UNIVERSITY OF EDUCATION-WINNEBA

THE EFFECT OF TEACHER CLASSROOM ACTIVITY ON STUDENTS' PERFORMANCE AND PERCEPTION IN STUDYING DIRECT CURRENT ELECTRICITY IN INTEGRATED SCIENCE

ERNEST SENA AMABLE

MASTER OF PHILOSOPHY

2018

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A thesis in the Department of Science Education, Faculty of Science Education, Submitted to the School of Graduate Studies in partial fulfillment

of the requirements for the award of the degree of Master of Philosophy (Science Education) in the University of Education, Winneba

JUNE, 2018

DECLARATION

STUDENT'S DECLARATION

I, ERNEST SENA AMABLE declare that this dissertation, with the exceptions of quotations and references contained in published works which have all been identified and duly acknowledged, is entirely my own original work, and it has not been submitted either in part or whole, for another degree elsewhere.

SIGNATURE: …………………………………….

DATE: ……………………………………….……

SUPERVISOR'S DECLARATION

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

NAME OF SUPERVISOR: DR. ISHMAEL K. ANDERSON

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DATE: ……………………………………….……

ACKNOWLEDGEMENTS

I humbly acknowledge the Almighty God for His directions and infallible Grace to complete this research. I am particularly very grateful to Dr. Ishmael K. Anderson, whose support, patience, constructive comments about my work and thoughtful guidance and directions at all stages of my work have gone a long way to make this thesis possible. May the good Lord give you strength and good health to continue your good work. I am also grateful to a good brother and friend, Dr. Worlanyo K. Agbosu for his good advice and immense support. My appreciation also goes to all my course mates, my sister Anastasia Fafa Kudenu and the husband, Mr. Mark Acquah for their prayers and support. Finally, I will like to extend my acknowledgement to the Head of Science Department, Swedru School of Business, Madam Salma Hamidu, and The Assistance headmaster (Academic), Swedru School of Business, Mr. Daniel Boafo for allowing me to use facilities in the school for this research.

DEDICATION

I dedicate this work to God almighty, my mother, Ms. Beatrice Nutsugah, my father, Mr. Felix Senegah Amable, my lovely Wife, Mrs. Comfort Pickson Amable, My kids, Rita Eyram Amable, Raynald Elikem Amable, Raphael Edrolali Amable and Rodney Etornam Amable.

TABLE OF CONTENTS

Content **Page**

LIST OF TABLES

Table **Page**

LIST OF FIGURES

ABSTRACT

The purpose of this study was to determine the effect of teacher classroom activity method on students" performance and acquisition of required skills in learning direct current electricity in integrated science for 4weeks. The study was done with a sample size of 30 Home economic students (all female) of Swedru School of Business. At the end of each week, a test was administered to students to collect data on weekly performance of students. At the end of the 4th week, a questionnaire on students" perception of the use of the teacher classroom activity method to teach Direct Current Electricity was administered. Descriptive statistics techniques were used to analyse the data obtained from the tests. The results indicated that class weekly average scores were 2.9, 3.5, 5.3 and 6.6 out of maximum score of 10. The study revealed that the performance of students improved during the period when the teacher classroom activity method was utilised. Also the teacher classroom activity method assisted students to acquire a wide range of experimental and process skills during the period of study. Also the study showed that students had positive perception towards the use of teacher classroom activity method to teach direct current electricity. The study recommended that teachers, especially science teachers are encouraged to use modern methods of teaching to teach students instead of the usual conventional methods, teachers are also to pay critical attention to skills development when teaching. Finally, it is recommended that since students had positive perception about teacher classroom activity method, teachers are to be encouraged to use the teacher classroom activity method to teach students at Swedru School of business.

CHAPTER ONE

INTRODUCTION

1.0 Overview

This chapter provides an overview of this research. It describes the background to the study, statement of the problem, purpose of the study, research objectives and research questions. It further provides information on the limitations, delimitations and the structure of the thesis.

1.1 Background to the Study

In Ghanaian schools science is taught as a core subject from the Basic School to the Senior High School level and passing this subject is a requirement for further studies. The learning of Integrated Science provides students with fair ideas on the various branches of science and how to use those ideas to help them in solving problems in the society (Baah & Anthony-Krueger, 2012).The global and local concerns about the teaching and learning of science now require the need for all stakeholders to transform their attitudes and practices (Mbugua, Kibet, Muthaa and Nkonke (2012). The attempt to define "science" has been assessed by many researchers to be controversial however the inclusion of specific major words has been suggested by most scientists (Baah & Anthony-Krueger, 2012). For example, Mbugua, et al. (2012), define science as an organized body of knowledge about natural phenomena as observed through experimentations and manipulations. Other researchers are of the view that science is a continuous process of investigation and experimentation in order to widen the understanding of people about the natural world (Adaramola, 2011; Anamuah Mensah, 2004; Muzah, 2011). Scientists from diverse fields have indeed argued that science application involves the gathering and recording of knowledge to resolve the questions and challenges that life poses to humanity.

Therefore, it still remains factual that science is needed in order to survive and continues to be one of the most significant subjects in educational systems worldwide (Laugksch, 2009; Muzah, 2011; Mbugua et. al., 2012). In reality, science may be viewed globally as machinery that facilitates development in all countries. Science therefore, plays important and dominant roles in spearheading technological advancement, promoting individual and national wealth, improving health, and accelerating industrialization (Validya, 2003). Presently, various methods for teaching and learning science have been introduced at all levels in schools globally. These include demonstration, activity, and inquiry methods (Khan & Iqbal, 2011; McBride, Bhatti, Hannan & Feinberg, 2004). Practically, all these methods of teaching and learning science are aimed at facilitating procedures to help students to understand scientific concepts and further acquire skills even without intervention from science teachers (Naidoo & Green, 2010). Therefore, any classroom activity employed by a teacher is expected to improve student performance. Contemporary science educators such as; Killermann (1998) and Ngesa (2002) have compared the effectiveness of the activity method to the demonstration method in several studies. Indeed, such studies have consistently provided either conflicting or inconclusive results.

In order to achieve the benefits or objectives of science education, students must develop skills such as taking measurements, drawing, recording and interpreting results, etc. during the teaching and learning of science to make them more competent and confident in conducting diverse experiments (Bybee, 2000). This can be achieved through the use of methods that involve students in active practical activities that afford them enough time to explore, observe, collect, sort, test ideas, measure, record, draw, interview, survey, compute, and to skillfully handle scientific apparatus, to enhance students" retention of scientific concepts and skills (AAAS, 1990).

1.2 Statement of the problem

In reality, a lot has been done to improve the teaching and learning of integrated science in senior high schools in Ghana, however, the expected performance in integrated science is still low. It appears the teaching and learning of integrated science in Ghanaian senior high schools do not fully match the understanding of scientific concepts and the acquisition of expected skills by students; therefore, most of the students do not perform well. As a result, stakeholders especially parents have over the years objectively criticised almost all aspects of science teaching and learning (Anamuah-Mensah, Mereku & Ampiah, 2009; Entsuah-Mensah, 2004).

Though there may be many reasons for students" low performance in integrated science, however the notable ones which have been mentioned by researchers are: poor financial background of learners, poor method of teaching, lack of experienced teachers, inadequate laboratory facilities and the classroom environment (Aminu, 2011; Dhurumraj, 2013; Oyenuga & Lopez, 2012). As a result of these inadequacies students in our schools have resorted to the rote method of learning science without a better understanding of concepts and acquisition of skills (Okebukola, 2000).

Regardless of the several studies done in assessing the effectiveness of the various methods of teaching science, extensive research is still needed to evaluate the efficacy of using appropriate methods to teach specific topics. Therefore, this study used the teacher classroom activity method, consisting of demonstration method and activity method to teach Direct Current Electricity with the view of determining its effects on students‟ performance.

1.3 Purpose of the study

The purpose of this study was to use teacher classroom activity to teach and determine its effect on students‟ performance.

1.4 Objectives of the study

The objectives that guided this study were;

1. To determine students‟ performances in studying "Direct Current Electricity" after the application of teacher classroom activity.
2. To determine the student‟s level of acquisition of skills required for learning Direct Current Electricity after the application of teacher classroom activity.
3. To determine student‟s perception about the use of teacher classroom activity in teaching Direct Current Electricity.

1.5 Research questions

The research questions that guide this study were;

1. What is the general performance of students after the application of teacher classroom activity in teaching Direct Current Electricity?
2. What is the level of students‟ acquisition of skills required for learning Direct Current Electricity after the application of teacher classroom activity?
3. What are the students‟ perceptions about the use of teacher classroom activity in teaching Direct Current Electricity?

1.6 Scope of the study

This study focused on the teaching and learning of direct current electricity using the teacher classroom activity method (demonstration and activity) to improve performance and acquisition of relevant skills by students in SHS 2 at Swedru School of Business in Agona West Municipality.

1.7 Limitation of the Study

The study has been limited to only the SHS 2 Home Economics class at Swedru School of Business in Agona West Municipal. Other limitations of this study included absenteeism and the fact that, it was conducted as a case studies hence the results cannot be generalized.

Data collection for the research encountered frequent interruptions from school activities such as inter-school sports and workshops organised for teachers. This prevented the researcher from collecting extensive data to inform the study.

1.8 Organization of the Study

The whole study is organised into five chapters. Each chapter contains a distinctive presentation adding up to an overall logical presentation of the study.

Chapter one consists of background to the study and statement of the problem, purpose, objectives and research questions as well as the limitations of the study. The Chapter two covers a review of related and relevant literature on the subject of teacher classroom activity in the teaching and learning of direct current electricity. The chapter is presented in different significant sections; theoretical review, Bruner's Constructivist Theory, Kelly's Personal Construct Theory, Integrated Science as a concept, Aims of Integrated Science, Teaching Integrated Science, Teacher classroom activity as a method in teaching integrated science. Critical perspectives of teaching direct current electricity, Performance of learners and factors that enhance learner‟s performance, were also discussed.

Chapter three covered the methodology used in the study. Chapter four presented the results and findings from the analysis. It directly links the findings presented using descriptive statistics to the objectives and chapter five covered the summary, conclusions and recommendations for further research.

CHAPTER TWO

LITERATURE REVIEW

2.1 Theoretical review

The theoretical review of this study depends principally on the concept, "teacher classroom activity" and theories surrounding "academic performance". A theoretical review describes a standard for applying or developing theories meant to be relevant, logically interpreted, well understood, and in alignment with the main objective of the study (Lovitts, 2005).

Therefore, theoretical reviews, according to Merriam and Simpson (2000) are expected to;

1. Construct an exceptional basis;
2. Demonstrate how a study deepens knowledge;
3. Conceptualise the research work;
4. Assess research design and instrumentation; and
5. Provide a reference point for the explanation of results.

Indeed, all the above motivations intend to use previous work to indicate linkages, illustrate patterns, synthesise existing theories and relate concepts and empirical research, to develop a basis for new findings (Ng, 2008). Chiappetta and Fillman (2011), reveals important personal beliefs and understandings about the nature of knowledge, how it is perceived, the possible roles to be adopted and tools to be utilised in the study.

Anyon (2009) argues that theory and educational research bridges the old-age theory by demonstrating how researchers can use theories to determine appropriate empirical research strategies, and extend the analytical, critical and sometimes emancipator power of data gathering and interpretation.

Dressman (2008) further states that theory circumscribes methods of thinking about educational problems and inhibits creativity among researchers, policy makers and teachers. According to Suppes (1974), there are five kinds of arguments for using theory in educational research:

i) argument by analogy (although the argument that the success of the natural sciences in the use of theory provides an excellent example for educational research, it does not follow that theory must be comparably useful as we move from one subject to the other).

ii) reorganisation of experience (a more important way to think about the role of theory is to attack directly the problem of identifying the need for theory in a subject matter).

iii) recognition of complexity (one of the thrusts of theory is to show that what appear on the surface to be simple matters of empirical investigation, on a deeper view, prove to be complex).

iv) Deweyan problem solving (inquiry is the transformation of an indeterminate situation that presents a problem into one that is determinate and unified by the solution of the initial problem) and

v) Triviality of bare empiricism (recording of individual facts and with no apparatus of generalisation or theory).

According to Maxwell (2010), no fact, investigation, or conclusion can be theory free. The issue is whether one is aware of the theory one is using and whether one is using it critically or uncritically.

In order to understand any educational phenomenon, one needs to also look at the larger social, economic and political contexts within which that phenomenon is embedded, and seek out theories that connect there (Maxwell, 2010). Theories can be used not just to understand the individuals, situations and structures studied, but also to change them. One needs to avoid simply citing theory to support one‟s argument, and to actually incorporate theory into the logic of one‟s study and use it to deepen one‟s research process.

