UNIVERSITY OF EDUCATION, WINNEBA

USING THE ACTIVITY METHOD TO HELP THE SECOND YEAR DIPLOMA OF EDUCATION STUDENTS IN ST MONICA'S COLLEGE TO TEACH SOME SELECTED TOPICS IN BIOLOGY

NKETIA, WILSON SIAW

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A THESIS IN THE DEPARTMENT OF SCIENCE EDUCATION, FACULTY OF SCIENCE EDUCATION, SUBMITTED TO THE SCHOOL OF RESEARCH AND GRADUATE STUDIES, UNIVERSITY OF EDUCATION, WINNEBA, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF EDUCATION IN SCIENCE

2012

DECLARATION

Candidate's Declaration

I, **Nketia, Wilson Siaw** hereby declare that this dissertation, with the exception of quotations and references contained in published works which have all been identified and acknowledged, is entirely my own original work, and it has not been submitted, either in part or whole, for another degree elsewhere.

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NKETIA, WILSON SIAW **DATE**

Supervisor's Declaration

This thesis has been read and approved as meeting the requirements of the School of Research and Graduate Studies, University of Education, Winneba.

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DR K. D. TAALE **DATE**

DEDICATION

This dissertation is dedicated to my lovely wife, Mrs. Veronica Nketia Siaw, my children, Nana Yaw Afriyie Mensah Nketia, Abraham Lincoln Angoh Nketia and Kwame Dei-Kwarteng Nketia. I love you all.

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ABSTRACT

The study sought to use the activity method to teach some selected topics in biology in St. Monica‟s College of Education in Mampong Ashanti. The study was an action research which aimed at identifying a problem and putting down the appropriate interventional strategies to solve the identified problem. The data collection instrument used was test items. The population of study was all the second year students pursuing the Diploma in Basic Education (DBE). The results of the study showed that the activity method was very relevant and beneficial in helping the second year students of St. Monica‟s College of Education to improve upon their performance in teaching "Integrated Science" because they were able to secure higher test scores after the intervention as compared to their test score before the intervention. It is recommended that classroom teachers should try as much as possible to use the activity method in their routine methods of instruction in science classes.

CHAPTER ONE

INTRODUCTION

Overview

This chapter provides the background and rationale for this study. The following are also discussed; statement of the problem, purpose of the study and the research questions. The significance of the study which highlights the importance and the benefits of the expected outcomes are discussed. The limitations and delimitations of the study are also discussed. The chapter ends with the definition of terms and organization of the study.

1.1 **Background to the Study**

Basic education in most part of the world today recognizes science as one of the most important foundation subjects which is given a place in the core of the educational curriculum. This is due to the belief that the study of science can improve one"s chance in social achievements. Science as compared to other subjects is given much attention in the school curriculum. The rationale for the teaching and learning of science at the training college is to inculcate in the teacher trainees the ability to obtain the requisite skills and knowledge relevant to impart scientific knowledge effectively to the basic school children when they complete their training. This will help the basic school child to obtain the needed knowledge and skills to be successful in their chosen careers and daily lives.

There are various topics in the basic school syllabus for science and each topic needs to be handled with required activities for better understanding of the pupils.

Some of the important topics in biology are food chain, transpiration, photosynthesis and osmosis. These topics are found in the syllabus of the second year diploma course. Food chain forms the basis of all feeding in an ecosystem whereby energy is transferred from one trophic level to another. Transpiration on the other hand is the release of water vapour from the leaves of plants into the atmosphere which also is able to regulate the amount of moisture in the environment which has several effects on organisms.

Photosynthesis is a process by which green plants and other organisms turn carbon dioxide and water into carbohydrates and oxygen, using light energy trapped by chlorophyll. Osmosis is the movement of solvent molecules through a semi permeable membrane from a dilute to a more concentrated solution.

The knowledge of these topics is needed for further developments of higher concepts as well as their application in the environment. However these topics prove very difficult for students to learn and understand because the topics are taught in abstract without the use of activities. The use of the activity method will be the best solution to help teachers to teach these topics very well.

Nowadays, many research studies are based on the constructivists‟ teaching and learning theories which state that students construct their own knowledge through activities or experiences and they come into class with existing knowledge; in other words the students are not simply passive learners. Further, social constructivists believe that knowledge construction is the basis of social interactions; such interactions include sharing ideas, comparing and debating ideas among students, and between students and teachers (Driver, Asoko, Leach, Mortimer & Scott, P. (1994).

Conceptual change has become a common term denoting learning science from a constructivist perspective. Constructivist ideas are developed by merging various cognitive approaches with a focus on viewing knowledge as being constructed - such as with the Piagetian interplay of assimilation and accommodation. The classical conceptual change approach involves the teacher making students" alternative frameworks explicit – prior to designing a teaching approach consisting of ideas that do not fit the students" existing ideas and thereby promoting dissatisfaction. If the student is dissatisfied with his/her prior conception and available replacement conception is intelligent, plausible and/or fruitful, then accommodation of the new conception is more likely to follow (Duit & Treagust, 2003). There are a number of constructivist-based research that illustrate the pedagogical knowledge needed to help students learn effectively and meaningfully in science context such as laboratory activities, inquiry-based learning, concept mapping and problem-based learning (Novak, 2002; Wallace, Tsoi, Calkin, & Darley, 2003).

Laboratory activities are considered by many authors as important in teaching and learning science concepts (Hofstein & Lunetta, 2004). Practical work provides a wealth of benefits in learning science, for example, changing teaching approaches from teacher-directed to student-directed, which gives students learning experiences by interacting with material and/or with a model to observe and understand science concepts through individual and/or group learning (Hofstein & Lunneta, 2004). However, Abraham (1998) and Clark (1994) say that a hands-on laboratory experience in not enough. The benefits come from both inquiry-based strategy and hands-on laboratory activities, so the incorporation of practical laboratory work and inquiry-based strategy can help students learn science concepts better than rote learning. In addition it also helps students to develop science process skills and promote a positive attitude toward science (Hofstein & Lunneta, 2004).

Since the inception of the Diploma in Basic education programme in the Colleges of Education, records from the teaching practice supervision/assessment of the students have shown that student trainees perform poorly in teaching primary school as well as the Junior High school science. The researcher has since observed that not much has been done to overcome this problem facing the trainees on their internship programme.

The approach to the teaching and learning of science in Ghana today does not vary from the well-known repeated actions where the teacher is the main source of ideas, facts, and information and sometimes the demonstrator of processes and learners are recipient of the information and the only perceived effective methods, being drills, lectures, subject based and teacher-centered (Beach & Reinhats, 1989). However these repeated actions do not work for all the categories of students. From the researcher‟s observations, two particular challenges need to be addressed mutually to improve the teaching and learning of science in the basic schools. One paramount issue is the use of the activity method in the teaching and learning of science. Teachers are also expected to improve on their methodology of teaching science to teach effectively to allow students develop interest in the learning of science and integrate science concepts while acquiring positive attitudes and values, process skills and problem- solving skills.

1.2 Statement of the Problem

Students often have difficulty in understanding the following topics; food chain, transpiration, photosynthesis, and osmosis. Generally students learn these topics by rote method and perform traditional experiments by following a cookbook style laboratory manual.

These teaching and learning strategies are not consistent with a constructivist teaching and learning approach. Hands-on activities and experiments can assist students to develop an understanding of these topics since they will acquire process skills through an instructional model based on the activity method. This will go a long way to help them when they embark on their teaching practice because they will obtain the needed skills and knowledge. Students find it difficult to understand most of the biology topics in their syllabus. This is because the topics are taught to students without any practical activity and better experiments. For this reason, food chain, transpiration, Photosynthesis and osmosis are the selected topics that the researcher has decided to use proper activities and better experiments to help the second year diploma students of St. Monica"s college to teach these selected topics in this research.

1.3 **Purpose of the Study**

This action research is purposely designed to meet the pressing need for improvement in the quality of teaching and learning of science in the colleges of education and in Ghanaian basic schools. By its nature, it focuses on the constructivist teaching and learning approach which deals with activity and hands-on teaching and learning approach. Teachers are only functioning as facilitators.

This drive will help to achieve better standards in teaching and learning of science. This will also build on the momentum of using activity method across all the educational institutions in the whole world and for that matter Ghana in particular, so the purposes of this study are.

1.4 **Research Questions**

This study answered the following four research questions:

1. Can the activity method of teaching and learning improve the teacher trainees‟ performance in science?
2. Can the activity method of teaching and learning enhance teacher trainees‟ content knowledge in science?
3. Can the activity method of teaching and learning enhance the teacher trainees‟ attitude towards science?
4. Can the activity method of teaching and learning motivate teacher the trainees to learn science?

1.5 Significance of the Study

This study will be of great importance to the classroom teachers, teacher trainees, all categories of students-low and high achievers, and the nation as a whole with regards to educational theories, practices and policies. It will serve as an in-service training for classroom teachers as it will enhance their knowledge, skills and experiences in using the activity method to guide students to learn.

Furthermore the teachers will find this approach to learning as a timely intervention measure to relieve them of the ordeal of maintaining forward progress of high achievers in science. This will also help teachers to re-teach the same topics over and over again to low achievers in the class. This is because the activity method will provide varieties in using heterogeneous experiences to help students to construct the needed knowledge.

1.6 Delimitation

The study should have covered all the colleges of education in Ghana as a whole, but due to the complex nature of the data that will be collected, techniques of data analysis, the study is limited to only one class of the year group selected for the study and that is 2A class of St. Monica"s College of Education.

The reason for the selection of this class is that most tutors do complain about the learning styles of this particular class and their performance in science is not encouraging and therefore the findings of this research work would be appropriate to a whole range of situation in the teaching and learning of science and for that matter biology in this school as a whole.

1.7 **Limitations**

In the course of the study, the researcher was entangled with some problems which are worth mentioning. The constrains of time on the part of the researcher in the face of the academic pursuits and commitments cannot be ruled out, thus the time needed to distribute and collect questionnaires.

Again, uncooperativeness of the sample population was also another problem; this therefore minimized the necessary information needed for the research.

Finally, financing the research work was also another problem. These delayed the researcher‟s contact of relevant resources and resource personnel for the necessary information.

1.8 **Definition of Terms**

Constructivism is a theory that views the student as an active creator of knowledge, who learns by observing, manipulating and interpreting the world around themselves. From this view knowledge cannot be transmitted but must be constructed by mental activity of the students, so learning is viewed as a result of mental construction. This view focuses on both individual and social processes (Driver, Asoko, Leach, Mortimer & Scott, 1994).

Activity-based learning refers to the teaching and learning process in which teachers allow students to learn science by „doing" and acting as a scientist might do in the real world. Students use scientific inquiry to solve problem that interest them or one that teacher proposes (Bybee 2004).

Science process skills are skills that students use in order to acquire scientific knowledge in laboratory activities and research projects. They can be classified in two types; basic and integrated process skills. Basic science process skills are things such as observing, inferring, classifying, predicting and communication. Integrated science process skills includes formulating hypothesis, identifying variables, defining variables, describing the relationship between variables, designing investigations, experimenting, acquiring data and organizing data.

