teaching roles when implementing constructivist teaching/learning approaches. In D. F. Treagust, R. Duit, & B.J. Fraser (Eds.), *improve teaching and learning in science and mathematics* (pp. 79-93). New York: Teachers College Press.

Hartman, H. J., & Glasgow, W. A. (2002). *Tips for the Science Teacher: Research-based strategies to help students learn.* Thousand Oaks, CA: Corwin Press, Inc.

Herbert, D. T. (1970). *Teaching Elementary School Science. A laboratory Approach*. Yale: University Press.

Hirsch, E. D. (1991). *Microsoft student 2009 (DVD).* Redmond, WA: Microsoft Corporation.

Hubert, R. A., & Moore, C. J. (2000). A model for extending hands-on Science to be Inquiry. *Base School Science and Mathematics*, *101*(1), 32-42

Jenkins, E. W. (1998). Processes in science education: An historical perspective. In J. J. Wellington, (Ed.). *Skills and processes in science education*. London: Routledge

Johnson, R. B., & Christensen, L. (2008*).Educational Research. Quantitative, Qualitative and Mixed Approaches (3rd ed.).* Los Angeles: Sage Publications.

Jonasson, D. H. (1991). Objectivism versus constructivism: Do we need a new philosophical paradigm? *Educational technology research and development, 39* (3), 5-14.

Kelly, G. A. (1991). The *psychology of personal constructs: Volume one-A theory of personality*. London: Routledge.

Kombo, K. D., & Delno, L. A. (2006). *Proposal and thesis writing*: *An introduction*. Nairobi: Paulines Publications Africa.

Kujawa, S., & Huske, L. (1995). *Strategic teaching and reading project guidebook*. Oak Brook, IL: North Central Regional Educational Laboratory.

Kumar, R. (2005*). Research methodology: A step-by-step guide for beginners.* London: Sage Publication.

Kusi, H. (2012). *Doing qualitative research a guide for researchers*. Accra Newtown: Emmpong Press.

Kusi, H. (2013). *Human Resource Management in Education.* Unpublished lecture notes. University of Education, Winneba.

Leedy, P. D. (1980). *Practical research planning and design* (2nd ed.). New York: Macmillan Publishing Inc.

Marek, E. (1986). *Science misconceptions of students in middle school S.H.S*. Paper presented at the National Social Science Association Conference, San Antonio: TX.

Martin, D. J. (2000). *Elementary science methods: A constructivist approach*. Belmont, CA: Wasworth.

Mashman, D. (1982). Exogenous, endogenous, and dialectical constructivism. *Developmental Review, 2*(1), 371-384.

McKeachie, W. J. (1994). *Teaching tips*: *A guidebook for the beginning college teacher.* Lexington, Mass, DC: Heath & Co.

Mensah, S. K. E. (1992). Source book for science tutor and professional. Unpublished. Needed Research. *Journal of Research in Science Teaching*, *38*(2), 3-16.

Novak, J. D. (1991). Clarity with concept maps: A tool for students and teachers alike. *The Science Teacher, 58*(7), 45-49.

Ossei-Anto, T. A. (1999). Management and integration of science resources in Ghana's educational reform programme. *Journal of Educational Management 2*, 42-66.

Packer, M. J., & Goicoechea, J. (2000). Sociocultural and constructivist theories of learning: Ontology, not just Epistemology. *Educational Psychologist*, *35*(4): 227-241.

Patton, M. Q. (2002). *Qualitative research and evaluation methods*. Thousand Oaks, CA: Sage Publication.

Petty, S. (2001). *Teaching science in the African context*. Ibadan, Nigeria. Science Educational Book.

Piaget, J. (1977). *The development of thought: Equilibration of cognitive structures*. (A. Rosin, Trans). New York: The Viking Press.

Powney, J., & Watt, M. (1987). *Interviewing in educational research*. London: Routledge Publications.

Reisman K., & Payne B. D. (1987). *Social climate in high schools.* Washington, D.C.: U.S. Department of Education, National Center.

Ritchie, S. M., & Cook, J. (1994). Metaphor as a tool for constructivist science teaching. *International Journal of Science Education*, *16*(3), 293-303.

Robertson, S. (2002). *Introducing qualitative research in psychology: Adventures in theory and method.* Berkshire, UK: Open University.

Rosenblatt, L. (1938). *Literature as exploration*. London: D. Appleton-Century.