Formal learning and instruction strategies are inseparable (Tebogo, 2014). Yet learning theories only describe how learning occurs, but do not describe the specific methods and activities to follow in order to accomplish the intended learning outcomes. For example, learning theories may describe the age at which a learner may learn punctuations, but the instructional theories will provide guidelines on how to execute the teaching of punctuations (Tebogo, 2014). This study was purely guided by the constructivist theory of learning.

2.1.1 Constructivism

Constructivism is defined as a theory of learning, not a theory of teaching (Tebogo, 2014), Constructivism is an epistemology (theory of knowledge), a learning or meaning-making theory that offers an explanation of the nature of knowledge and how human beings learn (Abdal-Haqq, 1998). Therefore, instructional theories should translate the learning theories into instructional strategies. These instructional theories, according to Tebogo, (2014) should prescribe series of strategies the teacher should follow in order to produce certain types of learner learning.

An increasingly dominant constructivist view focuses on the cultural embeddedness of learning, employing the methods and framework of cultural anthropology to examine how learning and cognition are distributed in the environment rather than stored in the head of an individual (Duffy 2006).

Constructivism is a theory of knowledge (epistemology) that argues that humans generate knowledge and meaning from an interaction between their experiences and their ideas (Wales, 2010). As a theory of learning, constructivism is relevant in this study as the researcher wished to establish how learners learn by engaging in activities and teachers teach by involving students in activities.

Hein (2007) mentions that constructivism refers to the idea that learners construct knowledge for themselves, each learner individually and socially constructs meaning- as he or she learns. It maintains that individuals create or construct their own new understandings or knowledge through the interaction of what they already know and believe and the ideas, events, and activities with which they come in contact. (Wales, 2010). Constructivism is thus a theory of learning that likens the acquisition of knowledge to a process of building or constructing (Hein, 2007). Each learner should actively participate in the learning processes as everyone constructs his or her own knowledge (Tebogo, 2014).

Learning activities in constructivist settings are characterised by active engagement, inquiry, problem solving, and collaboration with others (Abdal-Haqq 1998). Learning is an active process of constructing rather than acquiring knowledge, and instruction is a process of supporting that construction rather than communicating knowledge (Duffy 2006). Learning therefore, is simply the process of adjusting our mental models to accommodate new experiences (Wilson 1996). Hein (2007) argues that learning does not understand the „true" nature of things, nor is it remembering dimly perceived perfect ideas, but rather a personal and social construction of meaning out of the bewildering array of sensations which have no order or structure besides the explanations which we fabricate for them. Rather than the dispenser of knowledge, the teacher is a guide, facilitator, and co-explorer who encourage learners to question, challenge, and formulate their own ideas, opinions and conclusions (Hein, 2007). Constructivists maintain that when information is required through transmission models, it is not always well integrated with prior knowledge and is often accessed and articulated only for formal academic occasions such as examinations (Tebogo, 2014). Learning is an active, constructive process. The learner is an information constructor. New information is linked to prior knowledge. In constructivism learning is an active, contextualised process of constructing knowledge rather than acquiring it (Tebogo, 2014).

According to Duffy (2006), learning involves activity and a context, including the availability of information in some content domain. Knowledge is not passively received but actively built up by the experiential world, not the discovery of ontological reality (Hein, 2007). The constructivists view learning as an activity in context (Duffy, 2006). Constructivists typically substitute some notion of viability for certainty, that is, we judge the validity of someone"s knowledge, understanding, explanation, or other action, not by reference to the extent to which it matches reality but, rather by testing the extent to which it provides a viable, workable, acceptable action relative to potential alternatives (Duffy 2006). Knowledge is in the constructive process rather than a finding (Neimeyer, 2006). Knowledge is not in the content but in the activity of the person in the content domain (Tebogo, 2014). The active struggling by the learner with issues of learning constitutes more learning. The instructional methods used include: inquiry, experimentations, observation, interviewing, literature search, summarising and defence of opinion (Neimeyer, 2006.). The learners are involved in the construction of their own understanding, and the social interaction in the classroom is essential to the constructive process. Constructivism is a theory of learning based on the idea that knowledge is constructed by the knower based on mental activity (Neimeyer, 2006). Knowledge is constructed based on personal experiences and hypotheses of the environment. Learners are considered to be active organisms seeking meaning (Tebogo, 2014).

Learning is an active process of constructing rather than acquiring knowledge, and construction is a process of supporting that construction rather than communicating knowledge (Duffy 2006). In other words, learning should be an activity in context. Though learning is construction of knowledge, sometimes learners can also learn by imitation and repetition. This can be done by constructing meaning on what is already known. Acquiring knowledge can also be seen as learning because learners shall have known what they did not know (Tebogo, 2014).

According to Hein (2007), the following are the basic guiding principles of constructivist thinking that teachers must keep in mind:

I. It takes time to learn: learning consists both of constructing meaning and constructing systems of meaning. Each meaning we construct makes us better able to give meaning to other sensations which fit similar patterns.

II. Learning is an active process in which the learner uses sensory input and constructs meaning out of it: learners need to do something because learning involves the learners engaging with the world.

III. People learn to learn as they learn: learning consists both of constructing meaning and constructing systems of meaning. Each meaning we construct makes us better able to give meaning to other similar patterns.

IV. The crucial action of constructing meaning is mental: physical actions, hands-on experience may be necessary for learning, especially for children, but it is not sufficient, we need to provide activities that engage the mind as well as the hands (Dewey called this reflective activity).

V. Learning is social activity: our learning is intimately associated with our connection with other human beings, our teachers, our peers, our family as well as casual acquaintances, including the people before us or next to us at the exhibit. Progressive education recognises the social aspect of learning and uses conversation with others, and the application of knowledge as an integral aspect of learning.

VI. Learning is contextual: we do not learn isolated facts and theories in some abstract ethereal land of the mind separate from the rest of our lives. We learn in relationship to what else we know, what we believe, our prejudices and our fears. Learning is active and social. We cannot divorce our learning from our lives.

VII. Learning is not the passive acceptance of knowledge which exists out there: learning involves the learner engaging with the world and extracting meaning from his/her experiences.

VIII. Motivation is a key component in learning: not only is the case that motivation helps learning, it is essential for learning.

In this study the researcher was guided by the above principles in critically analysing how learners learn by interacting with learning materials, at own pace, when teacher classroom activity method was utilized.

According to Wilson (1996: 23) the following are the guiding principles of constructivism:

I. Knowledge is constructed, not transmitted

II. Prior knowledge impacts the learning process

III. Initial understanding is local, not global

IV. Building useful knowledge structures requires effortful and purposeful activity.

These principles guided the researcher in this study to establish how to impart knowledge and skills to the learners through the use of the teacher classroom activity method.

Furthermore, Brooks and Brooks (1993) state that the constructivist views of education advocates that teacher should do the following:

I. Use cognitive terminology such as classify, analyse, predict and create.

II. Encourage and accept student autonomy and initiative

III. Use raw data and primary sources, along with manipulative, interactive, and physical materials

IV. Allow student responses to drive lessons, shift instructional strategies, alter content

V. Inquire about students‟ understanding of concepts before sharing your own understanding of those concepts

VI. Encourage students to engage in dialogue, both with the teacher and with one another

VII. Encourage student enquiry by asking thoughtful, open-ended questions

VIII. Seek elaboration of students‟ initial responses

IX. Engage students in experiences that might engender contradictions to their initial hypotheses and then encourage discussion

X. Allow wait time after posing questions

XI. Provide time for students to construct relationships and create metaphors

XII. Nurture students‟ natural curiosity through frequent use of the learning cycle model.

There are commonalities in principles as indicated by the above authors. They all emphasise the importance of learning tempo, self-discovery, problem solving, as well as the acquisition of knowledge through activity and initiativeness.

2.1.2 Constructivism and Classroom Practice

According to Gray (2008), a constructivist teacher and a constructivist classroom are distinguished from a traditional teacher and classroom by a number of identifiable qualities:

I. the learners are actively involved, the environment is democratic, the activities are interactive and student centred, and the teacher facilitates a process of learning in which the students are encouraged to be responsible and autonomous.

II. The constructivist classroom is an environment in which student will have enough time to develop mental models of the content, which will assist in moving that knowledge away from primary content area, so that it can be applied elsewhere (Spiro 2006).

III. Matthews (2007) states that the teacher is seen as a facilitator of learning, where learners are permitted to move around freely, use of time is flexible rather than structured, and evaluation compares learners to themselves rather than to peers, with de-emphasis on formal testing. Teachers need to recognise how learners use their own experiences, prior knowledge and perceptions.

IV. The constructivist classroom should be an environment based on inquiry which will leads the learners to deep understanding of the concepts under scrutiny. Social interactions and context is necessary for learning to occur.

V. Constructivist classrooms are structured so that learners are immersed in experiences with which they may engage in interactions, invention and meaning-making inquiry.

Martin (1994) argues that although teachers do not necessarily follow a deliberate constructivist approach to teaching in their classrooms, a number of implications for teaching practice can be derived from it, namely:

I. A constructivist approach recognises the value of a child‟s inherent curiosity;

II. Science is viewed as a dynamic, continual process of increasing a person‟s understanding of the natural world;

III. Knowledge construction occurs within each individual through interaction with other people and the environment;

IV. The teacher following a constructivist approach largely functions as a facilitator of knowledge construction and takes the following alternative roles: presenter, observer, question asker and problem poser, environment organiser, public relations coordinator, documenter and theory builder.

2.1.2 Overview of constructivism

Constructivists view the student as an active partaker in the teaching-learning process that enters the science class already holding onto some ideas about natural phenomena, which may be used to make sense of everyday experiences and new situations (Wheatley, 1991). In this view, the most important element or factor in the process of the teaching-learning is the interaction between the new knowledge constructed and the existing knowledge.

Specifically, an overview of constructivism is that, in building personal cognitive understanding, students construct and reconstruct their social realities (Reusser & Pauli, 2015; Leach & Zekpe, 2010). For instance, interactions among peers and with teachers at the school should enhance the teachers" ability to identify the differences and changes in the behavior of students. In general, Osborne and Dillion (2010) and Reusser and Pauli (2015) found that constructivism approaches to teaching science have been accepted and utilized by several researchers with a view that;

1. They create opportunity for students to explore their ideas and test their robustness in explaining phenomena responsible for events and making prediction.
2. The approaches provide stimuli for students to develop, modify and where necessary revise their ideas and perspectives.
3. They support the attempt by students to rethink and reconstruct ideas and views.

2.2 Integrated Science as a concept (Ghana Education Service, Integrated Science Teaching Syllabus, 2010)

Advancement in the contemporary world is based on scientific and technological knowledge. This knowledge is acquired faster through the use of science and technology in the daily ordinary activities of individuals. Subsequently, to create a scientific culture toward achieving a strategic program of scientific and technological literacy there is therefore the need for a general scientific education.

Integrated Science as a subject comprises of specific disciplines such as; physics, chemistry, biology, environmental and agricultural science and some social topics. This subject provides a conscious intervention to raise the level of scientific literacy and further equip students with the relevant basic scientific skills needed for national progress. Education in integrated science indeed provides tremendous opportunities for the youth to develop positive attitudes and values such as;

1. Curiosity to explore their environment.
2. Keenness to identify and answer questions through scientific investigations.
3. Creativity in suggesting new and relevant methods to solve problems.
4. Open-mindedness to accept all knowledge as tentative and dynamic.
5. Perseverance and patience in pursuing problems.
6. Concern for the quality of the environment.
7. Accuracy in recording and reporting scientific information (MOE, 2010).

2.2.1 Aims of Integrated Science Teaching

Integrated science at the senior high school aimed at providing students with the opportunity to:

1. Solve basic problems within his/her immediate environment through analysis and experimentation.
2. Seep a proper balance of the diversity of the living and non-living things based on their interconnectedness and repeated patterns of change.
3. Adopt sustainable habits for managing the natural environment for humankind and society.
4. Use appliances and gadgets effectively with clear understanding of their basic principles and underlying operations.

5. Explore, conserve and optimize the use of energy as an important resource for the living world.
6. Adopt a scientific way of life based on pragmatic observation and investigation of phenomena.
7. Search for solutions to the problems of life recognizing the interaction of science, technology and other disciplines (West Africa Examination Council. Syllabus, 2010).

2.2.2 Profile Dimensions in Integrated Science

The concept profile dimensions signify a collection of psychological units of a particular learning behaviour (MOE, 2012). It is considered as the central aspect of the school science curriculum and it is expected to guide teaching, learning and assessment (MOE, 2012). Profile dimensions involve action verbs that constitute specific objectives stated in science curriculum (MOE, 2012). At the Senior High School (SHS) level, the profile dimensions expected for teaching, learning and testing of Integrated Science are of different percentages. The stipulated percentage weightings on various profile dimensions in the senior high school integrated science are as follows:

1. Remembering and Understanding 20%
2. Applying Knowledge 40%
3. Practical and Experimental Skills 40%

The percentage weightings reveal that a lot of emphasis has been placed on Application of Knowledge and Practical and Experimental Skills, hence teachers must plan and execute teaching such that learners are allowed adequate time and space to perform varied activities (MOE, 2012; Acquah, Yakubu, & Osei-Yeboah, 2018).