1.9 **Organization of the Research Report**

The study is made up of five chapters. The first chapter includes the introduction, background of the study, statement of the problem, purpose of the study, research questions, and significance of the study, limitations, delimitations and organization of the study.

Chapter two deals with the review of related literature and is about the research ideas relevant to this study. This is followed by chapter three which also includes the methodology guiding the study. Research design, sampling techniques, instrument used, procedure and analysis of the data collected. This also covers pre-intervention, intervention, post-intervention and data analysis.

Chapter four involves the results, findings and discussion of findings. The last chapter which is chapter five deals with the summary, conclusions and recommendations.

CHAPTER TWO

LITERATURE REVIEW

Overview

This chapter discusses the following topics;

1. Activity- based learning in science education
2. Teaching and learning in science classroom
3. Group learning and cooperative learning in science practical lesson
4. Constructivist learning and teaching approach in science education
5. Basic concepts of science process skills
6. The promotion of science process skills

2.1 Activity-Based Teaching and Learning in Science Education

Some of the goals of teaching science are to promote understanding of scientific concepts and to help students to recognize that science knowledge is conjectural and to gain an appreciation of the rational criteria (for example consistency and coherence) which are drawn on by the scientific community in generating and validating knowledge claims(Claxon, 1991; Scott and Driver, 1998). In addition Schwartz, Lederman, and Crawford (2004) claim that students should develop an understanding of what science is, what science is not, what science can do and cannot do.

In order to achieve the understanding of scientific concepts, activity method of teaching and learning is considered the best way to incorporate science content with teaching and learning strategy. The analysis of general teaching and learning in the science classroom will be discussed in order to give a general idea of teaching and learning in science education.

2.2 Teaching and Learning in the Science Classroom

Some science teachers teach science as lists of facts to be memorized (Pines &Leith, 1981). Students learn science content in school by studying a textbook that reports the conclusions of what scientists have learned over the decades. To know science means to know the definitions of scientific terms and important discoveries of the past. To be good at science means to reproduce such science content as accurately and completely as possible. The focus of this kind of instruction is on what scientists know (Donovan & Branford, 1999). According to Schwab (1964), science had been taught as rhetoric of conclusions, a presentation of facts already known, so students often fail to integrate the content of one science with another. Simply telling students what scientists have discovered, for example, it is not sufficient to support changes in their preconceptions about important scientific phenomena. Similarly, asking students to follow the steps of the scientific method is not sufficient to help them develop the knowledge, skills, and attitudes that will enable them to understand what it means to do science and to participate in the larger scientific community (Donovan &Branford, 1999).

Nowadays many instructional strategies are used than simply to transfer knowledge. There is an active learning conducted based on constructivist view of teaching and learning. From this view, students construct their personal knowledge through social interaction and experience with the physical environment. Learning, therefore, is a purposive activity on the part of the student and requires active engagement. Individuals‟ existing conceptions influence the meaning they construct in a given situation (whether lecture, demonstration, or practical activity), and what is learned results from an interaction between the student‟s present conceptions and the various linguistic and sensory experiences provided (Scott & Driver, 1998). Similarly, Appleton (1997) stated that the main tenet on constructivist theories is that existing ideas which learners may hold are used to make sense of new experiences and new information. Learning therefore occurs when there is a change in the learners existing ideas, either by adding some new information or by reorganizing what is already known. Emphases in the constructivist method include considerations of the constructs and processes seen to be internal to the learner as well as the influence of the social context and social interactions.

Learning science is a dynamic process of shaping and reshaping thoughts based on new knowledge and experiences. It is the creative, ongoing synthesis of observations, reflection, and information about the physical and social world (Hammerman, 2006). In addition science learning as a process of conceptual change is a perspective that, fundamentally, concerns itself with issues about the growth of scientific knowledge (Duschil & Hamilton, 1998). Vygotsky‟s (1978) conceptual change pedagogy is a view of learning that recognises student‟s science learning as making sense of new information based on prior experiences and ideas

Clary and Wanderse (2007) stated that conceptual change will most likely occur via students‟ metacognition about their activities. When successful, science teaching leads students to exhibit new thought, feeling, and actions about the natural world. Educating students about science is thus considered to scaffold the fluent integration of thinking, feeling, and acting.

Pedagogical strategies are important for supporting students in the process of construction, reflection on, and evaluation of ideas; in other words, instructional activities are mediated in the science classroom (Scott & Driver, 1998). Johnson (2007) mentioned that teachers should utilize effective teaching strategies to ensure conceptual understanding of science. Good teachers help students learn meaningfully to achieve quality over quantity, meaning over memorization, and understanding over awareness (Mintzes, Wanderse, & Novak, 1998). Donovan and Branford (1999) suggested that the science classroom should be learner-centered, knowledge-centered, assessment-centered, and community- centered which is a useful framework to employ in the design of instruction. In summary, the learner-centered classroom, in other words, student-centered, encourages attention to preconceptions, and offers instruction on what students think and know. The knowledge- centered classroom focuses on what is to be taught, and what mastery looks like. The assessment-centered classroom emphasizes the need to provide frequent opportunities to make students‟ thinking and learning visible as a guide for both the teacher and the student in instruction and learning. The community-centered classroom encourages a culture of questioning, respect, and risk taking.

Assessment is one of the key roles in teaching and learning science. Gioka (2007) mentioned that assessment for learning is any assessment for which the first priority in its design and practice is to promote learning. Assessment methods can be categorized into two major uses: Summative and formative (Branford, Brown, & Cocking, 1999). Summative assessment is the assessment at the end of the course or one task that gives students a grade on one task (for example, a presentation about an experiment) and then they go on to the task. In other words, summative assessment measures which students have learnt at the end of set of learning activities (Branford, Brown, & Cocking, 1999; Donovan & Branford, 1999). In contrast, formative assessments are the methods that give opportunities for students and teachers to use feedback to revise their thinking (Donovan & Branford, 1999). Black and William (1998) give the definition of formative assessment that is to be interpreted as comprising all those activities undertaken by teachers, and/or by their students, which provide information to be used as feedback to modify the teaching and learning activities in which they are engaged. In a similar manner, Cowie and Bell (1999) stated that formative assessment is defined as the process used by teachers and students to recognize and respond to students‟ learning in order to enhance learning, during the teaching- learning process. Additionally, formative assessments are often referred to as classroom-based assessments; they are more likely to occur in the context of the classrooms.

However, many classroom-based assessments are summative rather than formative assessment (Donovan & Branford, 1999). In addition, Gioka (2007) explained that students also benefit from training in self- and peer-assessment, which help them share and understand the assessment criteria and what they need to do to achieve clearer understanding in learning. An example of formative assessments includes teachers‟ comments on work in progress, such as drafts of papers or preparations for presentations. Ideally, teachers‟ formative and summative assessments are aligned with the state and national assessments that students take at the end of the year (Branford, & Brown, & Cocking, 1999).

The central aspect of effective science teaching and learning in the twenty-first century is the activity-based teaching and learning which is based on the constructivist approach as the primary vehicle for students to develop meaningful understandings of key science concepts as well as learn about the nature and the process of science (Appleton, 1997; Dunkhase, 2003). It is generally accepted that achieving functional scientific literacy involves providing people with an understanding of science that they can use as they make decisions and engage in debate about scientific and technological issues outside formal educational settings (Irez, 2006). In addition, Matthews (1998) noted that it has been hoped that science teaching would have a beneficial impact on the quality of culture and personal life by virtue of students not only knowing science, but also by internalizing something of the scientific spirit, and knowing and appreciating something of the nature of science.

The researcher recognises that group learning and cooperative learning in science practical class as should be promoted in the study of science. Therefore group learning and cooperative learning in science practical class will be discussed.

2.3 Group Learning and Cooperative Learning in Science Practical Classes

The terms group learning, group work and cooperative learning are often used interchangeably (Woolfolk, 1998). Jaques (1992) recognises cooperation as a key word in group learning. Actually, group work is simply students working together and using cooperative skills to work together at tasks. This can be called cooperative learning (Woolfolk, 1998). The key role of the instructional strategies based on cooperative learning is to encourage students to work together to accomplish the shared goals (Killen, 2007). Cohen (1994) points out that cooperative learning involves students learning by working together in small groups to accomplish shared goals. It is widely recognized as a teaching strategy that promotes socialization and learning among students. Again Sharan (1990) stated that cooperative learning incorporates the social dimension of the classroom as a component of its basic procedures. It deals directly with all students collaborating directly with peers in small groups with a focus on academic content. In addition, group learning approaches have been applied to virtually all aspects of the school curriculum including science (Battistich, Solomon, & Delucchi, 1993).

Lazarowitz and Hwrts-Lazarowitz (1998) indicated that cooperative learning methods are integrated into science classrooms and laboratories in an attempt to enhance students" learning within a peer context, based on a constructivist learning and teaching approach. This approach claims that students achieve understanding through the social interaction which occurs in the classroom. Group work shifts the focus from students being passive recipients of information to being active learners. This encourages students to verbalize their ideas and feelings and can help them to understand the subject matter. It is also a useful way of activating students, identifying students" prior knowledge and helping them to reconstruct understanding and not simply to receive information (Killen, 2007). Hufford (1991) mentioned the redesign of laboratory exercises into sets of activities. Each group of four students performed portions of the total investigation. Students within each small group had to cooperate in their tasks and then exchange results with other groups. Finally, each small group discussed the implications of the data that they collected. In addition, Johnson and Johnson (1994) identified five basic elements that need to be present for small group work to be considered truly cooperative: positive interdependence, direct interaction, individual accountability, appropriate interpersonal skills, and reflective learning.

Woolfolk (2000) illustrated that in setting up group learning, the group size depends on the learning goals. If the goal is to encourage each student to participate in discussion, problem solving, or computer learning, then groups of two or four members work best. On the other hand Killen (2007) noted that if the groups are too large, it will be difficult for the leader to keep them on task and each student will have limited opportunities to contribute. If the groups are too small, the group may not get the diversity of opinion and range of knowledge that are necessary for productive discussion.

An activity-based learning approach is a fruitful strategy for students to learn science content by active investigation in both science classroom and practical class (Zion et al., 2004).

2.4 Constructivist Learning and Teaching approach in Science Education

Matthews (1998) stated that from the 1990s, the constructivist learning and teaching approach influenced many education research studies as well as being the doctrine that underpined research programs in science education. At that time, constructivist teaching methods were beginning to be widely advocated and developed. There are basically two major traditions of constructivism: psychological and sociological constructivism (Matthews, 1994).

First is the psychological constructivism. This approach claims that learner"s learning is a process of personal, individual construction arising from their activities. In other words, learning is a constructive rather than a reproductive process (Shuell, 1993). The learner does not merely record the material to be learned. Rather, the learner constructs his or own mental representation of the material to be learned, selects information perceived to be relevant, and interprets this information on the basis of their existing knowledge and current needs, adding information not explicitly provided in order to make sense of new material.

Second is the sociological constructivism. This approach illustrates that scientific knowledge is socially constructed and vindicated and it investigates the circumstances and dynamics of science construction (Matthews, 1994). Later, Matthews (1998) distinguished educational constructivism (that has its origin in theories of children‟s learning), from constructivism in the philosophy of science (usually associated with instrumentalist views of scientific theory), and form constructivism in sociology of science (of which the Edinburgh Strong Programmed in the sociology of scientific knowledge is the best known example). Therefore, he divided constructivism into three main themes: educational (personal and social constructivism), philosophical, and sociological constructivism.