Rosenblatt, L. (1978). *The reader, the text, the poem: The transactional theory of the literary work*. Carbondale, IL: Southern Illinois University Press.

Roth, W. M. (1993). Construction sites: Science labs and classrooms. In K. Tobin (Ed.), *The practice of constructivism in science education* (pp.145-170). Washington, DC: American association for the advancement of science.

Saloman, G & Perkins, D.N. (1998). Individual and social aspects of learning. *Review of research in education, 23*, 124.

Saunders, W.L. (1992). The constructivist perspective: Implications and teaching strategies for science. *School Science and Mathematics*, *92*(3), 136-141.

Savasci, F. (2006). *Teacher beliefs and practice in science education*. Retrieved from http://www.ied.edu.hk../funda/. Accessed on October, 2012.

Simpson, W. (1986).*Understanding and misunderstanding of biological concepts of students attending large high schools and students attending small high schools. (*Unpublished Masters' thesis). University of Oklahoma, Norman.

Sipe, L. & Constable, S. (1996). A Chart of Four contemporary Research Paradigms: Metaphors for the Modes of Inquiry. *Taboo, Journal of Culture and Education, 1*,153-163.

Smith, L. (1990). *Manual descriptive of the aptitude test for elementary school teachers-in-training.* Toronto: Ont. Dent.

Talabi, J.K. (2007). *Educational technology*. Accra: KOESS Press.

Tillery, B. (1991*). Modern science concepts*. London: Christopher's Printing Press.

Tobin, K. (1990). Teacher mind frames and science learning. In K. Tobin, J. Butler, & B. J. Fraser (Eds.), *windows into science classrooms: Problems associated with higher level cognitive learning* (pp. 33-91). Bristol, PA: The Falmer Press.

Tobin, K. (2002). Constructing science experiences. In J.M. Peters and P.C. Gega (Eds). *How to teach elementary school science* (4th ed.). Upper Saddle River, New Jersey: Merrill Prentice Hall.

Twomey, F. C. (1989). *Enquiring teachers, enquiring learners: A constructivist approach for teaching*. New York: Teachers College Press.

UNESCO (1995). *UNESCO handbook for science teachers*. London: Heinemann.

Wadsworth, J. B. (1989). *Piaget's theory of cognitive and effective development* (4th ed.). New York: Pitman Publishing Inc.

Von Glasersfeld, E. (1993). Cognition, construction of knowledge and teaching. In M. R. Vygostsky and Piaget. In B. Rogoff, *apprenticeship in thinking: Cognitive development in social context.* New York: Oxford University Press.

Vygostsky, L. S. (1962). *Thoughts and language*. Cambridge MA: Harvard University Press.

Walklin, L. (1982). *Instructional techniques and practice*. London: Leckhampton

Walsh, J. A., & Sattes, B. D. (2005). *Quality questioning: Research-based practice to engage every learner.* Thousand Oaks, CA: Corwin Press.

Weiss, I. R. (1997). The status of science and mathematics teaching in the United States: Comparing teacher views and classroom practice to national standards. *NISE Briefs, 1*(3), 1-8.

Wells, G. (1999). *Dialogic inquiry: Toward a sociocultural practice and theory of education.* Cambridge: Cambridge University Press.

Wheatley, G. H. (1991). Constructivist perspectives on science and mathematics learning. *Science Education, 75*(1), 9-21.

Wilson, B. G. (1995). Metaphors for instruction: Why we talk about learning environments. *Educational Technology, 35*(4), 25-30.

Woods, D. R. (1995). Teaching and learning: what can research tell us? *Journal of College Science Teaching, 25*(2), 229-232.

Woodworth, B. (1947). *Practical work in science*. London: Cambridge University Press.

Yager, R. E. (1995). Constructivism and the learning of science. In S.M. Glynn, & R. Duit (Eds.), *learning science in the schools: Research reforming practice.* Mahwah, NJ: Erlbaum.

Yardley-Matwiejczuc, K. (1997). *Role-play: Theory and practice*. London: Sage Publications.

Young, B. L. (1990). *Teaching primary science.* Hongkong: Longman Group F. E. Ltd.

Zemelman, S., Daniels, H., & Hyde, A. (1993). *Best practice: New standards for teaching and learning in America's schools*. Portsmouth, NH: Heinemann.