2.2.2.1 Remembering and Understanding (RU)

Remembering is the process of committing information to memory (Johnson-Laird, 1998). It also involves processes such as understanding, retention and retrieval of information from the memory. Understanding is generally the ability to grasp the meaning of some material that may be verbal, pictorial, or symbolic (MOE, 2012). Johnson-Laird further explained that remembering requires the learner to understand a concept, retain it over a period of time and then recall the concept during assessments. Johnson-Laird (1998) proposes a five-step process for remembering;

1. The registration of information and decision to remember
2. The mental representation of the information
3. The maintenance of the memory
4. retention of the memory during thought process
5. Retrieval of the memory.

In testing students" knowledge and understanding of concepts learnt, the action verbs used are; recognize, retrieve, locate, find, recall, identify, define, describe, list, name, match, state, interpret, explain, infer, compare, explain, exemplify, categorize, comment, annotate, subscribe, summarize, translate, rewrite, paraphrase, give examples, generalize, and estimate among others (MOE, 2012).

2.2.2.2 Applying Knowledge (AK)

Application of Knowledge describes the ability of learners to use the knowledge and skills acquired to solve problems, operate tools and equipment, demonstrate scenario, discover principles and carry out experiments (MOE, 2012). On the other hand, activities such as breaking down a piece of material into its component parts to; differentiate, compare, deconstruct, attribute, outline, find, structure, integrate, link, validate, crack, appraise, distinguish, separate and identify significant points among others are under this domain. (MOE, 2012). Application of knowledge, as directed by the Integrated Science syllabus, involves the following learning behaviours; application, analysis, innovation or creativity and evaluation (MOE, 2012).

Though all these behaviours are relevant in knowledge application, however studies performed by science educators suggest consistently a highly positive correlation between students‟ creativity and science achievements (Gunn & Pomahac, 2008; Lam, Au Yeung, & McNaught, 2010). According to Simonton (2004) creativity requires an understanding of scientific logic and content in any discipline. Simonton (2004) further argues that, making analogy across different disciplines is a critical indicator of creativity. Though Mishra et al (2013) supports all the arguments put forward by Simonton (2004), Mishra et al (2013) is of the view that learning the content and mastering the creativity skill should be integrated.

Therefore, researchers have concluded that creativity is the most important piece of learning under knowledge application in science (Cheng, 2010). According to Lawson (1995) creativity is required to; develop scientific ideas, connect different ideas, formulate solutions to solve problems, implement solutions through practical activities and evaluate results.

2.2.2.3 Experimental and Process Skills

Science Experimental and process skills are the cognitive and psychomotor skills used in identifying and solving problems as well as collecting, analyzing, and presenting data (Akinbobola & Afolabi, 2010). Again, Experimental and process skills are the mental and physical abilities and competencies which serve as tools required for technology (Nwosu & Okeke, 1995). Further studies by Abungu, Okere, and Wachanga (2014) reveal that Experimental and process skills involve two processes; basic and integrated process skills.

Basic process skills include; observing, drawing, questioning, classifying, measuring, and predicting whiles integrated process skills include; formulating hypotheses, manipulating materials, designing investigations, identifying and defining variables. Integrated process skills again include; collecting and transforming data, establishing relationships between variables, interpreting data, and making inferences and generalizations (Chebii, 2008). However, a better acquisition of the basic process skills results in an excellent development of the basic integrated skills (Aka, Guven, & Aydogdu, 2010). A basic process skill such as measuring, drawing, classifying or observing begins at the elementary level; however more accurate tools are used at the secondary level during practical sessions (Bybee, 200). Practical sessions according to Okere (1996) involve the recording of observations, results, and measurements, drawing experimental set-ups and presenting them in tabular, descriptive and graphical forms. Also, interpretation as a basic integrated skill is a cognitive skill which students utilise to make scientific logic out of data obtained from a practical work (Tomkins & Tunncliffe, 2001).

To demonstrate the acquisition of experimental and process skills students should be able to develop properly their psychomotor domains such as handling apparatus, drawing and improvisation (Bilgin, 2006). According to Katz, et al. (2014) teachers can use drawing as a diagnostic tool to monitor students" performance effectively. This as explained by Katz, et al. (2014) is possible because drawing directly improves formative factors such as; creativity, perception, motor skills, intellect and emotions. Examples of empirical studies suggest that, students who receive inquiry instructions show positive gains in science process skills than those who receive traditional instructions (Brickman, et al., 2009). Another example by Bilgin (2006) confirms that using hands-on, cooperative learning method of instruction leads to higher achievement in process skills acquisition as compared to the teacher-centred method. Further explanation by Okere (1996) indicates that, there is always a strong positive correlation between the drawings or recordings presented by a student and the accuracy of the observed results.

2.3 Teaching Integrated Science

According to Dumela and Bree (2016) teaching is the act of imparting knowledge to learners. The teaching of integrated science can therefore be considered as the act of imparting the content of all the disciplines which forms the subject referred to as integrated science. The teaching and learning of integrated science ought to be guided by standards in order to achieve its goals and objectives. Though diverse standards have been mentioned worldwide by researchers such as; Dumela and Bree (2016) and Miles (2015), however, Bybee, Carlson-Powell and Trowbridge (2008) have summarized the standards adapted from the American Science Education specifications as;

1. The use of child-centered strategies by teachers;
2. Teachers should engage students in interactions to identify and support their individual differences;
3. Teachers ought to constantly assess their teaching as well as the performance of learners;
4. Teaching and learning conditions should have reasonable duration, space and resources;

To ensure the use of these standards in teaching effectively, researchers have recommended the utilization of the constructivist instructional model (engagement, exploration, explanation, elaboration and evaluation) which engages students in all the aspects of inquiry-based learning (Bybee et al., 2008; Hafize, & Fezile, 2012). Even though the above standards are set as guidelines in the USA, they could be potentially efficient in science classrooms worldwide.

Indeed, the worldwide diverse standards of teaching integrated science as mentioned earlier by Dumela and Bree (2016) also confirms the active participation of learners in all the teaching-learning procedures. Dumela and Bree (2016) are of a very strong opinion that, the active participation of learners enhances their ability to connect scientific concepts and skills to real life practical occurrences. In reality, the understanding, retention and practicing of scientific concepts and skills are properly achieved when learners are taught using the child-centered approach (Dumela & Bree, 2016). Unfortunately, objective observations performed in most schools in West Africa (Ibe, 2015; Okoli & Azubuike, 2012) vividly reveal that, presently a significant proportion of science teachers still utilize methods that are teacher-centered to teach integrated science despite it numerous advantages.

2.4 Teacher Classroom Activity Methods in Science

The "teacher classroom activity method" involves any procedure that is practically performed by the teacher or performed by learners which were initiated by the teacher (Miles 2015). Such "teacher classroom activity method" may include either one or a combination of the following methods of teaching; activity, demonstration, discovery, project, inquiry and fieldwork (Cortright et. al., 2005). Teacher classroom activity method may use to design and conduct laboratory activities to engage students individually, in small groups and in large-group laboratory activities in which the teacher guidance and instructions may range from highly structured and teacher centered to open inquiry in which the student may take the center stage (Hofstein & Mamlok-Naaman, 2007). Though there are different teaching methods employed in science education (Cortright et. al., 2005), this study utilized a combination of the activity and the demonstration methods to teach direct current electricity.

This "teacher classroom activity method" is contemporary and further promotes maximum social interactions in the classroom (Nguyen, Williams & Nguyen, 2012). Such collaborative interactions between students and students as well as between students and the teacher as emphasized by Nguyen, Williams and Nguyen (2012) guarantee an efficient and effective teaching-learning procedure. For example, such a procedure creates opportunities for students to deliberate on scientific concepts, verify hypothesis and further solve real life problems. Specifically, Nzewi (2008) recommends that, the teacher classroom activity methods of teaching can be regarded as a strategy that can be adopted to make the task of teaching more real to students as opposed to the abstract or theoretical presentation of facts, principles and concepts.

Therefore, this procedure contradicts the teacher-centered methods of teaching and learning science which according to Berry (2008) and Bok (2006) supports an average student to retain permanently only 20% of content imparted. Indeed, other science educationists have objectively mentioned time constraint and sizeable classes as the main factors militating against all child-centered approaches (Berry, 2008; Franklin, Sayre & Clark, 2014; Gehlen-Bauum & Weinberger, 2014).

2.4.1 Activity Method

The activities typical of a science class should include; manipulating equipment and materials, writing and drawing, asking and answering questions, explaining or presenting facts and scientific concepts. Others involve; observing and following instructions on experimental procedures among others (Omodara & Bandele, 2010). All these activities in reality, as assessed by Omodara, and Bandele (2010) can be broadly classified into three main domains; cognitive, affective and psychomotor activities. Furthermore, Omodara and Bandele (2010) in observing a specific science class concluded that, over 75% of the time allocated was mainly utilized for only cognitive activities. Indeed, the main adverse effect of this time allocation according to Inamulla, Naseer and Husain (2008) is that, it fails to enhance the development of intellectual and thinking skills of students. To avert this negative effect, fortunately for teachers, studies have revealed that there exists a strong linear correlation between a teaching method and the level of students" active participation (Omodara, 2010b). Practically, evidence from studies dominated by active participation confirms that about 80% of learners are readily able to correctly answer all questions posed by the teacher (Omodara, Kolawole, & Oluwatayo, 2008). On the other hand, Oviawe (2016) though confirms the positive influence of active participation, Oviawe (2016) further argues that, verbal utterances of teachers also have some level of influence on students" performances. Therefore, active participation ought to be augmented at all occasions with verbal utterances that would not upset learners.

2.4.2 Demonstration Method

The demonstration method describes a teaching technique whereby the teacher sorely performs an activity for students to observe with the intention to properly enhance the acquisition of knowledge and skills (Amadola, 2012). Again, according to Mundi (2006), the demonstration method involves a display or an exhibition usually presented by the teacher while students observe with keen interest. Though most explanations have limited the method to only teachers demonstrating to the class, however, other observers have recommended the involvement of resource persons (Daluba, 2013). Indeed, the explanations cited reveal that the demonstration method is student-centered and hence aimed at enhancing an efficient and effective teaching-learning procedure.

A demonstration according to Smith (2000) becomes necessarily when;

1. Materials needed for a particular skill development is not available for every member of the class.
2. The equipment or teaching-learning materials involved are expensive.
3. The activities involved pose a high risk to learners.
4. The skill being taught is complex.
5. Equipment or teaching-learning materials to be used are fragile or delicate.

Furthermore, science educators in outlining the benefits of using demonstration claim;

1. The method improves students' understanding and retention of scientific concepts and skills (McKee, Williamson & Ruebush, 2007).
2. The demonstration procedure is effective in teaching skills which involve the use of sensitive and delicate laboratory equipment as well as toxic or harmful chemicals (Ameh, & Dantani, 2012).
3. The method prevents rote learning (Crouch, Watkins, Fagen & Mazur, 2007).
4. The method is relatively cost effective (Mundi, 2006).
5. The demonstration process stimulates interest, focuses attention and therefore makes learning permanent (Ameh, & Dantani, 2012)
6. Empirical studies reveal that, though there has always existed a correlation between pedagogy and performance; however, that of the demonstration technique is exponential in nature (Bencze, Alsop & Bowen, 2009; Cahyadi, 2007; Sokoloff, Laws & Thornton, 2007 and The Centre for Inspired Teaching, 2008). Statistically Bencze, Alsop and Bowen (2009) estimate that,

classroom activities could account for 94.5% of success or failure of science students in examination.

In fact, a very objective assessment of the teacher classroom activity method by McKee, Williamson and Ruebush (2007) reveals that, the time available to undertake this procedure is very limited and, in some instances, does not really lead to hands-on laboratory experiences by learners.

2.4.3 Problems Facing the Effective Use of the Teacher Classroom Activity Method in Teaching Science

The use of the teacher classroom activity method in teaching science has become a dogma among science educators and teachers (Salmi, 2000). On one hand, they extolled the importance of the use of the method in science teaching while on the other hand, they only pay "lip service" to its use in practice (Allen, et al., 2009). Science teachers do not usually find it convenient to make teacher classroom activity method the center of their instructions in science (Abimbola, 2006). The usual complains are usually of lack of materials and equipment to carry out practical work (Salmi, 2000). Also the conditions under which many teachers function do not engender any enthusiasm to use the teacher classroom activity method of teaching science even when well-equipped laboratories are available (Salmi, 2000).