Some educators categorized constructivism into two main areas, but they use quite different details. For example, Child (2007) describes constructivism based on Piaget‟s and Vygotsky‟s work, so he divided constructivism into two main areas: constructivism and social constructivism. Similarly, Driver et al. (1994) described two major traditions in explaining the process of learning science: personal and social constructivism. From the literature analysis, Matthews (1994) separated sociological constructivism from psychological constructivism because sociological constructivism related to scientific, not human, knowledge. However, scientific knowledge is like social and culture factors that are situated in social constructivism (Driver et al., 1994). Indeed, two major traditions of constructivism, both individual and social constructivism are values to frame educational research studies.

From the constructivist perspective of teaching, teaching strategies in science concepts should focus on providing students with physical experiences that induce cognitive conflict and hence encourage students to develop new knowledge schemes. From this perspective, a teacher plays a critical role in student learning as a facilitator who helps students connect what they already know to a new experience or concept (Kang, 2007). In addition, a central tenet of conceptual change is how individuals make choices among competing or alternative views, models, or theories of the natural world (Duschil & Hamilton, 1998).

2.4.1 The constructivist classroom

A constructivist teacher and a constructivist classroom exhibit a number of discernible qualities markedly different from a traditional or direct instruction classroom. A constructivist teacher is able to flexibly and creatively incorporate ongoing experiences in the classroom into the negotiation and construction of lessons with small groups and individuals. The environment is democratic, the activities are interactive and student- centered, and the students are empowered by a teacher who operates as a facilitator/consultant (Osborne, 1996).

Constructivist classrooms are infrastructurally structured so that learners are immersed in experiences within which they may engage in meaning-making inquiry, action, imagination, invention, interaction, hypothesizing and personal reflection. Teachers need to recognize how people use their own experiences, prior knowledge and perceptions, as well as their physical and interpersonal environments to construct knowledge and meaning. The goal is to produce a democratic classroom environment that provides meaningful learning experiences for autonomous learners.

This perspective of learning presents an alternative view of what is regarded as knowledge, suggesting that there may be many ways of interpreting or understanding the world. No longer is the teacher seen as an expert, who knows the answers to the questions she or he has constructed, while the students are asked to identify their teacher's constructions rather than to construct their own meanings. In a constructivist classroom, students are encouraged to use prior experiences to help them form and reform interpretations. This may be illustrated by reference to a personal response approach to literature, a constructivist strategy first articulated by Rosenblatt (1978). Rosenblatt (1978) argued for a personal and constructive response to literature whereby students' own experiences and perceptions are brought to the reading task so that in transacting with that text, the realities and interpretations which the students construct are their own.

In traditional classrooms, an invisible and imposing, at times, impenetrable, barrier between students and teachers exists through power and practice. In constructivist classrooms, by contrast, the teachers and the students share responsibilities and decision making and demonstrate mutual respect. The democratic and interactive processes of a constructivist classroom allow students to be active and autonomous learners. Using constructivist strategies, teachers are more effective. They are able to promote communication and create flexibility so that the needs of all students can be met. The learning relationship in a constructivist classroom is mutually beneficial to both students and teachers.

2.4.2 A constructivist classroom should be student-centered

A constructivist classroom should be student-centered classroom. The student-centeredness of a constructivist classroom is clearly apparent in a reader response approach to literature. Recognizing the significance of the unique experiences that each reader brings to the reading of a selection of literature, the teacher in a response-centered approach should seek to explore the transaction between the student and the text to promote or extract a meaningful response (Rosenblatt, 1978). This places the student in a central position in the classroom since exploring this transaction seems unlikely to occur unless the teacher is willing to relinquish the traditional position of sole authority, thereby legitimating the unique experiences that all members of the class bring to the reading rather than just those experiences the teacher brings. The resulting perception and effect in the classroom is evident in students' recognition that the discussion is a legitimate one involving questions to which nobody knows the answer. It isn't a treasure hunting game where they are trying to guess what is in their teacher's head, but a process that creates meaning and knowledge.

From a constructivist perspective, where the student is perceived as meaning-maker, teacher-centered, text-centered and skills-oriented approaches to literature instruction are replaced by more student-centered approaches where processes of understanding are emphasized. In a discussion of language arts instruction based on constructivist theories of language use and language development, Applebee (1993) suggests that rather than treating the subject of Science as subject matter to be memorized, a constructivist approach treats it as a body of knowledge, skills, and strategies that must be constructed by the learner out of experiences and interactions within the social context of the classroom. In such a tradition, understanding a work of literature does not mean memorizing someone else's interpretations, but constructing and elaborating upon one's own within the constraints of the text and the conventions of the classroom discourse community.

A constructivist student-centered approach places more focus on students learning than on teachers teaching. A traditional perspective focuses more on teaching. From a constructivist view, knowing occurs by a process of construction by the knower. Lindfors (1984) advises that how we teach should originate from how students learn.

2.4.3 Instructors acting as facilitators

According to the social constructivist approach, instructors have to adapt to the role of facilitators and not teachers. Whereas a teacher gives a didactic lecture that covers the subject matter, a facilitator helps the learner to get to his or her own understanding of the content. In the former scenario the learner plays a passive role and in the latter scenario the learner plays an active role in the learning process. The emphasis thus turns away from the instructor and the content, and towards the learner. This dramatic change of role implies that a facilitator needs to display a totally different set of skills than a teacher. A teacher tells, a facilitator asks; a teacher lectures from the front, a facilitator supports from the back; a teacher gives answers according to a set curriculum, a facilitator provides guidelines and creates the environment for the learner to arrive at his or her own conclusions; a teacher mostly gives a monologue, a facilitator is in continuous dialogue with the learners. A facilitator should also be able to adapt the learning experience „in mid-air" by taking the initiative to steer the learning experience to where the learners want to create value (Palmer, 2005).

The learning environment should also be designed to support and challenge the learner's thinking. While it is advocated to give the learner ownership of the problem and solution process, it is not the case that any activity or any solution is adequate. The critical goal is to support the learner in becoming an effective thinker

2.5 Basic Concept of Science Process Skills

There are various descriptions of the skills that scientists use when they conduct their investigations: scientific process skills, procedural skills, experimental and investigative science, or scientific inquiry abilities (Harlen, 1999). Science process skills are defined as the understanding of methods and procedures of scientific investigation. They are related to the proficiency in using various aspects of science and are associated with cognitive and investigative skills. Through these skills, scientists collect knowledge, put experiments together, analyze data, and formulate results. Science process skills are very important for meaningful learning; because learning continues throughout life, and individuals need to find, interpret, and judge evidence under the different conditions they encounter. Therefore, it is essential for students" future to be provided with science process skills at education institutions (Bilgin, 2006; Harlen, 1999).

The role of the science process skill in the development of understanding is crucial. If skills are not developed sufficiently, for example, relevant evidence is not collected, students cannot interpret knowledge, and then the emerging concepts will not help student understanding of the real world. Thus the development of science process skills has to be one of the major goals of science education (Bligin, 2006; Burn, Okey, & Wise, 1985; Harlen, 1999).

Many science educators identify the science process skills which are the key elements in inquiry learning and teaching science effectively. Such skills include posing questions, formulating hypothesis, identifying and defining variables, designing experiments, collecting and transforming data, drawing conclusions, and providing evidence (Germann, Aram & Burke, 1996). Germann and Aram (1996) and Saat (2004) proposed that science process skills consist of basic science skills. The basic science process skills (BSPS) provide the intellectual groundwork in scientific inquiry, such as the ability to order and describe natural objects and events. Examples of the BSPS are observing, classifying, measuring and predicting. The BSPS are the prerequisites to the integrated process skills. The ability to use BSPS is attributed to the ability to perform empirical-inductive reasoning or Piagetian concrete operational reasoning (Germann & Aram, 1996).

The integrated science process skills (ISPS) are the terminal skills for solving problems or doing science experiments. Examples of ISPS are identifying and defining variables, collecting and transforming data, constructing tables and graphs of data, describing relationships between variables, interpreting data, manipulating materials, formulating hypotheses, designing investigations, drawing conclusions and generalizing (Germann & Aram, 1996).

Nevertheless, some science educators have identified slight differences in the skills. For example, Beaumont-Walters and Soyibo (2001) reported 18 basic and integrated science process skills: observing, classifying, measuring recording data, using numbers, inferring, communicating, crating models, replicating, interpreting data, making decisions, manipulating materials, formulating hypotheses, predicting, identifying variables, generalizing space-time operations, and recognizing number relations. The first seven skills are categorized as the basic science process skills, namely observation, classification, measurement and using numbers, time and spatial relationships, making inferences, prediction, communication: while the last five skills are categorized as the integrated science process skills, namely controlling variables, interpreting data, defining operationally, formulating hypotheses and experimentation.

2.6 The Promotion of Science Process Skills

There are several instructional approaches that science educators and teachers use to help students acquire science process skills, for example, activity-based, problem-based, and project based instructions. These strategies are very similar in the terms of their emphasis on student- directed rather than teacher-directed learning, active learning rather than passive learning, and integration of content and process rather separation of content and process (Colley, 2006). Taraban (2007) also reported that an active learning and teaching strategy has more advantage in learning and teaching science rather than a traditional strategy both in science content and knowledge of process skills. The active teaching and learning strategies included using hands-on activity and organizing students into collaborative learning groups in laboratory classroom.

Some research studies have shown that many teaching and learning activities can be used to promote student science process skills. For example, Solano-Flores (2000) used bubbles activities (hands-on activities) as a learning task to promote and assess science process skills. The intent of the activity was to promote higher order thinking skills. Students were asked to conduct the investigation in order to find what soapy solution makes the largest bubbles. The students were given opportunities to construct their own solution strategies.

CHAPTER THREE

METHODOLOGY

Overview

. The order of presentation of this chapter is as follows;

i) Research design

ii) Population and sample

iii) Instruments

iv) Data collection procedure

v) Data analysis

3.1 Research Design

The utmost reason for this research is to help teacher trainees of Saint Monica‟s College of Education to overcome their difficulties in the teaching of science in the basic schools through the use of the activity method. The type of research design employed is the case study using the action research approach. Action research is a process in which participants examine their own educational practice systematically and carefully, using the techniques of research. Watts (1985).

Although there are many types of research that may be undertaken, action research specifically refers to a disciplined inquiry done by a teacher with the intent that the research will inform and change his or her practices in the future. This research is carried out within the context of the teacher‟s environment, that is, with the students and at the school in which the teacher works on questions that deal with educational matters at hand. While people who call for greater professionalization say that teachers should be constantly researching and educating themselves about their area of expertise, this is different from the study of more educational questions that arise from the practice of teaching.

Implicit in the term action research is the idea that teachers will begin a cycle of posing questions, gathering data, reflecting, and deciding on a course of action. When these decisions begin to change the school environment, a different set of circumstances appears with different problems posed, which require a new look. Indeed, many action research projects are started with a particular problem to solve, whose solution leads into other areas of study. While a teacher may work alone on these studies, it is also common for a number of teachers to collaborate on a problem, as well as enlist support and guidance from administrators, university scholars, and others. At times, whole schools may decide to tackle a school-wide study to address a common issue, or join with others to look at district-wide issues. It involves people working to improve their skills, techniques, and strategies. Action research is not about learning why we do certain things, but rather how we can do things better. It is about how we can change our instruction to impact students.