APPENDIX A: BIO DATA

AMPABAME NO 1 R/C J H S

SUBJECT: INTEGRATED SCIENCE

The effect of activity method on the teaching and learning of science at the J H S ". It will be appreciated if you answer the following questions. You must note that this study is only a research and the marks you obtain will not be recorded. However, you must note that you will benefit greatly for taking part in this exercise as it will provide you with an approach in answering science questions. Thank you for accepting to take part in this exercise. All answers will be treated confidential.

SECTION A: BIO DATA

INSTRUCTION: Please fill where necessary and tick where necessary.

School :……

Age :……

Form : J H S 1 ☐ J H S 2 ☐ J H S 3 ☐

Sex: Male ☐ Female ☐

APPENDIX B: PRE-INTERVENTION TEST

AMPABAME NO 1 R\C JUNIOR HIGH SCHOOL

SUBJECT: INTEGRATED SCIENCE

SECTION B: PRE INTERVENTION TEST

DURATION: 2 Hours

INSTRUCTION: Answer all questions

1. In your own words explain what an acid is.

2. Define what a base is.

3. a. Deduce one property of an acid, when a blue litmus paper is dipped in acidic solution.

b. How do you test for an acid?

4. How do you determine the basicity of a solution by using a litmus paper?

5. What will be the effect on the colour of blue litmus paper when dipped in each of the following solutions?

i. Sodium Hydroxide solution

ii. Dilute Hydrochloric acid

iii. Lime juice.

iv. Water

6. Distinguish between an acid and a base.

7. When an acid reacts with a base what compound is formed?

8. Sodium chloride is prepared by the reaction between dilute hydrochloric acid and sodium hydroxide.

a. What is the name given to this reaction?

9. If three different liquids, namely, dilute acid, distilled water and alkaline solutions are poured into three identical bottles and presented to you for identification, describe how you would identify them.

10. List two properties of an acid and a base.

APPENDIX C: POST INTERVENTION TEST

AMPABAME NO 1 R\C JUNIOR HIGH SCHOOL

SUBJECT: INTEGRATED SCIENCE

SECTION C: POST INTERVENTION TEST

DURATION: 2 HOUR

1. What is an acid?

2. Define a base.

3. a. Deduce one property of an acid, when a blue litmus paper is dipped in acidic solution.

b. How do you test for an acid?

4. How do you determine the basicity of a solution by using a litmus paper?

5. What will be the effect on the colour of blue litmus paper when dipped in each of the following solutions?

i. Sodium Hydroxide solution

ii. Dilute Hydrochloric acid

iii. Lime juice.

iv. Water

b. Explain why.

6. Distinguish between an acid and a base.

7. When an acid reacts with a base what compound is formed?

8. Sodium chloride is prepared by the reaction between dilute hydrochloric acid and sodium hydroxide.

a. What is the name given to this reaction?

9. If three different liquids, namely, dilute acid, distilled water and alkaline solutions are poured into three identical bottles and presented to you for identification, describe how you would identify them.

10. List two properties of an acid and a base.

APPENDIX D:

MARKING SCHEME FOR THE PRE-INTERVENTION TEST.

1. An acid is any compound that dissolves or ionizes (break down) in solution to produce hydroxide ions (H^+ ions). OR an acid is also a compound that turns blue litmus paper red. (10 marks).

2. A base is a compound that ionizes (break down) or dissolves in solution to produce hydroxide ions (OH^- ions). OR a base is also a compound that turns red litmus paper blue. (10 marks).

3. a. One property of an acid is that it turns blue litmus paper red.

(5marks)

b. An acid is tested by using a blue litmus paper.

(5marks)

4. The basicity of a solution is determined by using a red litmus paper.

(4marks)

5. I. The colour of the paper remains the same.

(4marks)

ii. The colour of the litmus paper changes from blue to red.

(4marks)

iii. The colour of the litmus paper changes from blue to red.

(4marks)

iv. The colour of the litmus paper does not change.

(4marks)

6. An acid changes blue litmus paper to red but a base changes red litmus paper to blue. (10marks)

7. When an acid reacts with a base salt is formed.

(4marks).

8. Neutralisation reaction. (8marks).

9. A litmus paper would be used for identification of the liquids, A blue litmus paper would be dipped in the solutions, the one that turns the blue litmus paper to red is an acid, and the other solution that turns the red litmus paper back to red is a base, automatically the remaining solutionis a distilled water. (12marks).