Another reason why teachers refused to use child-centred methods in science is class size. Class size in urban schools is getting larger and this does not usually encourage teachers to use the teacher classroom activity method to teach science (Allen, et al., 2009). In some urban schools with large class sizes, teachers go for months without using activity methods to teach science (Abimbola, 2006). Higher institutions with the responsibility of training science teachers at all levels, are increasingly churning out teachers without requisite laboratory experience (Abimbola, 2006). Such trained science teachers usually lack the necessary confidence to conduct practical classes with their students (Abimbola, 2006).

2.5 Performance of learners

The performance of learners has been argued from diverse perspectives by researchers (Martin & Sass, 2010). According to Menenu (2018), academic performance is a notion utilized to qualify the observable expression of a learner"s knowledge, skills, understanding and ideas. In expressing this knowledge, learners are expected to contribute ideas, analyze the factors associated with the ideas; develop possible solutions to problems apply and further evaluate the solutions (Yawe, 2011). Based on the overall aim of this research, it is therefore deemed appropriate and very relevant to set an expected minimum mark of 50% to be achieved by all students after the intervention. This 50% is graded as C6 which is the minimum entry requirement for admission into all tertiary institution in Ghana (WAEC, 2020). According to Graetz (2008) several factors contribute to students" performance in class, some of these factors include social economic status of parents, educational institution, classroom management, lack of science laboratory and effective teaching.

2.5.1 Socioeconomic status

For example, Considine and Zappala (2002) mention socio economic status of parents as a factor that impact on the academic performance of students. They explain that, learners from wealthy parents are more likely to be successful academically as they are provided with sufficient psychological and emotional supports. According to Graetz (2008) learners from wealthy parents are readily introduced to learning environments that develop confidence and further enhance the improvement of skills needed for success in achievement.

2.5.2 Educational institution

Standard and type of educational institution attended strongly influence the learning outcomes and educational performance of students (Bhavana & Achchi, 2018). Indeed, schools having poor basic facilities especially for the teaching of the sciences have low performance expectation which adversely affect the learning outcomes of students (Kwesiga, 2002). Studies confirming this assertion claim that, elite schools perform successfully because the resources and facilities available directly influence the performance of the students (Adetayo, 2008; Masingila & Gathumbi, 2012).

In terms of teaching and learning science, standard schools terns to have well equipped science laboratory which enable students to perform practical activities which affect their performances in science.

Laboratory has been described as a room or a building specially built for teaching by demonstration of theoretical phenomenon into practical terms (Ado, 2009). With the laboratory experience, students will be able to translate what they have read in their texts to practical realities, thereby enhancing their understanding of the learnt concepts (Hofstein, 2004). Yara (2010) argued that seeing is believing is the effect of using laboratories in the teaching and learning of science and other science related disciplines as students tend to understand and recall what they see more than what they hear and also acquire skills practice. Laboratory is very important and essential to the teaching of science and success of any science course is much dependent on the laboratory provision made for it. Lending credence to this statement, Odubunni and Balagum (2000) said that there is a general consensus among science educators that laboratory occupies a central position in science instruction. It could be conceptualized as a place, where theoretical work is practicalised (Odubunni & Balagum, 2000). Practical works in any learning experiences involve students in activities such as observing, counting, recording, measuring, experimenting, recording and carrying out fieldwork (Habu, 2005).

These activities could not be easily carried out, where the laboratory is not well equipped. There is usually a strong move to emphasize the dependence of science teaching on the existence of a well-equipped science laboratory (Habu, 2005).

Laboratory activities have long had a distinctive and central role in the science curriculum and science educators have suggested that many benefits accrue from engaging students in science laboratory activities (Hofstein & Lunetta, 2004; Hofstein, 2004; Lunetta et al., 2007).

At the beginning of the twenty-first century, both the content and pedagogy of science learning and teaching are being scrutinized, and new standards intended to shape and rejuvenate science education are emerging (Ado, 2009).

Lois, (2013) reaffirm the conviction that teacher and student classroom activity in general and inquiry in the context of practical work in science education is central to the achievement of scientific literacy and quality education (Ado, 2009). Inquiry-type laboratories have the potential to develop students' abilities and skills such as: posing scientifically oriented questions (Krajcik et al., 2001; Hofstein & Mamlok-Naaman, 2007), forming hypotheses, designing and conducting scientific investigations, formulating and revising scientific explanations, and communicating and defending scientific arguments (Hofstein & Mamlok-Naaman, 2007). Tobin (1990) noted that Laboratory activities appeal as a way to learn with understanding and, at the same time, engage in a process of constructing knowledge by doing science. He also suggested that meaningful and quality learning is possible in the laboratory if students are given opportunities to manipulate equipment and materials in order to be able to construct their knowledge of phenomena and related scientific concepts. Yara (2010) also lent credence to the significance of laboratory work in the learning scientific concepts and acquiring scientific skills. In his submission, he identified six major significance of laboratory method in promoting quality and effective learning of science and these are follows:

I. Motivating students by stimulating interest and enjoyment
II. Teaching students skills needed to study science
III. Assisting concept acquisition and development
IV. Developing and understanding of scientific inquiry and developing expertise in conducting laboratory activities
V. Encouraging social skills development
VI. Inculcating in students scientific attitudes

Yara (2010) listed laboratory adequacy as one of the factors that affect the learning outcomes of students. In terms of academic achievement, Kofo (2012) noted that laboratory instructional strategy gives a new approach to science teaching and learning because it provides a non-threatening, realistic and concrete approach to learning of science as opposed to the difficulty encountered in learning the formal, abstract treatment of the typical textbook. Oyedeji (2000) discovered that students taught with science Laboratory Instructional Strategy performed significantly better than use of traditional lecture and text book method. The most effective vehicle by which the process of inquiry can be learned appears to be a laboratory method where the student experiences, firsthand, the inquiry process. Laboratory method has also been demonstrated to be effective means for comprehension, understanding and application of scientific knowledge (Kofo, 2012). Laboratory experiences provide opportunities for teachers to model best practices in the study of scientific concepts, including application of scientific methodologies, respect for life and the environment, inclusion of learners of all abilities, and consistent adherence to safety standards (Odubunni, & Balagun, 2001).

From the discussion above, it is quite obvious that well equipped laboratory should be available to the teacher during the utilization of the teacher classroom activity method and any other methods that involve the use of laboratory.

2.5.3 Classroom management

Classroom management significantly controls academic performance (Martin & Sass, 2010). Sunday-Piaro (2018) explains classroom management as the processes and strategies employed by a teacher to maintain an environment that is conducive to the successful performance of learners. According to Umoren (2010) classroom management is not limited to just controlling and disciplining the student but all the activities that the teacher must do to promote academic involvement and cooperation in the classroom. Such strategies include; curtailing learner"s disruptive behaviors such as fighting and noise making, arrangement of classroom learning materials, skillful teaching of content and the effective redress of students" behavior (Marzona,2008). A study to assess the effectiveness of classroom management by Bassey (2012), Marzono (2003) and Moore (2008) revealed that, teaching and learning in properly managed environments, enhances students" engagement in lesson, reduces students" inappropriate and disruptive behaviour, increases student responsibility for academic work, and improves students" academic performance.

2.5.4 Effective teaching

According to Ayeni (2011), teaching is a process that involves bringing about desirable changes in learners so as to achieve specific outcomes. This is expected to be in a form of communication between a more knowledgeable individual and a learner in imparting knowledge (Asokhia, 2009).This process involves three main components; the person imparting the information, the message or information and the receiver of the message (Asokhia, 2009).The primary purpose of teaching at any level of education is to bring a permanent fundamental change in the learner (Tebabal & Kahssay, 2011). To facilitate the process of knowledge transmission, teachers should apply appropriate teaching methods that best suit specific objectives at various levels. Further arguments by Mukolwe, Kadenyi, and Mukuna (2018) suggest that, for a teaching method to be effective it should be guided by a pedagogical theory. Effective teaching as explained by Akomolefe (2010) and Omoifo and Urevbu (2007) involve the use of distinctly formulated objectives, illustrated instructions and the application of knowledge to related problems. Again, in order to ensure effective teaching, Adunola (2011) also maintains that teachers need to be conversant with numerous teaching strategies that take recognition of constructivism. However, effective teaching at all levels ought to be concluded by the use of appropriate techniques to evaluate students (Omoifo & Urevbu, 2007).

Substantial research on the effectiveness of teaching methods indicates that the quality of teaching depends on the professional skills of the teacher and is manifested in the achievements of learners (Adunola, 2011). Effective teaching has been considered widely by various observers as promoting academic performance of students (Akinmusire, 2012; Kukuru, 2010). The outcome of effective teaching on learners are; creativity in thinking, ideas conceptualization, development of potentials and a permanent change in behavior (Adegbile & Adeyemi, 2008). However, all these outcomes according to Babalola (2009) strongly depend on the methods utilized by the teacher.

For the teaching of integrated science to be effective, a lot of methods have been recommended in all existing literature (The Centre for Inspired Teaching, 2008). Prominent among them are inquiry, activity, discovery, demonstration and expository teaching which are constructivism inclined (Centre for Inspired Teaching, 2008). Though all these teaching methods, and many others, have been recommended, however, the integration of the activity and demonstration methods have been highly commended (Bencze, Alsop, & Bowen, 2009); as it aroused and sustained students" interest throughout the lesson (Cahyadi, 2007; Sokoloff, Laws, & Thornton, 2007).

For the learning of integrated science to be effective, learners should be in a position to assume responsibility for their own learning through active construction and reconstruction of their own meanings for concepts, events, experiences and phenomena (Brass, Gunstone, & Fensham, 2003). Research findings suggest that most of the learning in science do not involve the development of conceptual understanding by students (Brass et al., 2003; Freitas, Jiménez, & Mellado, 2004; Gunstone, Mulhall, & McKittrick, 2009).

Currently, contemplations over the effectiveness of teaching methods on students learning have consistently raised considerable interest in the thematic field of educational research (Hightower, 2011). Moreover, research on teaching and learning is consistently being focused on the extent to which different teaching methods enhance achievement in students" learning.

2.6 Students' Perceptions on "teacher classroom activity"

Earlier explanations suggest that, perception is the natural ability to understand or notice something quickly (Ou, 2017). Again, perception refers to the awareness of things through the physical sense, especially sight (Procter, 1995). A person‟s perception is that person‟s ability to notice and understand things that are not obvious to other people (Allport, 2006). This, according to Allport (2006) could be explained from physical, psychological and physiological perspectives. According to Allen, Sian and Shevell (2012), perception is valuable because it influences the information that enters a working memory. Students‟ interest in science has been conceptualized as a complex and diverse construct that includes; perceptions, value of science as a discipline, enjoyment, and achievement (Osborne, Simon, & Collins, 2003). Again, background knowledge in the form of schemas and subsequent learning affect perception. Research findings have corroborated this claim that background knowledge resulting from experience strongly influence perception (Allen, Sian and Shevell, 2012).

There are varieties of reasons why students, especially at the pre-tertiary level, may perceive Integrated Science as difficult in comparison to other core subjects. For example, in a general overview, findings by Anamuah-Mensah (2004) reveals that students‟ perceptions of the methods used in teaching topics in science strongly reflect their performance in those topics. Another study by Allen, Sian and Shevell (2012) shows that, when teacher-centered methods for teaching science have not enhanced the understanding of concepts hence raising perception among students that science is really a difficult subject. Such a misunderstanding among students leads to misconceptions about scientific phenomena and may subsequently result in a high perception that science is difficult to study (Behar & Polat, 2007). On the other hand, Mallam (2004) opines that perception increases among students when they perceive the teacher to be incompetent in imparting scientific knowledge and skills.

Others including Ogunkola and Samual (2011) are of the view that, how students perceive a subject is based on their experiences or even from information about the subject from other persons. In citing specific examples, Ogunkola and Samual (2011) state that, most students generally found difficulty in physics and chemistry concepts such as electrical and heat energy, physical and chemical changes and components of air. Other findings regarding perceived difficult topics in integrated science based on the location of school was observed with students in urban schools recording the lowest perception whilst rural schools recorded the highest perception (Etsey, 2005). Again, Anderson (2004) also argues that, learning environment and the availability of infrastructural facilities are contributing factors to positive learning outcomes.

Practically, the perceptions pupils hold on to become an accepted means of reviewing teaching methods and developing effective teaching strategies (Mohan, 2007). Such a review in pedagogy may be urgently required especially if the teaching methods still utilized by teachers are not adequate to allow for conceptual change in students (Behar & Polat, 2007). However, researchers are of the opinion that consulting students about their perceptions of science can enhance their learning and contribute to the development of a wider range of teaching strategies (Flutter & Rudduck, 2004). Therefore, students" perceptions can be used in research to identify the respective teaching strategies perceived to be the most effective means to facilitate the learning of science (Abdulghani & Al-Nagger, 2015). Studies by Abdulghani and Al-Nagger (2015) pinpoint that, students "feedback when implemented is indeed an invaluable tool for improving learners" performances. Another advantage, according to Abdulghani and Al-Nagger (2015) is that students" feedback helps to provide several diverse useful inputs for educational improvements. For example, curriculum review processes, learner-centered knowledge building processes, teaching methods as well as enhancing the quality of learning environments (Abdulghani & Al-Nagger, 2015).