3.2 Population and Sample Selection

The target population was all the teacher trainees in the Mampong Monica‟s College of Education. However the accessible population was the second year students of St. Monica‟s College of Education. The reason being that, these second years will very soon go for their teaching practice and this will help them to overcome difficulties in teaching at the basic school level. The researcher employed the purposive sampling technique. This technique did not leave out any subject in the sample: all the students in the class were exposed to the same sample treatment for the effective change expected to take place in the class. Further the students were put into ten groups of thirteen each.

3.3 Research Instruments

The main instruments that were considered and used in the research work were test items.

3.3.1 Tests (Pre-intervention test and Post-intervention test)

The tests used were sampled from the set of past questions since the inception of the Diploma in Basic Education (DBE) programme from 2006 to 2011. The topics were selected from the teacher training college syllabus. The topics under study were transpiration, food chain, osmosis and photosynthesis. The tests were made up of 20 items, five items each for the four topics under study. The same questions were used for both pre-test and post-test to reveal the kind of thinking and understanding the teacher trainees were having in teaching science at the basic school levels.

3.3.2 Validity and reliability of the instrument

Validity is the soundness of the interpretations and uses of student"s assessment results. It can also be defined as the appropriateness or correctness of inferences, decisions, or descriptions made about individuals, groups or institutions from test results. The validity of the instrument represents the extent to which the instrument measures what it is intended to measure. In order to ensure the validity of data collected, five (5) colleague teachers and my supervisor scrutinized the questionnaire items for its ambiguity and items non-contribution to the questionnaires purpose and suggestions were offered for improvement. This helped to improve the content validity of the instrument.

3.3.3 Reliability

Reliability is an essential characteristic of a good test, because if a test does not measure consistency, then one could not count on the scores resulting from a particular administration to be an accurate index of the students" achievement. The instrument developed for the study was once again subjected to scrutiny to make sure that the questions that were given to students were made clearer and unambiguous.

3.4 Data Collection Procedure

This component of the research highlights on the processes followed by the researcher to collect data associated with the study. Empirical research of this nature required that data should be collected on the variables under study for analysis. The section consists of:

1. Pre-intervention test
2. Intervention
3. Post-intervention test

3.5 Pre-intervention

The students were taught the four topics without the use of the activity method during the first week of the study. After the teaching, the students were tested and their marks recorded.

The test questions were sampled from the set of past questions since the inception of the Diploma in basic education (DBE) programme (2006-2011) and were significantly testing critical thinking and understanding of the teacher trainees in the content knowledge and pedagogical skills in teaching the topics at the basic school level. The pre-intervention test consisted of 20 items. Five items each for the four topics to cover all the intended topics for the basic school science. The test was administered to one hundred and twenty three students during the first week of the study. The duration was 45minutes. These tests were collected, marked and scored.

Table 1 Pre-intervention test results

Number of students	Scores
15	12
15	15
12	18
21	21
24	24
21	27
15	33
123	**150**

3.6 Intervention

Considering the low performance of the pupils in the pre-test, an activity was designed with detailed experiments and practical activities each for the four topics as an intervention strategy to help improve students" performance in teaching **Food chain, Transpiration, Photosynthesis** and **Osmosis** in basic schools.

3.6.1 Performing the activities

The sample students were taken through the contents and activities of the four topics during the second and third weeks of the study. In the second week, food chain and transpiration were taught using two periods each on two different days. The two periods lasted 120minutes. Again, in the third week, photosynthesis and osmosis were also taught using 120minutes for two periods on two separate days.

The students were put into thirteen groups in all the activities that were taken. The researcher discussed the content and the activities used with students at the end of each topic.

3.6.2 Activity on Transpiration

Purpose: To demonstrate transpiration, that is, the loss of water from leaves.

Materials: growing potted plant

Plastic polythene bag

Tape (cellophane)

Procedure for students facilitated by the researcher

- Place the polythene bag over the leaves of the potted plant
- Secure the bag to the stem with the tape
- Place the plant in sunlight for two hours.
- Observe the inside of the polythene bag

Observation

Droplets of water collect on the inside of the polythene bag. The inside of the bag may appear cloudy due to the water in the air

Discussion

Droplets of water were collected on the inside of the polythene bag. This shows that plants loose water from their leaves to the atmosphere, but with the polythene bag over the potted plant, the vapour was collected inside the polythene bag.

Plants absorb water from the soil through their roots. This water moves up the stem to the leaves where 90 percent is lost through the pores of the leaf (stomata). This loss of water through the stomata of the leaves is called transpiration.

3.6.3 Activity on Osmosis

Purpose: To find out how water moves in and out of cells

Materials:

small bowls or cups

water

salt

sugar

a potato

a knife

paper

pencil or pen

Procedure for students facilitated by the researcher

- Fill each of the bowls about 500ml of water and place them on a flat table where they can sit for several hours

- Use the pen and paper to label the bowls, that is A (salt solution) and B (plain water)
- Now add 3 teaspoonful of salt to the bowl labeled salt solution.
- Carefully use the knife to cut two slices from the middle of the potato, each slice should be about ¼ of an inch thick.

  NB. The thinner the slices are made, the faster the results are seen.
- Place on slide in each bowl and leave it for 30 minutes.

Observation

After 30 minutes, the potato in the salt solution seems to have wilted; it has become very soft and flexible while the potato in the plain water did not wilt and it is even more rigid than it was previously.

Discussion

The potato is made up of tiny, living units called cells. Each cell is surrounded by a cell membrane which acts much as your skin does. It keeps the cells parts inside and keep other things outside, protecting the cell. While this membrane stops most things, water can pass through it. The water tends to move towards higher concentrations of dissolved chemicals. That means that if the water outside the cell is saltier than the water inside, water will move from the inside of the cell to the outside. That is what happened to the slice of potato in the salt water. As the water left the cell it was much like letting the air out of a balloon. As more and more of the cells lost water, the slice of potato became soft and flexible.

When you put the potato into the plain water, Water moved from the outside, where there was no salt or sugar, into the cell where there was some. This caused the cells to swell up, becoming very stiff. This has to do with a process known as Osmosis which is the movement of water molecules through a plasma membrane from a region of low solute concentration to a region of higher concentration.

3.6.4 Activity on Photosynthesis

Purpose: To demonstrate that starch, a food substance is produced in leaves.

- Bunsen burner, tripod stand,
- 250 cm^3 beaker
- boiling tube
- forceps
- test tube holder
- white tile
- leaf to be tested (hibiscus leaves)
- ethanol
- iodine/potassium iodide solution

Procedure for students facilitated by the researcher

- Remove a green leaf from a plant that has been exposed to sunlight for a few hours
- Half-fill a 250cm3 beaker with water. Heat the water until it boils. Keep the water at boiling point.
- Use the forceps to place the leaf in the boiling water. Boil for 2 minutes.
- Turn off the Bunsen burner.
- Place the boiled leaf in a boiling tube containing 90% ethanol.
- Place the boiling tube in hot water and boil for 10 minutes or until the leaf decolourises.
- Gently remove the leaf and wash with a fine trickle of cold tap water.
- Spread the leaf evenly on a white tile.
- Add a few drops of iodine/potassium iodide solution to the leaf and note any observations

Observation

- The leaf was flaccid (soft) after being boiled in water
- The ethanol changed from colourless to green
- The leaf was brittle after being boiled in ethanol
- The leaf became flaccid once more after being rinsed in cold water
- Iodine/Potassium Iodide solution changed from brown to blue- black

Discussion

Chlorophyll is a green pigment and so masks the colour change of the iodine test for starch. Chlorophyll needs to be removed from the leaf that is the leaf needs to be ' decolourised' for changes to be observed. A decolourised leaf is pale yellow or green. Ethanol is an organic solvent and so extracts chlorophyll from the leaf. Photosynthesis is an energy-producing reaction that occurs in the leaves of plants. Starch a food substance, is one of the products of this reaction. It is easier to see the results of the starch test without the presence of the green chlorophyll. Iodine combines with starch particles to form a dark purple to black colour.

3.6.5 Activity on Food Chain

Purpose: To determine that energy in food is transferred from one organism to another

Materials: Rectangular strips of construction paper

Procedure for students facilitated by the researcher

- Let students research and outline a food chain. (remind students that most food chains begin with the sun, which provides energy for everything that grows on the planet)
- Let students draw each part of their food chain on individual rectangular strips of construction paper. Have them label each picture

- Let them make a paper chain link with their drawings. Students can share their food chains with the whole class and discuss each part. Is the living thing a producer or a consumer? Is it a carnivore, herbivore, or omnivore?
- Let them predict what might happen if one of their links in their chain become endangered or extinct.
- Let them break a link of their chain to demonstrate and draw conclusions

  Grass → Grasshopper → Lizard → Snake

Grass Grasshopper Lizard Snake

Grass → Grasshopper –///→ Lizard → Snake

A break in the chain

Observation

The food chain was endangered when the link in the chain was broken.

Discussion

Energy is being transferred from the grass to the grasshopper and from the grasshopper to the lizard and from the lizard to the snake. The presence of the arrow shows the direction of flow of energy. When the link (arrow) is broken, there will be no transfer of energy in a food chain. The grass absorbs energy from the sun. The sun is the ultimate source of energy in a food chain. The grass is described to be a producer because it prepares its own food. The grasshopper is the primary consumer because it cannot prepare its own food and gets its energy from the grass which is a plant.

The lizard is the secondary consumer because it also feeds on the grasshopper to get energy. Lastly the snake is the tertiary consumer with the reason that it feeds on the lizard to get energy. Each level is called a trophic level or feeding level and therefore in a food chain energy is transferred from one trophic level to another trophic level.

Food chains are crucial science concepts that help children understand how living things in nature are connected, and how humans‟ actions can affect the environment. Living things are divided into different groups, including producers and consumers. Consumers are further divided into more groups such as herbivores, carnivores, and omnivores. A food chain shows how living things rely on each other for food and how energy is transferred from one living thing to another.

Food chain shows the interconnected relationships between predators and prey. A predator is a living that hunts animals and a prey is an animal eaten by predators

3.7 Post- intervention activities

A post-intervention test was carried to assess the students understanding on the four topics after the various practical activities and experiments were used to teach the topics. The students were given tests on the topics. The items that were used as pre-intervention test items were also used in the post- test. The duration of the test was 45 minutes on both occasions. The tests were scored and analyzed.

After the post-test, students were given some questions to answer. The reason for these questions were to find out from the students point of view, the benefits of teaching and learning of science topics with experiments and practical activities to teaching and learning of science topics without any experiments and practical activities. These questions will be given to the sample students to answer and after that the questions and answers from the sample students will be collected, analysed and discussed.

Table 2

Post-intervention test results

Number of students	Scores
6	36
12	39
18	42
21	45
15	48
24	51
27	57
123	**318**

3.8 DATA ANALYSIS PLAN

The data collected was analyzed with the use of frequency distribution tables and charts. Pre-intervention test results and post-intervention test results were analyzed and a generalization was after each analysis. Responses with highest percentages were considered to be the general opinion with regards to that question. Findings were also given after the analysis.