10. a. Two properties of an acid:

i. Acid turns blue litmus paper red. (4marks)

ii. They have a sour taste. (4marks)

b. Two properties of a base: i. Base turns red litmus paper blue. (4marks)

ii. They have a bitter taste. (4marks)

APPENDIX E

MARKING SCHEME FOR THE POST-INTERVENTION TEST

1. An acid is any compound that dissolves or ionizes (break down) in solution to produce hydroxide ions (H^+ ions). OR an acid is also a compound that turns blue litmus paper red. (10 marks).

2. A base is a compound that ionizes (break down) or dissolves in solution to produce hydroxide ions (OH^- ions). OR a base is also a compound that turns red litmus paper blue. (10 marks).

3. a. One property of an acid is that it turns blue litmus paper red.

(5marks)

b. An acid is tested by using a blue litmus paper.

(5marks)

4. The basicity of a solution is determined by using a red litmus paper.

(4marks)

5. I. The colour of the paper remains the same.

(4marks)

ii. The colour of the litmus paper changes from blue to red.

(4marks)

iii. The colour of the litmus paper changes from blue to red.

(4marks)

iv. The colour of the litmus paper does not change.

(4marks)

.

An acid changes blue litmus paper to red but a base changes red litmus paper to blue.

(10marks) 6

7. When an acid reacts with a base salt is formed.

(4marks).

8. a. Neutralisation reaction. (8marks).

9. A litmus paper would be used for identification of the liquids, A blue litmus litmus paper would be dipped in the solutions, the one that turns the blue litmus paper to red is an acid, and the other solution that turns the red litmus paper back to red is a base, automatically the remaining solution is a distilled water. (12marks).

10. a. Two properties of an acid:

i. Acid turns blue litmus paper red. (4marks)

ii. They have a sour taste. (4marks)

b. Two properties of a base: i. Base turns red litmus paper blue. (4marks)

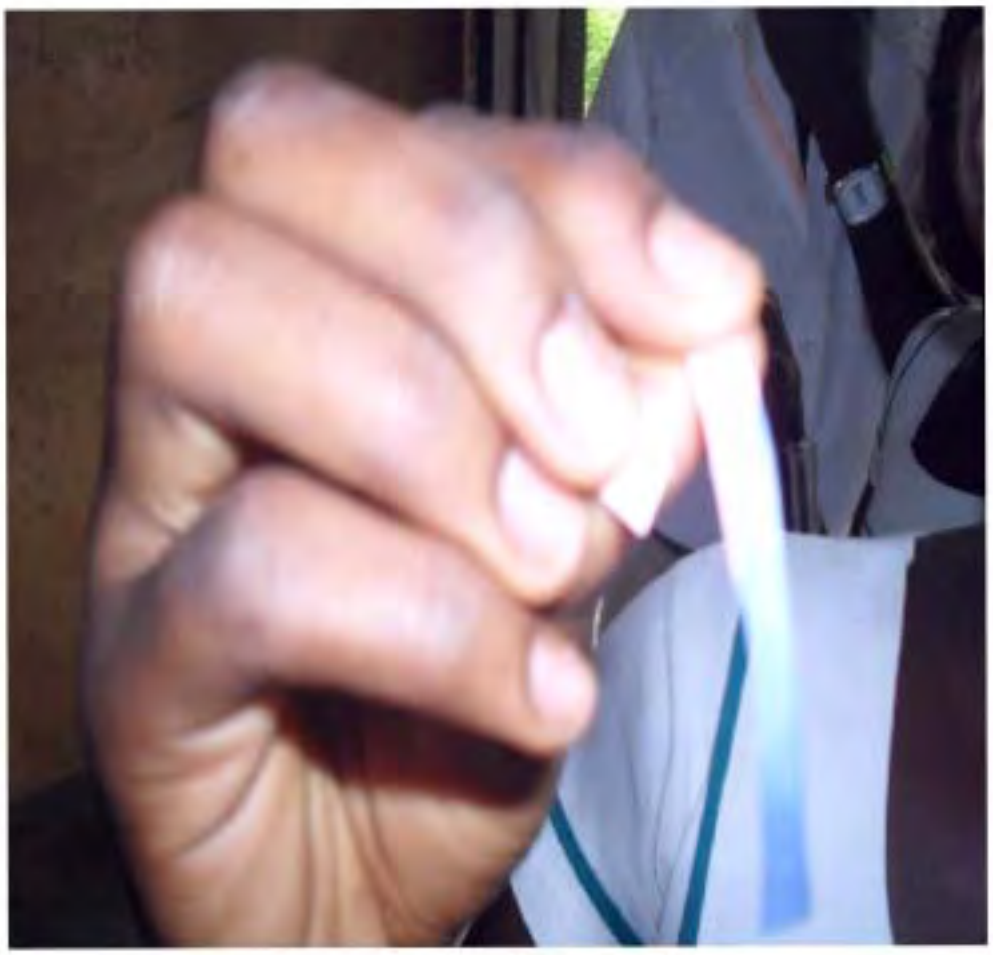
ii. They have a bitter taste. (4marks)