2.7 Teaching Direct Current (D.C) Electricity

Direct current electricity is one of the major topics in physics and Integrated Science at the pre-tertiary level (Ates, 2005). However, students‟ understanding of concepts in direct current electricity is affected by misconceptions, preconceptions and alternative conceptions (Ates, 2005). Students in pre-tertiary levels have preconceptions about concepts such as 'electric current', 'voltage' and 'resistance". Others include; series and parallel circuits', 'electric potential', 'electrical energy' and Ohm‟s law (Engelhardt & Beichner, 2004). Such preconceptions could be due to several reasons such as; teaching methods, students‟ pre-existing knowledge, insufficient connection between concepts or between pre-existing knowledge and new knowledge, textbook and procedural learning (Aubrecht & Raduta, 2005).

A study conducted by Kừçközer and Kocakừlah (2007) about secondary school students' misconceptions about simple electric circuits in Turkey involving seventy-six students in the three grade 9 classes, revealed the following misconceptions;

1. No bulb lights when the circuit is closed,
2. Bulbs in parallel are always brighter than those in series,
3. Batteries are constant sources of current, and
4. Current is consumed by components in the circuit.

These misconceptions were attributed to; everyday use of language and the usage of the teacher- centered approach.

Other studies by science educators including Periago and Bohigas (2005) and Clement and Steinberg (2002) report that students have alternative conceptions on concepts such as "electric circuits", "electric charges" and how the brightness of bulbs and resistance change in series and parallel arrangements. This alternative conception is as a result of students" prior academic knowledge, pre-existing knowledge, learning difficulties and misunderstandings about direct current electricity in their previous learning.

Another hindrance to students" understanding of the direct current electricity concepts is the kind of mental models they possess prior to the teaching of the topic (Ipek & Calik, 2008). According to Ipek and Calik (2008) students possess six mental models on direct current electricity prior to the teaching of the topic. These include;

1. "Unipolar model" (sink theory): where students assume one wire between a bulb and a battery can light a bulb;
2. "Clashing current model" (two-component theory): two types of current (positive and negative) leave the terminals to meet and light the bulb;
3. "Closed circuit model": the circuit elements have two connections - current circulates around the circuit in a given direction and current flowing through a resistive circuit element liberates energy;
4. "Current consumption model" (Attenuation model): some portion of the current is used up as it goes through each component of the circuit;
5. "Constant current source model": a battery is seen as a source of constant current.
6. "Scientific view model": current flows round the circuit to transmit energy. Current is conserved and well differentiated from energy. The circuit is seen in a whole as an interacting system, such that a change introduced at one point of the circuit affects the entire system.

However, research findings available suggest that students can easily change their views on concepts in DC electricity when appropriate methods of instruction are used (Heller & Finley, 1992).

2. 8 Empirical evidences

In a research conducted by Omodara, Kolawole and Oluwatayo, (2013) in which teacher classroom activity and student classroom activities were used to measure the academic performance of senior secondary school students in core science subjects Ekiti state in Nigeria. In all 54 teachers and 1,620 SS students across the state were used. The data for this research was obtained using 26 item interaction schedule and achievement test. The findings of the research show the use of teacher classroom activity (demonstration method) and student"s classroom activity (activity method) in teaching core science have significant effect on students" performance. This is evidence in the r-calculated value 0.432 for activity method and 0.970 of teacher classroom activity which are greater than r-critical value 0.273 at 0.05 level of significance. Again, the r-calculated value of teacher classroom activity is far greater than that of the students" classroom activity, this implies that teacher classroom activities in science lessons improved academic performance of students" better than the classroom activities of students in the science lessons.

Again, a research conducted in Israel by Basheer, et al.,(2016) on „The Effectiveness of Teachers' Use of Demonstrations for Enhancing Students' Understanding of and Attitudes to Learning the Oxidation-Reduction Concept" the result shows the mean achievements score among students exposed to demonstrations method after the treatment was 86.79, whereas those who were not exposed to the demonstration method was 81.03. Further analysis using t-test shows a significant difference between the means ($t = 3.26$, $p < 0.01$) and between the two cases ($t = 3.72$, $p < 0.001$), indicating that a significant improvement in the achievements of students exposed to demonstrations method when learning redox and electrolysis.

Another research conducted by Ekeyi1, (2013) to investigate the effect of teacher classroom activity method on students" achievement in agricultural science in secondary school in Kogi East Education Zone of Kogi State. Six (6) secondary schools were sample out of 196 schools, four hundred and eighty (480) students in the twelve intact classes constituted the sample for the study. The instrument for data collection was a 30-item „Agricultural Science Achievement Test" (ASAT). The available data shows mean pretest score and standard deviation of 47.77, 4.48 and 46.33, 4.30 for the experimental and the control group respectively. But after the treatment the posttest mean scores for the experimental students improved appreciably from 47.77 to 66.57 while their standard deviation shows a decrease. But for the control group, it was an improvement from a mean score of 46.33 to 61.47 and an increase in standard deviation of 4.30 to 6.05. This implies that the experimental class performed better in the achievement test than the control group.

Additionally, a research by Akani, (2017), aimed at determining the effect of teacher classroom activity method on student"s achievement in chemistry at the secondary school in Afikpo Education Zone of Ebonyi State of Nigeria. The sample for the study comprised 201 Secondary School 3 chemistry students from Afikpo Education Zone of Ebonyi State of Nigeria. One intact class of 201 Secondary School 3 chemistry class was randomly selected and assigned to either control or treatment group. The treatment group was taught with the teacher classroom activity method while the control group was taught using conventional method. A mean pretest score of 10.3, and 7.7, were obtained by the experimental group and control group respectively. After the treatment posttest was administered to both groups. The mean and the standard deviation of the posttest are 15.1 for the experimental group and 12.4 for the control group. This implies that the students in the experimental group had better achievement than those in the control group.

A research conducted by Adu-Gyamfi, (2013) which sought to investigate the effects of Activity Method (AM) on 53 Junior High School students" performance in energy transformation at the Sekyere South District of the Ashanti Region of Ghana. A pretest-posttest action research design was used as the main design for the study. The students from the experimental group were taught with the Activity Method whereas the students from the control group were taught with the traditional lecture method. After the pretest the data shows that two-thirds of the students from the control group with a mean 3.2 (SD = 1.3, Max score = 6) were found between a scoring range of 1.9 and 4.5. However, two-thirds of the students from the experimental group were found between a scoring range of 1.6 and 4.2 indicates that students from both control and experimental groups had difficulties in topic. However, there was no statistical difference between the mean score of the students from the control group and the mean score of the students from the experimental group and both groups have the entry point. Data available after the posttest shows that majority (90.7%) of the students from the control group scored marks less than or equal to 10 whereas only 3.3% of the students from the same group scored marks greater than 10 to 15. It could further be deduced from the data that 47.8% of the students from the experimental group scored marks greater than 10.

Another research conducted by Musasia, et al., (2012) on the effect of practical work in Physics on girls" performance, attitude change and skills acquisition in three

Secondary Schools in Kenya, specifically on acquisition of science process skills, which involved two groups of girls from three sampled medium performing schools in Western Kenya. In the research experimental group was exposed to intensive practical work (activity method) whiles the control group was taught the same content using the conventional "chalk and talk method". A performance test of reliability index, of 0.879 was administered to both groups at the end of the semester. The results demonstrated that 97(70.29%) were able to perform observation, 86 (62.32%) did measurement, 89 (64%) classification and 88 (63.77%) perform recording, as compared to 23(17.29%), 25 (18.80%), 17 (12.78%) and 24 (24.05%) for the control group. This implied that the Experimental group gain more experience in all the stated process skills as compared to the control group. Again on acquisition of practical skill, 111 representing 80.43% were able to set up practical equipment, 98(71.01%) read measuring instruments, 109 (79.00%) manipulated data obtained and 113(81.88%) wrote laboratory reports as compared to 26(19.55%), 29(21.80), 20(15.04%) and 22(16.54%) in the control group. The result indicate that the Experimental group demonstrated superior practical skills as compared to the Control group (Musasia, et al,. 2012).

Research by Aboagy, (2009), which purported to compare the learning cycle approach (constructivist theory) to the traditional approach of teaching on senior secondary school students' understanding of selected concepts in direct current electricity, in New Juaben Municipality of the Republic of Ghana, In all 101 students (59 in experimental group and 42 in control group) who study physics as elective subject part-take in the study. The main data collection instrument was Current Electricity Concept Achievement Test (CECAT). Preliminary result in the study was done by comparing the pretest scores of the two groups' using t-test for independent samples shows that, there was no statistical1y significant difference between the mean scores of students in the experimental and control groups with respect to CECAT before instruction, hence both groups had similar preconception of the selected concepts in direct current electricity. Also, the results revealed that there was a significant difference between the posttest of the two groups; this was done by comparing the mean posttest scores of both experimental group (21.14) and the control group (16.07). It was also noted that the difference in posttest mean scores for the experimental and control groups was very large with a standardized effect size index of 2.06.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This chapter presents the research approach and design which entails methods and procedures involved in the study. It provides description of the research area, the population, the sampling and sample size, methods of data collection, data analysis, reliability and validity and ethical consideration in research field.

3.1 Research Area

The study was conducted in Agona Swedru which is the capital of the Agona West Municipality in the Central Region of Ghana (Fig.1).The Municipality lies within latitudes 5^0 30‟ and 5^0 50‟N and between longitudes 0^0 35‟ and 0^0 55W and covers a land area of 447 km^2 (GSS, 2013). The Agona West Municipality has a total population of 115,358 with female slightly dominating at an estimated population of 61,199 while male population was estimated at 54,159 (GSS, 2013). The population of Agona Swedru was also estimated at 55,239 with a higher proportion of the many tribes being *Agonas*. There are two (2) private tertiary institution in the Municipality, eleven (11) Senior High Schools (8 are private whilst 3 are public) and 137 basic schools (66 are private whilst 71 are public) (AWMA, 2015).