CHAPTER FOUR

EMPIRICAL FINDINGS, ANALYSIS AND DISCUSSION

Overview

This chapter consists of empirical data presentation and discussion. Empirical data is presented under these main headings: presentation and analysis of pre-intervention test results and presentation and analysis of post-intervention test results and discussion.

4.1 PRESENTATION AND ANALYSIS OF PRE-INTERVENTION TEST AND POST INTERVENTION TEST RESULTS

Table 3: Presentation and analysis of pre-intervention test results

Number of students	Scores	Percentage (%)
15	12	12.19
15	15	12.19
12	18	9.76
21	21	17.07
24	24	19.51
21	27	17.07
15	33	12.19
123	**150**	**100**

The table 3 above represents the analysis of pre- intervention test results. From the table, 15 respondents representing 12.19% scored 12 and 15 marks respectively. Also, 12 respondents representing 9.76% scored 18 marks. Again 21 respondents representing 17.07% scored 21 marks respectively. The table also revealed that 24 respondents representing 19.51% scored 24 marks in the pre-intervention test. It is again followed by 21 respondents representing 17.07% scoring 27 marks respectively. The table finally revealed that 15 respondents representing 12.19% scored 33 marks respectively.

Table 4: Presentation and analysis of post-intervention test results

Number of students	Scores	percentage (%)
6	36	4.88
12	39	9.76
18	42	14.64
21	45	17.07
15	48	12.19
24	51	19.51
27	57	21.95
123	**318**	**100**

The table 4 above shows that 6 respondents representing 4.88% scored 36 marks respectively. 12 respondents representing 9.76% scored 39 marks. 18 respondents representing 14.64% scored 42 marks respectively. The table again revealed that 21 respondents representing 17.07% scored 45 marks. 15 respondents representing 12.19% scored 48 marks respectively. 24 respondents representing 19.51% also scored 51 marks. And lastly 27 respondents scored 57 marks respectively.

4.2 COMPARISON AND ANALYSIS OF PRE-INTERVENTION TEST AND POST-INTERVENTION TEST SCORES

Pre-intervention test and post-intervention test scores

Table 5: The table below shows the results of Pre-intervention test and post-intervention test scores

Type of test		**No. of students and their scores**							**Total**	**Score diff.**
Pre-intervention test	No.	15	15	12	21	24	21	15	**123**	
	Score	12	15	18	21	24	27	33	**150**	**1**
Post - intervention test	No.	6	12	18	21	15	24	27	**123**	
	score	36	39	42	45	48	51	57	**318**	**2.1**

Table 5 shows the results of pre-intervention test and post-intervention test scores. The data suggests that out of 123 students who took part in both the pre-intervention test and post-intervention test, the total score for the pre-test was 150 while the post-test was 318. This indicates about two times (200%) increase of the post-intervention test score over the pre-intervention test score.

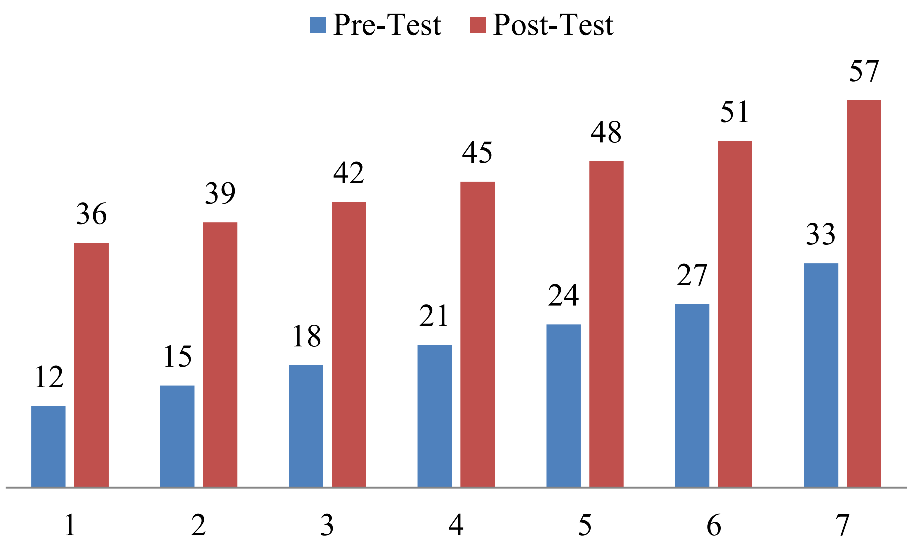

Fig1: Graphical representation of Pre-intervention test and post-intervention test scores

The figure above shows the performance of students with regards to pre-test scores and post-test scores. The blue colour represents the pre-test scores and the red colour represents the post-test scores. This shows that the students performed better after the researcher used experiments and practical activities as an intervention to teach the selected topics.

4.3 THE PRESENTATION AND ANALYSIS OF RESULTS ARE AS FOLLOWS:

The activity method and the performance of students in science

Table 6: Response of students' performance in science

Response	Frequency	Percent
Strongly Agree	75	61.0
Agree	42	34.1
Disagree	6	4.6
Total	**123**	**100.0**

Table 6 shows the response of students" performance in science. The data suggests that 61% of the respondents strongly agree that activity method of teaching improves performance in science, 34.1% of them agree and 4.6% disagree that that activity method of teaching improves performance in science.

The activity method and the explanation of scientific concepts

Table 7: Response of students on activity method and the explanation of scientific concepts

Response	Frequency	Percent
Strongly Agree	75	61.0
Agree	45	36.6
Disagree	3	2.4
Total	**123**	**100.0**

Table 7 shows the response of students on activity method and the explanation of scientific concepts. The data indicate that 61% of the respondents strongly agree that activity method of teaching helps to explain scientific concept better, 36.6% of them agree and 2.4% of them disagree that that activity method of teaching helps to explain scientific concept better.

The activity method and the teaching of science

Table 8: Response of students on whether the activity method should be used in the teaching of science

Response	Frequency	Percent
Strongly Agree	81	65.9
Agree	36	29.3
Disagree	6	4.9
Total	**123**	**100.0**

Table 8 shows the students response on whether the activity method should be used in the teaching of science. It indicates that 65.9% of the respondents strongly agree that activity method of teaching should be used in the teaching of science, 29.3% of them agree and 4.9% of them disagree that activity method of teaching should be used in the teaching of science.

The activity method and the improvement of content knowledge

Table 9: Response of students' on the activity method and the improvement of content knowledge

Response	Frequency	Percent
Strongly Agree	57	46.3
Agree	57	46.3
Disagree	9	7.3
Total	**123**	**100.0**

Table 9 shows the students response on the activity method and the improvement of content knowledge. The data indicate that 46.3% of the respondents strongly agree that activity method of teaching improves content knowledge, 46.3% of them agree and 7.3% of them disagree that that activity method of teaching improves content knowledge.

The activity method and the understanding of scientific concepts

Table 10: Response of students on the activity method and the better understanding scientific concepts

Response	**Frequency**	**Percent**
Strongly Agree	63	51.2
Agree	60	48.8
Total	**123**	**100.0**

Table 10 shows the response of students on activity method and the better understanding of scientific concepts. It indicates that 51.2% of the respondents strongly agree that activity method of teaching helps to understand scientific concept better and 48.8% of them agree that activity method of teaching helps to understand scientific concept better.

The activity method and the development of process skills

Table 11: Response of students on Activity method and the development of process skills

Response	Frequency	Percent
Strongly Agree	72	58.5
Agree	42	34.1
Disagree	6	4.9
Strongly Disagree	3	2.4
Total	**123**	**100.0**

Table 11 shows the response of students on the activity method and the development of process skills. It indicates that 58.5% of the respondents strongly agree that activity method of teaching helps to develop process skills, 34.1% of them agree, 4.9% of them disagree and 2.4% of them strongly disagree that activity method of teaching helps to develop process skills.

The Activity method and the application of science in everyday life

Table 12: Response of students on activity method and the application of science in everyday life

Response	Frequency	Percent
Strongly Agree	66	53.7
Agree	51	41.5
Disagree	6	4.9
Total	**123**	**100.0**

Table 12 shows the response of students on the activity method and the application of science in everyday life. It depicts that 53.7% of the respondents strongly agree that activity method of teaching helps to apply science in everyday life, 41.5% of them agree and 4.9% of them disagree that that activity method of teaching helps to apply science in everyday life.

The activity method and the easily summarisation of facts

Table 13: Response of students on the activity method and the easily summarization of facts

Response	Frequency	Percent
Strongly Agree	54	43.9
Agree	51	41.5
Disagree	15	12.2
Strongly Disagree	3	2.4
Total	**123**	**100.0**

Table 13 shows the response of students on the activity method and the easily summarisation of facts. It indicates that 43.9% of the respondents strongly agree that activity method of teaching helps to summarise facts easily, 41.5% of them agree, 12.2% of them disagree and 2.4% of them strongly disagree that activity method of teaching helps to summarize facts easily.

The activity method helping to demystify science

Table 14: Response of students on the activity method helping to demystify science

Response	**Frequency**	**Percent**
Strongly Agree	69	56.1
Agree	51	41.5
Disagree	3	2.4
Total	**123**	**100.0**

Table 14 shows the response of students on the activity method helping to demystify science. It depicts that 56.1% of the respondents strongly agree that activity method of teaching helps to demystify science, 41.5% of them agree and 2.4% of them disagree that activity method of teaching helps to demystify science.

The writing of science textbooks with the activity method in mind

Table 15: Response of students on the writing of science textbooks with the activity method in mind

Response	**Frequency**	**Percent**
Strongly Agree	24	19.5
Agree	60	48.8
Disagree	33	26.8
Strongly Disagree	6	4.9
Total	**123**	**100.0**

Table 15 shows the response of students on the writing of science textbooks with the activity method in mind. The data suggests that 19.5% of the respondents strongly agree that science textbooks are written with the use of activity method in mind, 48.8% of them agree, 26.8% of them disagree and 4.9% of them strongly disagree that science textbooks are written with the use of activity method in mind.

Science teacher and the use of the activity method for teaching

Table 16: Response of students on the Science teacher and the use of activity method in teaching

Response	Frequency	Percent
Strongly Agree	51	41.5
Agree	36	29.3
Disagree	30	24.4
Strongly Disagree	6	4.9
Total	**123**	**100.0**

Table 16 shows the response of students on the science teacher and the use of activity method in teaching. It indicates that 41.5% of the respondents strongly agree that their science teacher uses activity method for teaching, 29.3% of them agree, 24.4% of them disagree and 4.9% of them strongly disagree that their science teacher uses activity method for teaching.

The activity method and first-hand experience

Table 17: Response of students on Activity method and first-hand experience

Response	**Frequency**	**Percent**
Strongly Agree	93	75.6
Agree	24	19.5
Disagree	3	2.4
Strongly Disagree	3	2.4
Total	**123**	**100.0**

Table 17 shows the response of students on the activity and first-hand experience. It indicates that 75.6% of the respondents strongly agree that activity method of teaching helps to learn through first-hand experience, 19.5% of them agree, 2.2% of them disagree and 2.4% of them strongly disagree that activity method of teaching helps to learn through first-hand experience.