APPENDIX F

Some of the Teaching Learning Materials used in the Lesson Presentation

Group undergoing Activities

C. A pupil showing the colour change of a litmus paper



APPENDIX G

INTERVIEW TEST ITEMS

Q1: *How can the activity method be effectively used to teach science?*

Responses on interview items from the Science teachers

Teacher 1: *By making TLM's more available for the lesson in class*

Teacher 2: *By guiding pupils to carry out practical work*

Teacher 3: *Pupils should be made to work in groups and sometimes role play the lesson*

The teachers responses indicated that teachers agree to the findings of Anderson & Helms (2001), who suggested that by providing pupils at the basic level with experiences to 'learn science by doing' using variety of hands-on practical activities, stimulate in pupils the interest, develop skills, enhance cognition and challenges them to do critical thinking. A related study by Walklin (1982) whose findings agrees with that of this present study revealed that science is a discipline which is understood better through practical activities, and concluded that materials and equipment play a very important role in the teaching and learning of science. This is because learners are helped to develop scientific skills, knowledge and attitude toward science. It is therefore easy to conclude that pupils after the intervention understood and performed better in the task given.

Q 2: *What teaching methods do you use most during the teaching of integrated science?*

Responses on interview items from the Science teachers

Teacher 1: *I am used to the lecture method of teaching science. This is because there are a lot of topics to be treated but we don't have enough time.*

The lecture method, to me, saves time. Actually, I don't like the use of methods such as the activity because it's mostly time consuming.

Teacher 2: Actually, I must say that I mostly use lecture method so that I can finished all my topics for the term before the pupils write their final examinations. However, I always ensure that i discuss assignments, class exercises and even past questions with the pupil.

Teacher 3: I like my pupils to participate in my science lessons and so, I sometimes use the activity method in teaching when materials are available.

On the issue of the method often used in teaching science, it can be deduced from the teacher's response that they are more comfortable with the use of lecture method, than the activity method. However, McKeachie (1994) found that activity method of teaching science assist learners to discover their own knowledge and also leads to the acquisition of process skills such as measuring, recording, analyzing and interpretation of data which the learners may need in the course of their schooling and working in future.

It can be deduced from the responses above that most of the science teachers are familiar with the activity method of teaching science even though they don't use it. Interestingly, these same teachers strongly recommend the use of the activity method for science teaching. In a similar study by Mensah (1992), he found out that activity method of teaching science assists learners to discover their own knowledge. McKeachie (1994) found that activity method of teaching science assists learners to discover their own knowledge and also leads to the acquisition of process skills such as measuring, recording, analyzing and interpretation of data which the learners may need in the course of their

schooling and working in future. McKeachie's position supports the findings of this present study.

The reason for poor performance by pupils to this question especially after the two pre-tests can be attributed to the fact that pupils fall short in application questions. That is to say when simple questions demand that pupils apply the knowledge gain in new situations, it becomes a challenge to them. This means that when teaching pupils in the basic schools, it is just appropriate to use things which are familiar to the child and also common in his/her environment and so that the enthusiasm of the child would be aroused. In this way, through playing manner the child would unconsciously develop the needed skills to become scientifically literate.

In general, the experimental group performed better in all the post-test exercises than the pre-tests conducted for the two groups (i.e. both the experimental and the control groups). Anamuah-Mensah, Mereku, and Ameyaw-Asabere, (2004) in a related study observed that pupils in most Ghanaian schools are not able to apply the science concepts that they are taught in the classroom, leading to poor performance of pupils in science examination and other external examination bodies. McKeachie (1994) found that activity method of teaching science assists learners to discover their own knowledge and also leads to the acquisition of process skills such as measuring, recording, analyzing and interpretation of data which the learners may need in the course of their schooling and working in future. Again Walklin (1982) in a study indicated that science is a discipline which is understood better through practical activities, and concluded that materials and equipment play a very important role in the teaching and learning of science. This is because learners are helped to develop scientific skills, knowledge and attitude toward science.