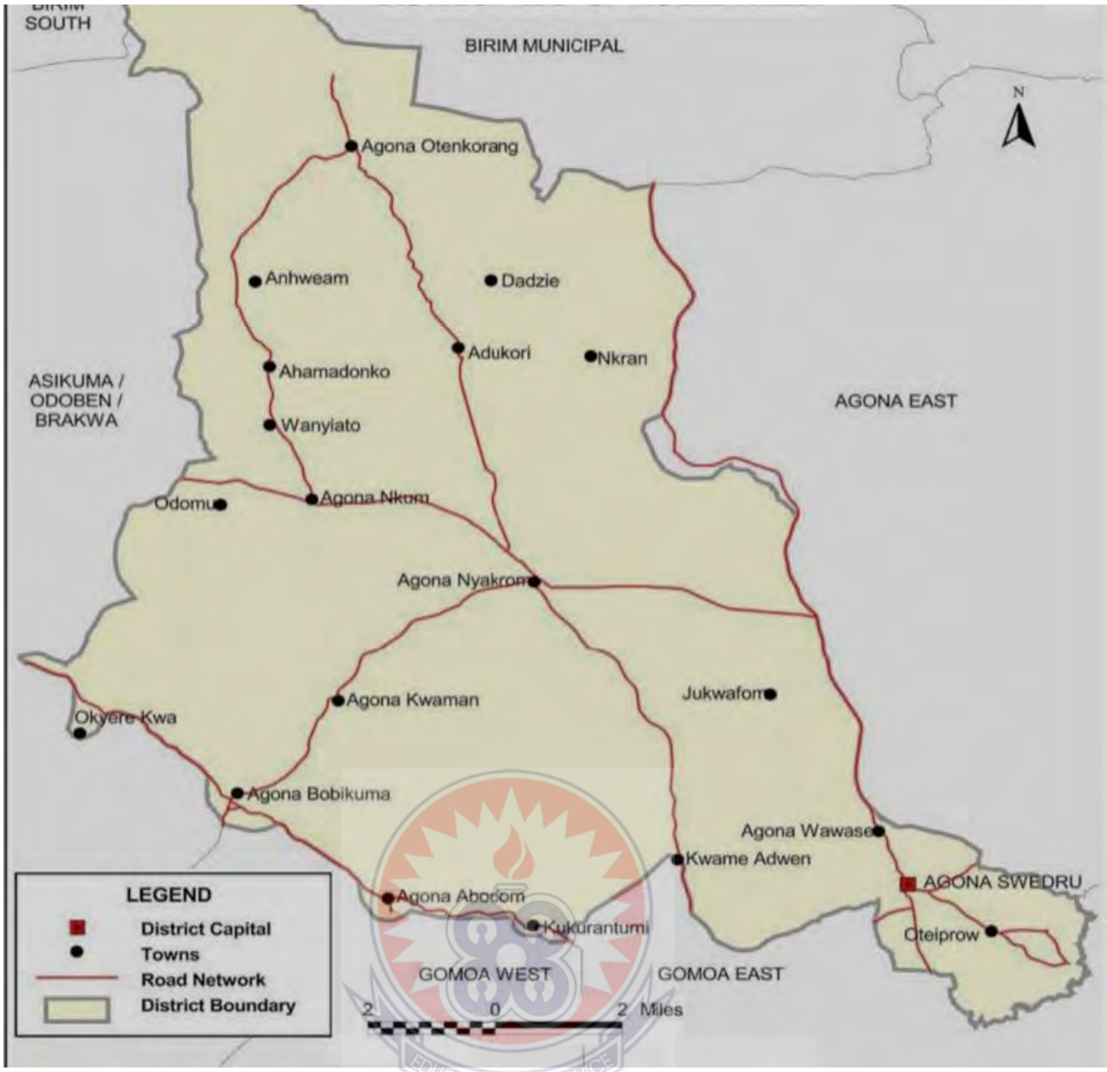


Figure 1 Map of Agona West Municipality

3.2 Research Design

A research design is a systematic plan or procedure in research which outlines how a researcher intends to perform a research process for the purpose of finding solutions to research problems and expanding knowledge and understanding (Creswell, 2009). Again, it also refers to the framework used to conduct a research, within the context of a particular set of philosophical assumptions (Wahyuni, 2012). It further includes a detailed plan for data collection and analysis depending upon the research question(s) or objective(s) of a study (Saunders, Lewis & Thornhill, 2012; Sekaran & Bougie, 2013).

There are different types of research designs and the choice for any particular study usually depends on the main objective of the research (Burns & Bush, 2000). Generally, five distinct research designs have been identified by research scientists. These include experimental, survey, longitudinal, comparative and case study (Bryman & Bell, 2011). The utilisation of these research designs involves the following broad approaches; quantitative, qualitative and multi-strategy-quantitative and qualitative (Creswell, 2009; Robson, 2002).

This study uses the case study design. Considering the objectives, this study discusses the effect of teacher classroom activity method on students" performances and perception in the study of direct current electricity under Integrated Science using intervention-posttest approach. Indeed, in the current research, qualitative data can be readily converted to quantitative data (Chang et al, 2009).

The quantitative approach uses numerical data by applying different statistics techniques to examine associations between variables (Saunders, Lewis and Thornhill, 2012). The quantitative research approach was utilised for this research based on the following advantages**:**

1. Data (numbers, percentages and measurable figures) can be calculated and manipulated efficiently by computer software, statistical package for the social sciences (SPSS) (Connolly, 2007).
2. It uses scientific methods for data collection and analysis which makes generalisation of results and findings possible. (Shank & Brown, 2007; Cohen, Manion & Morrison, 2007 & Morrison, 2008).
3. Quantitative research can be replicated to obtain the same results or otherwise (Shank & Brown, 2007; Lichtman, 2013).

4. There is relative control over alternatives such as interpretations, explanations and conclusions (Muijs, 2004; Litchman, 2006), hence the objectivity of the researcher is consistently maintained (Bryman, 2012; Creswell, 2009).

3.3 Population for the Study

A population is described as an entire group of individuals about which some information is required to be ascertained (Banerjee & Chaudhury, 2010) and must share at least a single attribute of interest (Bartlett et al., 2001; Creswell, 2003). The population considered for this study consisted of all SHS 2 students studying Integrated Science in Swedru School of Business.

3.4 Target Population

The target population was a subset of the general population, which was defined as the total group of individuals or participants from which the sample was drawn for a study (Bartlett et al., 2001; Creswell, 2003). Also, Lavrakas (2008) states that it is those units for which the findings of the research are meant to generalise. The target population for this study was made up of all the four SHS 2 Home Economics classes, of an average class size of 65 and an average age of 16 years.

3.5 Sample Size and Sampling

A sample refers to members of a population usually selected for the sole purpose of an investigation (Bryman & Bell, 2011). Again, a sample is the segment of a population that is selected for an investigation (Bryman, 2008; Cohen et al., 2007). Further explanations by Bryman (2008) and Cohen et al. (2007) suggest that it is the subset of the larger population which serves as representative for a study.

According to Yount (2006), Sampling is the process of selecting a group of subjects for a study in such a manner that the individuals represent the larger group from which they were selected. This study used the convenience sampling technique as

In every type of research, it would be superlative to use the whole population, but in most cases, it is not possible to include every subject because the population is almost finite. This is the rationale behind using sampling techniques like convenience sampling by most researchers (Battaglia, 2008). Convenience sampling also known as Haphazard Sampling or Accidental Sampling is a type of nonprobability or nonrandom sampling where members of the target population that meet certain practical criteria, such as easy accessibility, geographical proximity, availability at a given time, or the willingness to participate are included for the purpose of the study (Dörnyei, 2007). It is also referred to the researching subjects of the population that are easily accessible to the researcher (Joepasasa, & Given Lisa, 2008). Convenience Sampling are use due to its following advantages, is affordable, easy and the subjects are readily available (Hatch, & Lazaraton, 2001). It is also necessary to describe the subjects who might be excluded during the selection process or the subjects who are overrepresented in the sample (Henry, 2003). The main objective of convenience sampling is to collect information from participants who are easily accessible to the researcher (Hatch, & Lazaraton, 2001). The main assumption associated with convenience sampling is that the members of the target population are homogeneous (Morse, & Niehaus, 2009). Therefore, 30 girls representing the whole 2HE2 class were used for this study. Specifically, the 2HE2 class was conveniently sampled because the researcher teaches Integrated Science in the class and also the class" performance in Integrated Science Physics topics over the years has been below average.

3.6 Data Collection Procedure

Data are facts obtained about people, situations, events, things, and relationships (Tripp, 1996).

The techniques employed for data collection in this study were:

1. Tests
2. Questionnaire

3.6.1 Test

A teacher made test was designed and used to collect data on performance of students for the study. According to Marwat (2010), tests are able to assess perception and variety of human abilities such as potentials, achievements and behavioural tendencies.

In this research, interventions were done for 4 conservative weeks, using the teacher classroom activity method to teacher direct current electricity. After each weekly intervention, test consisting of theory, which covered knowledge and understanding and test of practical covering the four main skills under experimental and process skills were administered to the student. The test and its 10 points items or criteria covered all the distinctive profile dimensions as stipulated in the senior high school Integrated Science syllabus (MOE, 2012) of which experimental and practical skills covers 40% of the total point for each test.

The intervention using teacher classroom activity method begun by the teacher demonstrating key techniques, processes, equipment handling and operation and allowing students to repeat what is stated on the worksheet or spelt out by the teacher.

The interventions and the test for this research covered the following subtopics under DC electricity as stipulated in the integrated science syllabus for senior high school. (MOE, 2010)

1. Components and functions of a simple electrical circuit.
2. Arrangement of cells in a simple electrical circuit.
3. Arrangement of resistors in a simple electrical circuit.
4. Verification of Ohm"s law. (pg. 31)

The weekly lesson plans used for the four weeks period intervention lessons are presented below.

SPECIMEN OF WEEKLY LESSON PLANS FOR SELECTED SUBTOPICS IN DIRECT CURRENT ELECTRICITY

WEEK ONE

Topic: Components and functions of a simple electrical circuit.

Duration: 120 minutes

Relevant previous knowledge: Students have been using a torchlight bulb, dry cell(s) and connecting wires to produce light.

Objectives: By the end of the lesson, the student should be able to:

1. State the physical components of a simple electric circuit and their functions.
2. Draw a simple electrical circuit and rebelled the parts.
3. Define 'electromotive force', 'potential difference', and „electric current' and 'electric resistance' in his/her own words.
4. State the instruments used in measuring potential difference, electric current and electric resistance.

5. Use the instruments to measure potential difference, electric current, and resistance.

Teaching learning materials: dry cells, connecting wires, a bulb, voltmeter, ammeter.

Teacher-learner activity:

Introduction: Teacher uses questions to review students' previous knowledge.

1. Teacher explains the symbols used in electrical circuits to students. He explains to students the uses of the various materials supplied to them.

2. Teacher provides the material to students in groups of three.

3. Teacher demonstrates to students the different way to light up the bulb using the materials provided.

4. Students are asked to also connect up the materials to let the bulb light up.

5. Teacher explains the functions of the dry cell, connecting wires and bulb to students and asks them to copy the following into their notebooks.

6. Teacher guides students in using the ammeter to measure the current flowing through the circuit.

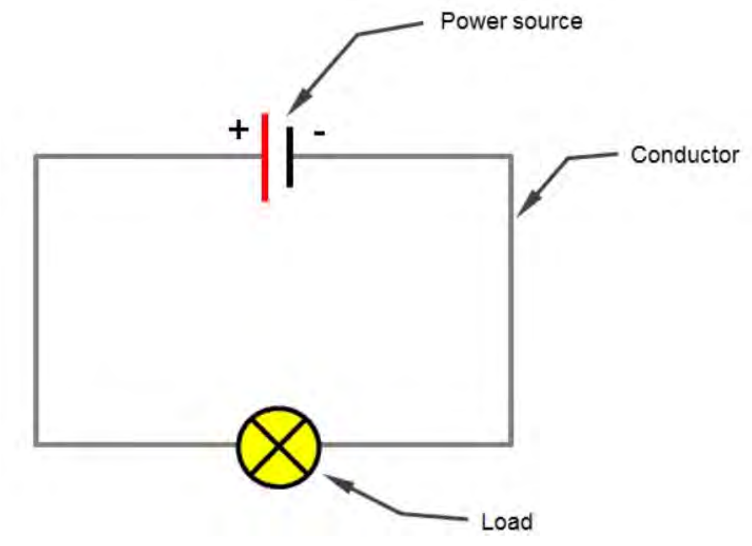
7. Demonstrate to students how to use the voltmeter in measuring the voltage in the circuit.

8. Allow the students to use their instruments to measure the respective quantities.

9. Teacher goes round the group to inspect what the students are doing.

Core points:

A simple electric circuit consists of at least a bulb (load), a dry cell (source) and connecting wires as shown below:



Electrical circuit may also consist of other components, such as a key/switch, resistor, capacitor, instruments like voltmeter, ammeter etc.

When the key is closed, the bulb lights up because current flows through the circuit. When the key is opened the bulb does not light up because no current flows.

A dry cell, either primary or secondary, supplies electrical energy; it has an electromotive force (e.m.f.) which drives electric charges (current) around a closed circuit which sets up a potential difference across the various components. The e.m.f may be defined as the total work done when the cell transfers a unit charge around a circuit. For any given circuit, the greater the e.m.f. the greater the current in the circuit. The unit of measuring e.m.f. is volt (V).

The e.m.f. creates an electric potential energy (potential) around a circuit. Conventionally, the direction of current is from the positive terminal to the negative terminal of a cell. Hence, the potential is considered to fall from the positive terminal to the negative terminal (i.e. the positive terminal of a cell has a greater potential than the negative terminal).

At any two points in the circuit, there exist a potential difference (Pd) arising from the fall in potential. Electrical potential energy is analogous to gravitational potential energy (i.e. the higher a body is from the ground the greater the potential energy). Electric potential energy may be defined as the work done in moving a unit charge from one point to another in a circuit.

The amount of electric charge that passes a point in a circuit in one second determines the current. Electric current (I) may be defined as the rate of flow of electric charges around a circuit. Its unit is ampere (A). Mathematically

$$\text{Current (I)} = \frac{Electri\ charge\ (Q)}{Time\ (t)}$$

As the electrons move through a wire their movements get restricted by the positive centers which are continuously vibrating about their fixed positions.

This offers resistance to the flow of electric charges. Electrical resistance may be defined as the force which opposes the flow of electric charges (current) in a conductor. Its unit is ohm (Ω).

The filament of the torchlight bulb is made of a thin wire which offers more resistance to the flow of charges compared to the connecting wires in a circuit. Through collision, charges in the filament produce friction which generates heat energy and is converted to light energy to light the bulb.

Closure: Sum up the lesson and invite questions from students and give them a test.

Evaluation:

1. Draw a simple electrical circuit consisting of the following components, 2 dry cells, a key, a resistor, voltmeter and a bulb.