The activity method motivating students to learn science

Table 18: Response of students on Activity method motivating students to learn science

Response	Frequency	Percent
Strongly Agree	60	48.8
Agree	57	46.3
Disagree	6	4.9
Total	**123**	**100.0**

Table 18 shows the response of students on the activity method motivating students to learn science. It indicates that 48.8% of the respondents strongly agreed that the activity method of teaching motivates students to learn science, 46.3% of them agreed and 4.9% of them disagree that the activity method of teaching motivates students to learn science.

A well resourced science laboratory and the use of the activity method

Table 19: Response of students on a well resourced science laboratory and the use of the activity method

Response	Frequency	Percent
Strongly Agree	99	80.5
Agree	21	17.1
Strongly Disagree	3	2.4
Total	**123**	**100.0**

Table 19 shows the response of students on a well resourced science laboratory and the use of the activity method of teaching. It depicts that 80.5% of the respondents strongly agree that a well resourced science laboratory enhances the use of the activity method of teaching, 17.1% of them agree and 2.4% of them strongly disagree that a well resourced science laboratory enhances the use of the activity method of teaching.

Good classroom environment and the use of the activity method

Table 20: Response of students on good classroom environment and the use of the activity method

Response	**Frequency**	**Percent**
Strongly Agree	69	56.1
Agree	39	31.7
Disagree	9	7.3
Strongly Disagree	6	4.9
Total	**123**	**100.0**

Table 20 shows the response of students on good classroom environment and the use of the activity method of teaching. The data suggests that 56.1% of the respondents strongly agree that good classroom environment enhances the use of activity method of teaching, 31.7% of them agree, 7.3% of them disagree and 4.9% of them strongly disagree that good classroom environment enhances the use of activity method of teaching.

The activity method enhancing positive attitude towards science

Table 21: Response of students on the activity method enhancing positive attitude towards science

Response	Frequency	Percent
Strongly Agree	36	29.3
Agree	63	51.2
Disagree	18	14.6
Strongly Disagree	6	4.9
Total	**123**	**100.0**

Table 21 shows the response of students on the activity method of teaching enhancing positive attitude towards science. It indicates that 29.3% of the respondents strongly agree that activity method of teaching enhances attitude towards science, 51.2% of them agree, 14.6% of them disagree and 4.9% of them strongly disagree that activity method of teaching enhances attitude towards science.

Science teachers help students to perform activities in science textbook

Table 22: Response of students on Science teachers helping students to perform activities in science textbook

Response	Frequency	Percent
Strongly Agree	45	36.6
Agree	51	41.5
Disagree	24	19.5
Strongly Disagree	33	2.4
Total	**123**	**100.0**

Table 22 shows the response of students on the science teachers helping students to perform activities in science textbook. The data suggests that 36.6% of the respondents strongly agree that science teachers help students to perform activities in science textbook, 41.5% of them agree, 19.5% of them disagree and 2.4% of them strongly disagree that science teachers help students to perform activities in science textbook.

The activity method helping to become familiar with science apparatus

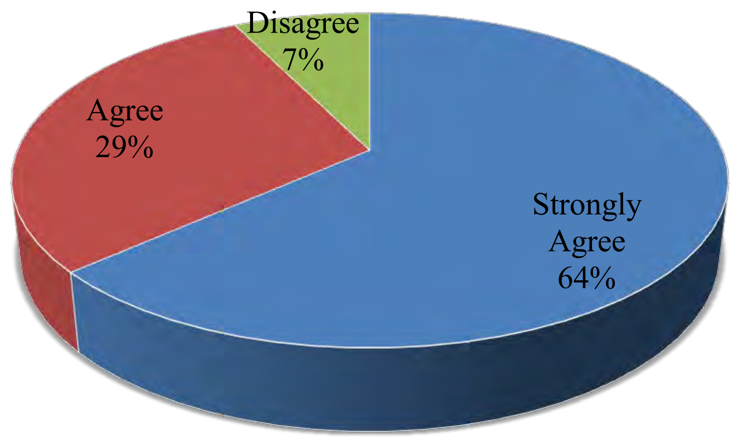

Figure 2: Response of students on the Activity method helping to become familiar with science apparatus

Figure 2 shows the response of students on the activity method of teaching helping to become familiar with science apparatus. The data indicates that 7% of the respondents disagree that activity method of teaching helps to become familiar with science apparatus, 29% of them agree and 64% of them strongly agree that activity method of teaching helps to become familiar with science apparatus.

The activity method and the retention of knowledge for a long time

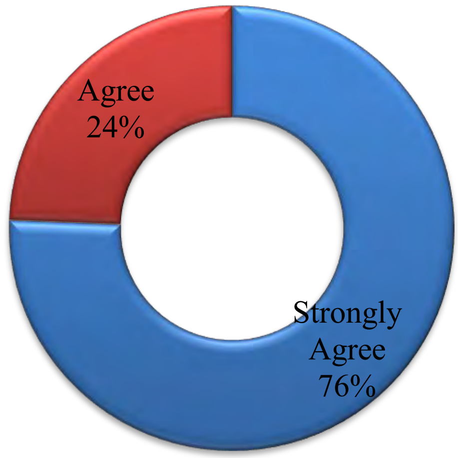

Figure 3: Response of students on the activity method and the retention of knowledge for a long time

Figure 3 shows the response of students on the activity method of teaching and the retention of knowledge for a long time. It suggests that 76% of the respondents strongly agree that activity method of teaching helps to retain knowledge for a long time and 24% of them agree that activity method of teaching helps to retain knowledge for a long time.

The activity method and the organisation of facts

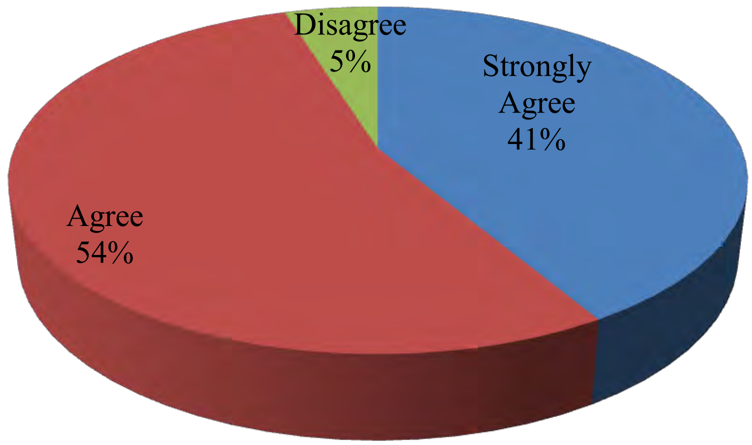

Figure 4: Response of students on the activity method and the organization of facts

Figure 4 shows the response of students on the activity method of teaching and the organisation of facts. The data depicts that 41% of the respondents strongly agree that activity method of teaching helps to organize facts easily, 54% of them agree and 5% of them disagree that activity method of teaching helps to organize facts easily.

The activity method and recall of facts

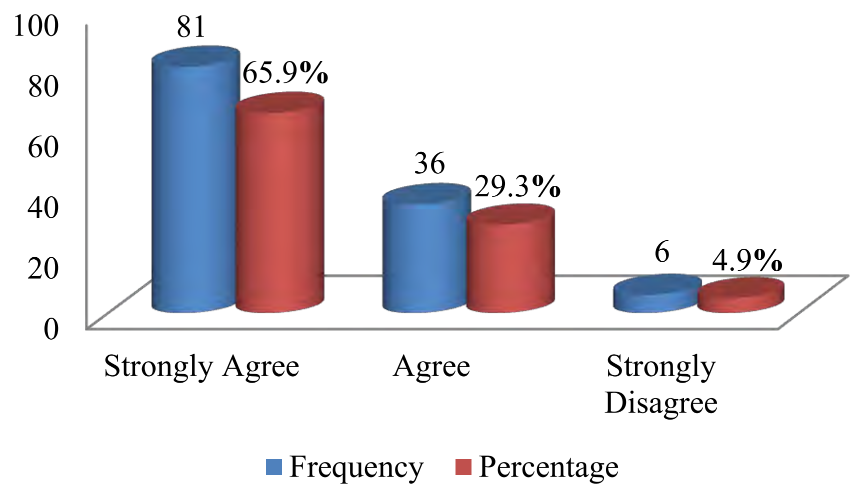

Figure 5: Response of students on the activity method and recall of facts

Figure 5 shows the response of students on the activity method of teaching and recall of facts. The data suggests that 65.9% of the respondents strongly agree that activity method of teaching helps to recall facts easily, 29.3% of them agree and 4.9% of them strongly disagree that activity method of teaching helps to recall facts easily.

The activity method and the enhancement of interest in the study of science

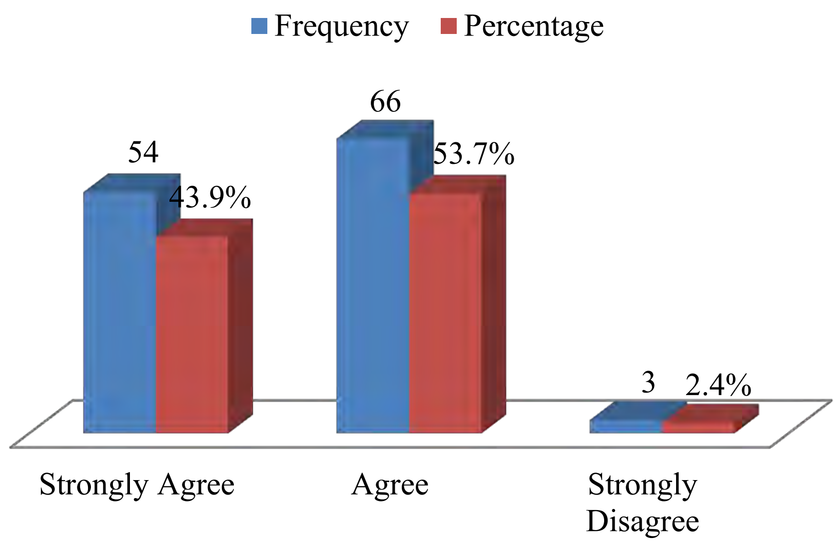

Figure 6: Response of students on the Activity method and the enhancement of interest in the study of science

Figure 6 shows the response of students on the activity method enhancement of interest in the study of science. The data indicates that 2.4% of the respondents strongly disagree that activity method enhances interest in the study of science, 53.7% of them agree and 43.9% of them strongly agree that activity method of teaching enhances interest in the study of science.

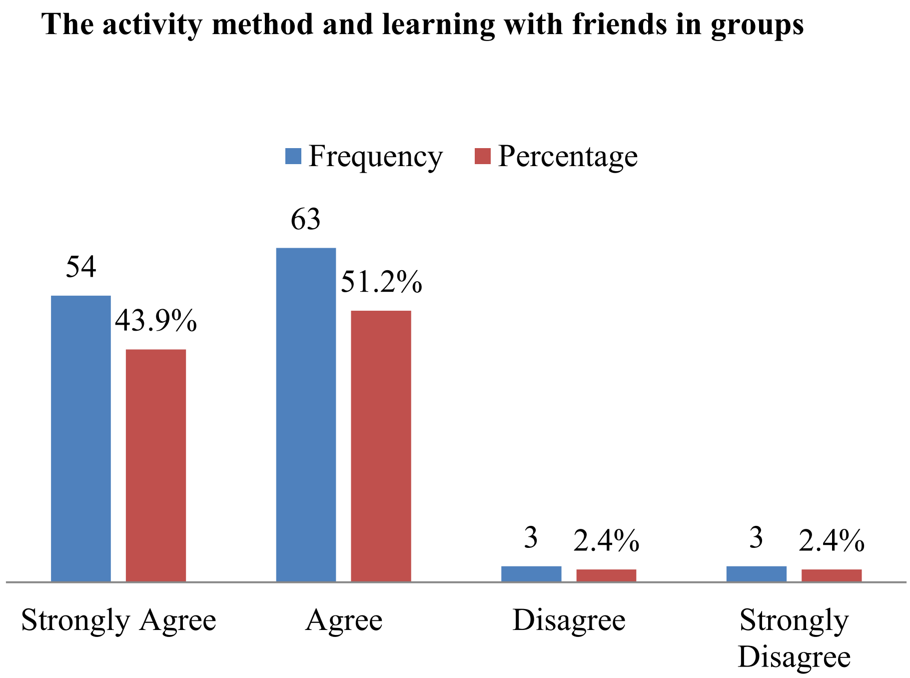

Figure 7: Response of students on the activity method and learning with friends in groups

Figure 7 shows the response of students on the activity method of teaching and learning with friends in groups. The data indicates that 2.4% of the respondents strongly disagree that activity method helps to learn with friends in groups, 2.4% of them disagree, 51.2% of them agree and 43.9% of them strongly agree that activity method of teaching helps to learn with friends in groups.

There are enough TLMs in the school that help in the use of the activity method

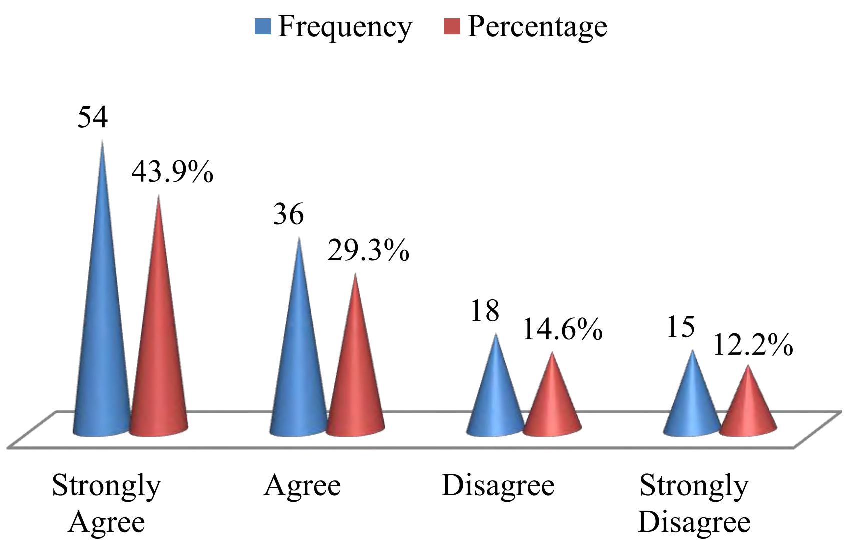

Figure 8: Response of students on the activity method and enough TLMs in school

Figure 8 shows the response of students on the activity method and enough TLMs in school. The data suggests that 12.2% of the respondents strongly disagree that there are enough TLMs in the school that help in the use of activity method, 14.6% of them disagree, 29.3% of them agree and 43.9% of them strongly agree that there are enough TLMs in the school that help in the use of activity method.

4.4 DISCUSSION OF THE RESULTS

In this section the results of the study as presented in the tables and figures above would be discussed to address the research objectives and answer the questions.

4.4.1 Research Question One

Can the activity method of teaching and learning improve teacher trainees' performance in science?

In addressing this research question, this sub-section will cover the following sub-headings"

The activity method improves student's performance in science

From Table 6 majority of the students strongly agreed that activity method of teaching improves performance in science. One possible reason for this result might be that after the intervention activity, that is when students were taken through the various experiments for the four topics, the students had a better understanding of the topics they treated. On the other hand, a small percentage of the students disagreed that the activity method of teaching improves performance in science, which might be due to the fact that not all the students benefited from the intervention.

The activity method helps to explain scientific concepts better

It can be observed in Table 7 that greater percentage of the students strongly agreed that activity method of teaching and learning helps to explain scientific concepts better. This shows that the activity method of teaching as applied in the intervention process helped students to better understand the scientific processes and difficult concepts because they took part in the activities. This is in line with Claxon (1991), Scott and Driver (1998) that some of the goals of teaching science are to promote understanding of scientific concepts and to help students to recognize that science knowledge is conjectural and to gain an appreciation of the rational criteria (for example consistency and coherence) which are drawn on by the scientific community in generating and validating knowledge claims

The activity method should be used in the teaching of science

The result in Table 8 indicates that most of the respondents strongly agreed that activity method of teaching should be used in the teaching of science. This is because after going through the activities, they realized it can improve the teaching of science as it improved their performance in the post-intervention test score in Table 5. According to Schwartz, Lederman, and Crawford (2004) students should develop an understanding of what science is, what science is not, what science can do and cannot do.

It can be concluded from the discussions above that the activity method helps to improve the performance of students.

4.4.2 Research Question two

Can the activity method of teaching and learning enhance teacher trainees' content knowledge in science?

In addressing this research question, the discussion was based on the following sub-headings

The activity method improves content knowledge

From Table 9 about 92.6% of the respondents strongly agreed that the activity method of teaching improves content knowledge. This is due to the fact that the application of the activity method of teaching and learning helps to concretize what is learned in the mind of a student, and therefore improve the content knowledge among learners. This is in agreement with Taraban, et al (2007) who reported that an active learning and teaching strategy has more advantage in learning and teaching science rather than a traditional strategy both in science contents and knowledge of process skills.

The activity method helps to retain knowledge for a long time

From Figure 3 most of the respondents strongly agreed that the activity method of teaching helps to retain knowledge for a long time. One possible reason for this response is that the activities the students went through helped to make the content of the lessons real and therefore registered the skills and knowledge acquired permanently in the minds of the students.

The activity method helps to understand scientific concepts better

The data in Table 10 shows that all the respondents strongly agreed that the activity method of teaching and learning helps them to understand scientific concepts better. The activity method takes away the abstract approach of teaching and rather makes the teaching and learning real by going through the activities step by step using the actual materials and apparatus. This therefore helps better understanding of scientific concepts and content knowledge. The central aspect of effective science teaching and learning in the twenty-first century is the activity-based teaching and learning which is based on the constructivist approach as the primary vehicle for students to develop meaningful understanding of key science concepts as well as learn about the nature and the process of science (Appleton, 1997; Dunkhase, 2003).

4.4.3 Research Question three

Can the activity method of teaching and learning approach enhance the teacher trainees' attitude towards science?

In addressing this research question, the discussion was based on the following sub-headings

The activity method helps to develop process skills

From Table 11, a greater percentage of the respondents strongly agreed that the activity method of teaching and learning helped to develop process skills. The activity method of teaching and learning goes through a step-by-step process for acquisition of knowledge and skills, and therefore help the students to acquire skills. Skill acquisition is an attitude, so when students develop their skills process in science they are enhancing their attitudes towards science. Therefore, it is essential for students to be aided to acquire science process skills in educational institutions.

The activity method helps to organize facts easily

According to Figure 4 most of the respondents agreed that the activity method of teaching and learning helps to organize facts easily. This is due to the fact that the activity method of teaching and learning involves prior preparation of materials, which seeks to inculcate in the students the attitude of organizing facts. It can therefore be said that the activity method of teaching and learning helps students to organize facts and materials easily.

The activity method helps to recall facts easily

The data in Figure 5 suggests that 95.2% of the respondents strongly agreed that the activity method of teaching and learning helped to recall facts easily. This is because the activity method of teaching and learning present activities in practical and concrete form which makes it easy to remember and recall knowledge and facts. This creates in students the attitude of easily recalling facts. Applebee (1993) suggests that rather than treating the subject of Science as subject matter to be memorized, a constructivist approach treats it as a body of knowledge, skills, and strategies that must be constructed by the learner out of experiences and interactions within the social context of the classroom.

The activity method helps to apply science in everyday life

Most of the students according to Table 12 strongly agreed that the activity method of teaching and learning helps to apply science in everyday life. This is because the activity method of teaching and learning is a process and everyday life is also a process, therefore the application of activity method in teaching and learning science can help in applying science in everyday life.

The activity method helps to summarise facts easily

The result as presented in Table 13 indicates that 85.4% of the respondents agreed strongly that the activity method of teaching helps to summarize facts easily. The activity method of teaching and learning goes through a process which includes summary of the activities. This therefore helps the students to acquire the skill of summarizing facts easily. According to (Germann, Aram & Burke (1996), such skills include posing questions, formulating hypothesis, identifying and defining variables, designing experiments, collecting and transforming data, drawing conclusions, and providing evidence.

The activity method helps to demystify science

From Table 14 majority of the respondents agreed that the activity method of teaching and learning helps to demystify science. Some people have the impression that science is a difficult subject which creates some myth around the study of science. But through the activity method, it becomes easy to understand the subject without much difficulty. This shows that the activity method of teaching and learning helps to create attitude in students which demystify science.

Science textbooks are written with the use of activity method in mind

From Table 15 greater percentage of the respondents agreed that science textbooks are written with the use of the activity method in mind. One possible reason for this is that the science textbooks used for laboratory practical activities are written with the activity method approach which presents the lessons systematically. This therefore supports the fact that the science textbooks are written with the use of activity method in mind. Recognizing the significance of the unique experiences that each reader brings to the reading of a selection of literature, the teacher in a response-centered approach should seek to explore the transaction between the student and the textbook to promote or extract a meaningful response (Rosenblatt, 1978)

4.4.4 Research Question four

Can activity method of teaching and learning approach motivate teacher trainees to learn science?

In addressing this research questions, the discussions will be based on the following sub-headings.

Science teacher and the use of activity method for teaching

The data as presented in Table 16 indicates that 70.8% of the respondents agreed that their science teacher uses the activity method of teaching. This is because of the intervention which introduced the use of activity method for teaching science. This therefore has not only motivated the teacher trainees to learn science but also developed interest in the study of science. Johnson (2007) mentioned that teachers should utilize effective teaching strategies to ensure conceptual understanding of science. Good teachers help students learn meaningfully to achieve quality over quantity, meaning over memorization, and understanding over awareness (Mintzes, Wanderse, & Novak, 1998).

The activity method helps to learn through first-hand experience

Ninety-five percent (95%) of the respondents strongly agreed that activity method of teaching helps students to learn through first-hand experience according to Table 17. This is due to the fact that the activity method of teaching and learning is a systematic approach which incorporates step by step practical event aimed at exposing learners to the real experience. The first-hand experience the students go through in the activity method of teaching and learning motivates them to learn science. In line with this, 95.2% of the respondents agreed that the activity method of teaching motivates students to learn science according to the data in Table 18.