2. The diagrams below show ammeter and voltmeter readings obtained during an investigation of a concept.

Figure 1b

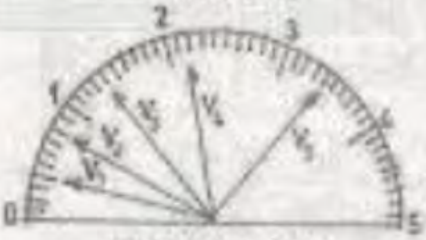


Figure 1c

Read and record the ammeter readings I = I_1, I_2, I_3, I_4 and I_5 and their corresponding voltmeter readings V_1, V_2, V_3, V_4 and V_5 in the table below.

Current (I/A)					
Voltage (V/V)					

3. Use the data obtained to plot a graph with V against I.
4. From the graph, state the relationship be V and I

WEEK TWO

Topic: Cells Connected in series.

Duration: 120 minutes

Previous knowledge: Students can connect up simple electric circuits.

Specific Objectives: By the end of the lesson the student should be able to:

1. Explain what series connection of cells is.

2. Connect cell in series.

3. Use ammeter to measure current flowing through the circuits.

4. Use voltmeter to measure the voltage in each circuit

5. Connect cells in parallel.

Teaching /Learning materials: 5 dry cells, 2.5V, key and 3 connecting wires, ammeter and voltmeter.

Teacher / Learner activity

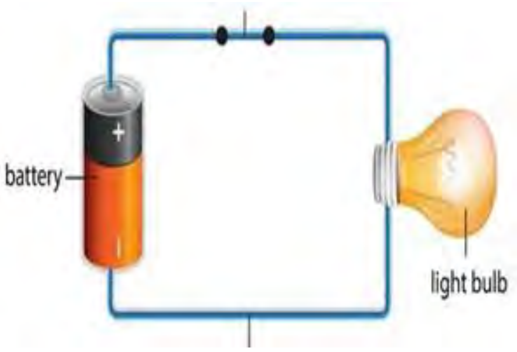
Introduction stage:

Teacher demonstrate to students how to connect cells series and in parallel.

Put students into groups of 5 and gives the activity sheets to students to perform the activities on the sheet.

Students' Activity

1. Connect the voltmeter across the terminals of the 3dry cells.
2. Read and record the reading.
3. Connect two cells in series shown below.



4. Measure the current flowing through the circuit using the ammeter.
5. Add the third, fourth and fifth cells to the arrangement and measure the corresponding current.
6. Record the voltage and its corresponding current in the table below.

Voltage (v)	Current (I)

7. Using the value above, plot a graph of Voltage (V) against Current (I).
8. Connect two cells in parallel, and measure the voltage and the corresponding current.

9. Connect the third, fourth and the fifth cells in parallel with the first two and measure the voltages and the corresponding currents.
10. Record the voltages and corresponding currents in the table below.

Voltages (V)	Current (I)

11. Plot a graph of V against I

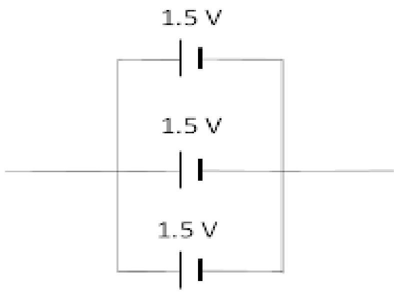
Core points

1. A group of dry cells connected together is called a battery.

2. Dry cells connected end to end consecutively to each other constitute a series connection of cells.

3. The effective voltage of a number of dry cells in series equals the algebraic sum of the voltages. ($V_T = V_1 + V_2 + V_3 + \ldots\ldots\ldots. V_n$).

4. Dry cells connected side by side with their corresponding ends joined together at their respective common points are said to form a parallel connection of cells.



6. A number of identical dry cells connected in parallel in a circuit does not increase the brightness of the bulb connected to them (i.e. the brightness remains the same).

Closure: Go over the main points for learners, invite question from them and give evaluation questions to answer.

Evaluation

1. Draw a circuit diagram to show how to connect three cells in:

   a). series b) parallel

2. Connect the following cells with e.m.f of 1V, 2V, 2V, and 3V in series, and parallel measure the voltage in both circuits.

3. Calculate the total e.m.f of four cells with e.m.f of 1V, 2V, 2V, and 3V connected in: a) series b) parallel

WEEK THREE

Topic: Arrangement of resistors in electrical circuits.

Duration: 120 minutes

Previous knowledge: Students are familiar with series and parallel connections of dry cells.

Teaching/learning materials: Three dry cells, connecting wires, four 1ohms resistors, Ohms meter

Specific Objectives: By the end of the lesson the student should be able to:

1. Connect resistor in series.
2. Measure the resistance of the resistors.
3. Show by diagram how resistors are connected in series and parallel
4. Connect resistors in parallel.
5. Deduce the general relation for resistors connected in series.

Teacher-Learner activity:

1. Using discussion method guide students to come out with the meaning of a resistor and resistance.
2. Guide students to connect a resistor in a circuit.
3. Using the Ohms meter, students measure the resistance produced in the circuit.
4. Lead students to add the two, third and fourth resistors in the circuit and measure their respective resistance in the circuit using the ohms meter.
5. Record your results in the table below.

No. of resistors	Series connection	Parallel connection
1.		
2		
3		
4		

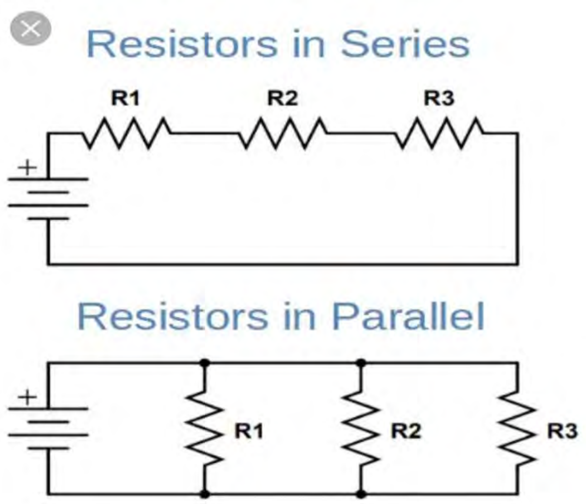
6. Guide students to deduce the equation for total resistance of resistors connected in series.
7. Guide students to deduce an equation for calculating the total resistance of resistors connected in parallel

Core points:

Resistance is the opposition to the flow of current in a circuit.

Resistor is an electrical device that produces resistance to the flow of electric current.

The diagrams below show series and parallel arrangement of resistors.



- Total resistance of resistors in series $(R_T) = R_1 + R_2 + R_3$ ……

- Total resistance of resistors in Parallel ($1/R_T$) $=1/R_1 + 1/R_2 + 1/R_3$ …..

Closure: sum up the lesson and invite question from students. Give learners the evaluation questions.

Evaluation

1. What is a resistor?
2. Three resistors with resistances 2Ω, 1Ω, and 3Ω, are connected in parallel,

   a). Calculate the total resistance in the circuit.

   b). Draw a circuit diagram illustrating the information above.

3. a) Give four resistors with different resistances to students, and ask them to connect in Series and read the resistance in the circuit.

b) Connect the four resistors in Parallel, and measure the resistance in the circuit.

WEEK FOUR

Topic: Ohm's law.

Duration: 120 minutes.

Previous Knowledge: Students can set up simple electric circuits and also define the terms 'electromotive force', 'current', 'potential difference' and 'resistance'.

Specific Objectives: By the end of the lesson the student should be able to:

I. state Ohm's law correctly.

2. Perform experiments to verify Ohm's law.

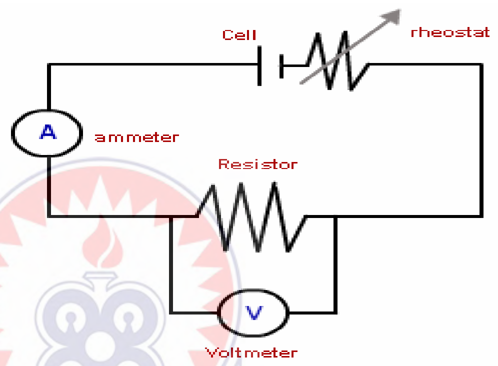
Teaching /Learning materials: A power supply, rheostat, key, ammeter, voltmeter, a standard resistor and connecting wires.

Teacher/learner activity

Exploration Stage

1. Teacher gives students the instructional sheets containing the steps to be followed in performing the experiment.
2. Explains to students that the experiment is about finding the relationship between" current" and the "potential difference". Teacher guides students to follow the instructions below to perform the experiment.

INTRUCTIONAL GUIDE



I. The circuit above consists of a battery B, a key K, a resistor R, a rheostat Rh, an ammeter A, a voltmeter V and connecting wires.

II. Connect the circuit as shown.

III. Set the rheostat Rh, so that it is as large as possible.

IV. Close the key K, and record the readings on the voltmeter and ammeter as V_0 and I_0 respectively.

V. Adjust the rheostat to a voltmeter reading of O.2V and record the corresponding ammeter reading.

VI. Repeat the procedure for values of O.4V, 0.6V, 0.8V and 1V.

VII. Tabulate the results as shown on the table below:

V(v)	I(A)	V/I()
0.2		
0.4		
0.6		
0.8		
1.0		

VIII. Evaluate the ratio of V and I.

What can be said about the results for the ratio of V and I from the table?

3. Teacher through discussion with students derives Ohm's law from the experiments performed.

Core points:

I. Ohm's law states that at constant temperature the current passing through a wire is directly proportional to the potential difference between the ends of the wire.

2. Mathematically, the law is given as $V \alpha I$, $V=IR$ where R is the constant of proportionality and called 'electrical resistance'

Closure: teacher summarises the lesson by going over the main points. Invite question from students and give exercise.

Evaluation Stage.

1. State Ohm's law.
2. With the aid of a diagram, describe an experiment to verify Ohm's law.
3. Using the data obtained above, plot a graph of V on the vertical axis against I on the horizontal axis and determine the slope of your graph.
4. What is the significant of the Slope of the graph?

3.6.2 Questionnaire

Questionnaires are more frequently used to provide complementary data to mostly quantitative measurements (Zartarian et. al., 2005). The decision to use questionnaire for the study was based on the numerous advantages of using questionnaire surveys (Zartarian et. al., 2005). The advantages include; responses being gathered in a standard manner, the speed of collecting information using questionnaires and the quantifiable and reliable information obtained that can be generalised for a larger population. Again, the respondents can read and write and they also offered a reliable assurance of anonymity (Amedahe & Gyimah, 2008). Objectively, Zartarian et al. (2005) mentioned some disadvantages of questionnaires such as; open ended questions generate large amounts of data that can take a long time to process and analyze, and provides respondents opportunity to give superficial answers if the questions take a long time to complete. Hence, this study utilised sorely closed-ended four points Likert-type scale questionnaire, ranging from strongly disagree (1) to strongly agree (4) to elicit students‟ responses to their perceptions towards the teacher classroom activity method.

Students‟ Perception about the use of Teacher Classroom Activities Questionnaire (SPTCAQ) was used to obtain the necessary data on students‟ perception of the intervention strategy. Further, the questionnaire was chosen because it is an effective means of obtaining information that cannot be obtained by the use of test (Macmillan, 1996). The students were given a maximum of 45 minutes to submit their responses. The SPTCAQ (Appendix B) was developed by the researcher in consultation with the supervisor and other experts in the field of science education.

3.7 Validity

According to Mugenda (2008) validity is the accuracy, trust worthfulness and meaningfulness of inferences that are based on the data obtained from the use of a tool or a scale for each construct or variable in the data. In this study, the validity of instruments (tests) was determined through professional judgment by the supervisors and other experts in science education department of the University of Education, Winneba.

3.8 Reliability

The reliability of the instrument is the consistency of the scores obtained over time on a population of individuals irrespective of time differences and the scorers (Amedahe & Gyimah, 2008). The SPTCAQ was trial tested in two other classes who were also treating same topic. The SPTCAQ was trial tested using 60 students, 30 from each class. Their responses were analyzed to test for the reliability of the SPTCAQ. The analysis yields, Cronbach alpha of 0.73 which is within an acceptable level to be considered reliable.

The test was also trial tested using 30 students from another Home Economic, to make sure it measures what it was intended to measure.

3.9 Data Analysis Procedure

Statistical Package for Social Sciences (SPSS) was the statistical tool used to analyze students‟ performance. Descriptive statistics measurements, especially mean values and percentages were used to assess the performances of individual students and their level of skills acquisition. Also, t-test was employed to test whether the weekly performances of students were statically significant or not from the preceding weeks. The analysis of students‟ perception about the use of teacher classroom activity method in teaching direct current electricity was performed using descriptive statistics, such as mean, mode, standard deviation, and graphs

3.10 Limitation of the Study

Limitation in research describes aspects of the study that negatively affect the possibility of generalizing the findings but which a researcher has no direct option to control. The study has been limited to only SHS 2 Home Economic students of Swedru School of Business in the Agona West Municipality of the Central Region. Furthermore, absenteeism by students, and failure of students to take the test at the end of the intervention period. Also, the fact that the study was conducted as a case study in only a specific school; hence the results cannot be generalized. Also reduced size from 65 to 30 students as a result of the covid-19 directive from Ghana Education Service to schools to maintain a class size of 30.