The activity method enhances interest in the study of science

From Figure 6, the majority of the respondents agreed that the activity method of teaching and learning enhances interest in the study of science. The reason for this is that the intervention involved the students in the lessons treated which aroused their interest in the lessons. Students‟ participation in the lesson enhances their interest and therefore motivates them to learn science.

The activity method helps to learn with friends in groups

Most of the students in Figure 7 agreed that the activity method of teaching helps to learn with friends in groups. The activity method of teaching and learning (as applied in the intervention) put the students in groups and so they worked together in their groups. This therefore promotes group learning and motivates the students to learn in groups. The key role of the instructional strategies based on cooperative learning is to encourage students to work together to accomplish the shared goals (Killen, 2007). Cohen (1994) points out that a cooperative learning involves students learning by working together in a small group to accomplish shared goals. Lazarowitz and Hert-Lazarowitz (1998) indicated that cooperative learning methods are integrated into science classrooms and laboratories in an attempt to enhance student learning within a peer context, based on a constructivist learning and teaching approach.

A well resourced science laboratory, TLMs and good classroom environment enhance the use of activity method

According to Table 19, 97.6% of the respondents agreed that a well resourced science laboratory enhances the use of activity method of teaching. This suggests that the use of activity method in teaching and learning requires a well resourced laboratory for handling science related courses. Also in Figure 8, most of the students agreed that there are enough TLMs in the school that help in the use of the activity method. This shows that the use of the activity method of teaching and learning requires the use of sufficient TLMs. In addition, the data in Table 20 show that majority of the students agreed and strongly agreed that good classroom environment enhances the use of the activity method of teaching. All of these indicate that the activity method of teaching and learning motivate students to learn science and also requires the provision of resources for its implementation. Donovan and Branford (1999) suggested that the science classroom should be learner- centered, knowledge-centered, assessment-centered, and community-centered which is a useful framework to employ in the design of instruction. In summary, the learner-centered classroom, in other words, student-centered, encourages attention to preconceptions, and offers instruction on what students think and know.

The activity method enhances positive attitude toward science

From the observation in Table 21, 51.2% of the respondents agree that activity method enhances attitude toward science. This is due to the fact that after the activity method was used to teach them, their mental state involving their beliefs and feelings and values and also dispositions about science changed. This was seen from the way the students spoke after the use of the activity method. This is in line with Schwartz, Lederman, and Crawford (2004) who says that students should develop an understanding of what science is, what science is not, what science can do and cannot do.

Science teachers help students to perform activities in science textbooks

Fourty one percent (41%) of the respondents agree that science teachers help students to perform activity in science textbooks from the observation in Table 22. Teachers of science should act as facilitators and also become co-learners with students. A teacher tells, a facilitator asks; a teacher lectures from the front, a facilitator supports from the back; a teacher gives answers according to a set curriculum, a facilitator provides guidelines and creates the environment for the learner to arrive at his or her own conclusions; a teacher mostly gives a monologue, a facilitator is in continuous dialogue with the learners.

4.5 Summary of Chapter four

From the result of the pre-test and the post-test scores, students were seen to have performed better after the intervention which dealt with the use of the practical activities and experiments in teaching the four topics. Responses from students also showed that most of the students agreed that the activity method improves teaching and learning of science better than without using it.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

Overview

This chapter of the study summarises the purpose and objectives, as well as the main findings and the conclusions. It again presents recommendations for the use of activity method for teaching some selected topics in biology to help the second year diploma of education students in St. Monica"s College to gather confidence in the teaching and learning of science.

5.1 Summary of the Major Findings

In this study, the main problem was to use teaching and learning strategies that are consistent with a constructivist teaching and learning approach to teaching some selected topics in biology to help the second year diploma of education students in St. Monica"s College. The purpose of the study was to use the constructivist teaching and learning approach which deals with activity and hands-on teaching and learning approach to meet the pressing need for improvement in the quality of teaching and learning of science at the colleges of education. The specific objectives were to find out the extent to which the activity method of teaching and learning helps to improve the teacher trainees" performance in science, to find out the extent to which the activity method of learning approach enhance teacher trainees" content knowledge in science, to find out if the activity method learning approach enhances teacher trainees" attitude towards science, find out if activity method of learning approach motivates teacher trainees to learn science and to provide recommendations for teacher trainees, teachers and managements of college of education in Ghana.

Based on an objective analysis of data and discussion of results and findings, the following are the summary of major findings and conclusions of this study.

5.1.1 Research Question One

Can the activity method of teaching and learning improve the teacher trainees' performance in science?

1. Generally, majority of the students strongly agreed that the activity method of teaching improves performance in science. The reason is that after the intervention, the students realized an improvement in their performance in science and had a better understanding of the topics they treated.
2. According to the results, a greater percentage of the students strongly agreed that activity method of teaching and learning helps to explain scientific concept better. This suggests that the activity method of teaching as applied in the intervention process helped students to better understand the scientific processes and difficult concepts because they took part in the activities.
3. The result revealed that majority of the students agreed that activity method of teaching helps to handle science apparatus easily. The reason

was that the intervention process involved the students practically in conducting activities in the laboratory for which the student had the opportunity to use the apparatus, and therefore became familiar with the use of science apparatus.

4. With respect to whether the activity method of teaching should be used in the teaching of science, most of the respondents strongly agreed. This is because after going through the activity method of teaching and learning they realized it can improve the teaching of science as it improved their performance in the post-test score.
5. The result showed that most of the students strongly agreed that science teachers should help students to perform activities in science textbook. This is because the students had gone through the activity method of teaching and learning which made them to perform activities in their science textbook.

5.1.2 Research Question Two

Can the activity method of learning enhance the teacher trainees' content knowledge in science?

1. From the results, 92.6% of the respondents strongly agreed that the activity method of teaching improves content knowledge. This suggests that the application of activity method of teaching and learning helped to

concretize what is learned in the mind of a student, and therefore improve the content knowledge among learners.

2. Most of the respondents strongly agreed that the activity method of teaching helps to retain knowledge for a long time. This is because the activity method of teaching and learning the students went through helped to make the content of the lessons real and therefore registered the skills and knowledge acquired permanently in their minds.
3. Concerning the issue that the activity method of teaching and learning helps the students to understand scientific concept better, all the respondents strongly agreed. This is due to the fact that the activity method takes away the abstract approach of teaching and rather makes the teaching and learning real by going through the activities step by step using the actual materials and apparatus.

5.1.3 Research Question Three

Can the activity method of teaching and learning enhance the teacher trainees' attitude towards science?

1. The result showed that greater percentage of the respondents strongly agreed that activity method of teaching and learning helps to develop process skills. This is because the activity method of teaching and learning goes through step by step process for acquisition of knowledge and skills, and therefore helped the students to acquire the skills.

2. Most of the respondents agreed that the activity method of teaching and learning helps to organize facts easily. This is due to the fact that the activity method of teaching and learning involves prior preparation of materials, which seeks to inculcate in the students the attitude of organizing facts.
3. The result suggested that 95.2% of the respondents agreed and strongly agreed that activity method of teaching and learning helps to recall facts easily. This is because the activity method of teaching and learning present activities in practical and concrete form which makes it easy to remember and recall knowledge and facts.
4. Concerning the issue that the activity method of teaching and learning helps to apply science in everyday life, most of the students strongly agreed. This is because the activity method of teaching and learning is a process and everyday life is also a process, therefore the application of activity method in teaching and learning science can help in applying science in everyday life.
5. Eighty five percent of the respondents agreed strongly agreed that the activity method of teaching helps to summarize facts easily. This is due to the fact that the activity method of teaching and learning goes through process which includes summary of the activities.
6. Majority of the respondents agreed that activity method of teaching and learning helps to demystify science. Some people have the impression that science is a difficult course which creates some myth around the study of

science. But through activity method, it became easy to for the students understand the lessons taught without much difficulty.

7. Greater percentage of the respondents strongly agreed that science textbooks are written with the use of activity method in mind. The reason for this is that the science textbooks used for laboratory practical activities are written with the activity method approach which presents the lessons in step by step process.

5.1.4 Research Question Four

Can activity method of teaching and learning approach motivate teacher trainees to learn science?

1. The result indicated that 70.8% of the respondents agreed that their science teacher used the activity method for teaching. This is because of the intervention which introduced the use of activity method for teaching science.
2. Ninety-five (95%) of the respondents agreed and strongly agreed that activity method of teaching helps students to learn through first-hand experience. This is due to the fact that the activity method of teaching and learning is systematic approach which incorporates step by step practical event aim at exposing learners to the real experience.
3. Majority of the respondents strongly agreed that the activity method of teaching and learning enhances interest in the study of science. The reason

for this is that the activity method of teaching and learning as used for the intervention involved the students in the lessons treated which aroused their interest in the lessons.

4. Most of the students agreed that activity method of teaching helps to learn with friends in groups. The reason being that the activity method of teaching and learning as applied for the intervention put the students in groups for which they worked together in their groups.
5. Ninety–seven point six percent (97.6%) of the respondents agreed that a well resourced science laboratory enhances the use of activity method of teaching.

5.2 RECOMENDATIONS

On the basis of the results obtained and the conclusions drawn, the following are some of the recommendations presented for the study.

5.2.1 The need to adopt the activity method for teaching science Lessons

Since majority of the students are of the view that the activity method of teaching improves performance in science and helps to explain scientific concept better, there is therefore the need to adopt the activity method for teaching science in schools. It is therefore recommended that teachers should adopt the activity method for teaching science subjects in schools.

Again the Ministry of Education should direct all science teachers to use the activity method in teaching. Also BECE and WASSCE examination questions should be set with the activity method in view.

5.2.2 The need to incorporate the activity method of teaching and learning in writing science textbooks

The results shows that a greater percentage of the respondents are of the view that the activity method of teaching and learning improve content knowledge, helps to retain knowledge for a long time and helps to understand scientific concept better and that science textbooks are written with the use of activity method in mind. This suggests that there is the need to incorporate the activity method of teaching and learning in writing science textbooks. In line with this, it is recommended that authors of science textbooks, curriculum developers, Ghana Education Service and Ministry of Education should ensure that textbooks for science subjects incorporate the activity method of teaching and learning in their preparation.

5.2.3 Provision of resources for teaching using activity method

Since greater percentage of the students agreed that a well resourced science laboratory enhances the use of activity method of teaching, the use of the activity method in teaching and learning requires a well resourced laboratory for handling science related courses, good classroom environment enhances the use of activity method of teaching and enough TLMs in the school help in the use of activity method, there is therefore the need to provide adequate resources for teaching science with activity method. It is therefore recommended that school managements, Ghana Education Service and the Ministry of Education should ensure the provision of adequate resources such as science laboratories and TLMs to promote the activity method of teaching in the schools.

5.2.4 Suggestions for further Research

Even though the researcher has been able to do his part of this study, there is still a great vacuum left to be filled. The researcher suggests that whoever wishes to undertake a similar study should concentrate on a large sample in different Colleges. The person should also choose different topics so as to get a better representation of the entire population to find out if similar results could be obtained.

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