3.11 Ethical Consideration

Ethics in research studies describes the standards set for conduct that differentiate between acceptable and unacceptable practices (Resnik, 2011). A study in social research should consistently be conducted in conformity with ethical standards (Babbie, 2010). Therefore, this study was conducted in a manner that sought to ensure voluntary participation, caused no harm to the participants, anonymity, confidentiality, and compliance with other codes of ethics in the research profession. Other codes of ethics regarding accuracy of research design, data collection and processing, as well as acknowledging sources of information have been adhered to in this study.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.0 Introduction

The results of the data analyses and discussion of the findings of the study are presented based on the research questions of the study as follows.

4.1 Research Question 1: What is performance of students after the application of teacher classroom activity method in teaching Direct Current Electricity?

This question was posed to determine the performance of students in the concept of direct current electricity after they have been exposed to the teacher classroom activity method through a four-week treatment.

Table1. Students' weekly performance over a period of four weeks (maximum of 10)

STUD. ID	WEEK 1	WEEK 2	WEEK 3	WEEK 4	TOTAL	MEAN
1	2	2	4	6	**14**	**3.5**
2	2	2	4	5	**13**	**3.25**
3	2	2	3	4	**11**	**2.75**
4	2	4	7	9	**22**	**5.5**
5	1	1	1	X	**3**	**0.75**
6	6	6	8	X	**20**	**5**
7	3	7	8	10	**28**	**7**
8	7	8	7	8	**30**	**7.5**
9	4	7	8	8	**27**	**6.75**
10	X	X	X	X	**0**	**0**
11	1	1	4	2	**8**	**2**
12	3	2	5	5	**15**	**3.75**
13	3	2	7	6	**18**	**4.5**
14	3	2	5	5	**15**	**3.75**
15	0	1	2	X	**3**	**0.75**
16	3	2	4	5	**14**	**3.5**
17	4	2	6	10	**22**	**5.5**
18	2	2	5	X	**9**	**2.25**
19	2	3	2	3	**10**	**2.5**
20	0	1	5	5	**11**	**2.75**
12	1	1	4	6	**12**	**3**
22	4	2	5	6	**17**	**4.25**
23	7	8	8	10	**33**	**8.25**
24	3	6	7	8	**24**	**6**
25	1	3	5	6	**15**	**3.75**
26	1	2	5	8	**16**	**4**
27	3	5	6	6	**20**	**5**
28	6	9	9	7	**31**	**7.75**
29	4	6	8	10	**28**	**7**
30	X	1	3	X	**4**	**1**
TOTAL	**80**	**100**	**155**	**158**	**493**	**123.25**
MEAN	**2.86**	**3.45**	**5.34**	**6.58**	**17.00**	**4.25**

Source: Field data, 2020

It should be noted that a dash (x) on table 1 shows that absenteeism of a student during the test.

Table 2: Statistical scores on students' mean performance

Weeks	weekly mean	Mean Difference	P-Value
1	2.86		
2	3.45	0.59	0.16
3	5.34	1.89	0.00
4	6.58	1.24	0.02

P< 0.05

Table 1 shows the weekly performance of the entire class and also the performance of individual students over the entire four weeks. It was observed that the students" total score for the first week was 80 marks out of an expected 280 marks. The entire class with 28 students present scored an average mark of 2.86 out of the expected average mark of 10 for the first week (Figure 2). This indicates a very poor performance by the class; however, it should be mentioned that four students (14.29%) were able to score pass marks of 5 and above.

The second week recorded a total class score of 100 marks out of an expected 290 marks with a class mean score of 3.45 out of an expected mean score of 10 (Table 1). The second week saw one student who was present during the intervention but did not take part in the test. The performances were consistently poor and there was an insignificant appreciation of 0.59 in the mean score between the second week and the first week (P>0.05) (Table 2). Nine students representing 31% of the students present during the second test scored five or more marks, indicating an appreciation of five more students over the first week.

The third week indicated a total class score of 155 marks out of an expected 260 marks and an average class score of 5.34 out of 10 (Table 1), indicating a significant appreciation of mean score of 1.89 over the second week. (P<0.05) (Table 2).

Nineteen students representing 73.08% of students present during the third class test scored a mark of five and above, indicating further appreciation of 10 more students as compared to the second week.

In the fourth week, the total score for the students was 158 marks out of an expected 240 marks with a total class mean score of 6.58, indicating a significant improvement of 1.24 over the mean score of the third weeks($p<0.05$) (see Table 2). From Table 1 the fourth week further witnessed an appreciation in the number of students as 21 out of 26 students who took the fourth test scored a mark of five or more, representing 88%.

At the end of the fourth week, the total score per student for the entire week was expected to be maximum of 40, eleven students representing 38% of the entire class scored 20 marks and above out of 40. Also, Table 1 revealed that 13 students representing approximately 45% of the entire class performed above the overall weekly mean of 4.11 over the period. This study supports the claim by Graetz (2008) which suggested that several factors such as effective teaching, using appropriate methods, availability of well-equipped laboratories and classroom management contribute to students" performances. Therefore, such a consistent increase in performance shown specifically in the number of students who scored five and above out of 10 could be attributed to the constructivist approach utilized by the teacher as suggested by Dillion and Osborne (2010) and Reusser and Pauli (2015). Practically, the constructivist approach enabled students during teaching to explore, revise and further reconstruct their ideas about scientific occurrences and predictions as confirmed in studies conducted in Nigeria (Omodara, Kolawole & Oluwatayo, 2013).

In all, the teacher classroom activity method arouses and sustains students" interest in the topic; this enable students to improve their academic performance over the entire period when the teacher classroom activity method was utilized in teaching the topic.

4.2 Research Question 2: What is the level of students' acquisition of Experimental and Process skills required for learning direct current electricity after the application of teacher classroom activity method?

This question was formulated to determine how the teacher classroom activity method will enable students acquire the necessary skills expected of students after it was used to teach direct current electricity. The profile dimension, "experimental and process skills" was assigned a maximum of four marks out of a total of 10 marks for each of the weekly tests as stipulated in the teaching syllabus for Integrated Science. Four skills that were expected of each student were: Drawing, Measuring, Recording and Interpretation. One mark was awarded to each of the skills under the profile dimension. Table 3 illustrates the number of students who acquired a particular skill over the four-week period.

Table 3: Number of students acquiring skills under the profile dimension "experimental and process skills" over the four-week period

SKILL	WEEK 1	WEEK 2	WEEK 3	WEEK 4	TOTAL
DRAWING	9	9	10	15	43
MEASURING	10	13	23	24	70
RECORDING	20	23	23	24	90
INTERPRETATION	2	3	7	9	21
TOTAL	**41**	**48**	**63**	**72**	**224**

Source: Field data, 2020

Table 3, revealed that the first week saw drawing recorded nine students, whiles measuring and recording recorded ten and twenty students respectively. Interpretation skill recorded the least number of two students. For the second week, drawing maintained same number of students as recorded in the first week, measuring and recording skills saw an improvement of three students each over the first week. Interpretation skill also witnesses an improvement of one student over the first week"s number of students. The third week recorded improvements in all the skills except measuring, which maintained same number of students as recorded in the second. Drawing recorded ten students, measuring twenty-three, recording twenty-three students and interpretation, seven students.

Finally the fourth week continues to record an increase in the number of students that acquired the skills. Number of students that did drawing correctly increased to fifteen, and that of measuring to twenty-four. Recording and interpretation also recorded an increased in the number of students to twenty-four and nine respectively.

Table 4. Students' weekly performance in experimental and process skills for the weeks 1.

STUDENTS ID	DRAWING	MEASURING	RECORDING	INTEPRETATION	TOTAL
1	1	0	0	0	**1**
2	0	0	1	0	**1**
3	0	1	1	0	**2**
4	0	0	1	0	**1**
5	0	0	0	0	**0**
6	1	1	1	0	**3**
7	0	0	1	0	**1**
8	0	1	1	1	**3**
9	0	1	1	0	**2**
10	0	0	0	0	**0**
11	0	0	0	0	**0**
12	0	0	1	0	**1**
13	1	0	1	0	**2**
14	0	1	1	0	**2**
15	0	0	0	0	**0**
16	1	0	1	0	**2**
17	1	1	0	0	**2**
18	0	0	1	0	**1**
19	0	0	1	0	**1**
20	0	0	0	0	**0**
21	0	0	0	0	**0**
22	0	1	1	0	**2**
23	1	1	1	1	**4**
24	0	1	1	0	**2**
25	0	0	1	0	**1**
26	0	0	0	0	**0**
27	1	0	1	0	**2**
28	1	0	1	0	**2**
29	1	1	1	0	**3**
30	0	0	0	0	**0**
TOTAL	**9**	**10**	**20**	**2**	**41**

Source : Field Data, 2020

Each of the experimental and practical skills under study is scored over 1, therefore a student which scored 4 marks for the week is deemed to have performed all the skills correctly.

For the first week, only a student was able to perform all the four experimental and practical skills correctly, five students were able to perform three skills, and ten students performed two of the skills under study. Eight students performed only one skill in the first week. Twenty-four students out of the total students of twenty-nine performed at least a skill under experimental and practical skills (Table 4)

Table 5. Students' weekly performance of experimental and process skills for week 2.

STUDENTS' ID	DRAWING	MEASURING	RECORDING	INTEPRETATION	TOTAL
1	0	0	1	0	**1**
2	0	0	1	0	**1**
3	0	1	1	0	**2**
4	0	1	1	0	**2**
5	0	0	1	0	**1**
6	1	1	1	0	**3**
7	0	1	1	0	**2**
8	1	1	1	1	**4**
9	0	1	1	0	**2**
10	0	0	0	0	**0**
11	0	0	0	0	**0**
12	0	0	1	0	**1**
13	1	0	1	0	**2**
14	0	1	1	0	**2**
15	0	0	0	0	**0**
16	1	0	1	0	**2**
17	1	0	0	0	**1**
18	0	0	1	0	**1**
19	0	1	1	0	**2**
20	0	0	0	0	**0**
21	0	0	0	0	**0**
22	0	0	1	0	**1**
23	1	1	1	1	**4**
24	0	1	1	0	**2**
25	0	0	1	0	**1**
26	0	0	1	0	**1**
27	1	1	1	0	**3**
28	1	1	1	0	**3**
29	1	1	1	1	**4**
30	0	0	0	0	**0**
TOTAL	**9**	**13**	**23**	**3**	**48**

Source: Field Data, 2020

In the second week, the number of students who performed all the four skills correctly increased to three, and the number of students who performed one skill correctly increased by two students to ten. However the number of the students who performed three skills decreased from five to three, likewise the number of students who performed two skills correctly decreased from ten to nine (Table 5).

In all, the second week recorded an increase in the number of students who performed at least one skill under experimental and process skill from twenty-four to twenty-five students (Table 5).

Table 6: Students' weekly performance of experimental and process skills for week 3.

STUDENTS ID	DRAWING	MEASURING	RECORDING	INTEPRETATION	TOTAL
1	1	1	1	0	**3**
2	1	0	0	0	**1**
3	0	1	1	0	**2**
4	1	1	1	0	**3**
5	0	0	0	0	**0**
6	0	1	1	0	**2**
7	0	1	1	1	**3**
8	1	1	1	1	**4**
9	1	1	1	1	**4**
10	0	0	0	0	**0**
11	0	0	0	0	**0**
12	1	1	1	0	**3**
13	0	1	1	1	**3**
14	0	1	1	0	**2**
15	0	0	0	0	**0**
16	0	1	1	0	**2**
17	0	1	1	0	**2**
18	0	1	1	0	**2**
19	0	0	0	0	**0**
20	0	1	1	0	**2**
21	0	1	1	0	**2**
22	0	1	1	0	**2**
23	1	1	1	0	**3**
24	0	1	1	0	**2**
25	0	1	1	0	**2**
26	0	1	1	0	**2**
27	1	1	1	1	**4**
28	1	1	1	1	**4**
29	1	1	1	1	**4**
30	0	0	0	0	**0**
TOTAL	**10**	**23**	**23**	**7**	**63**

Source: Filed work, 2020

The third week saw an increased in the number of students who performed all the four experimental and process skills correctly from three to five. Six students were able to performed three skills correctly, and twelve students performed two skills. However, the number of students that acquired a skill during the intervention recorded a significant decrease from ten to one (Table 6).

Further analysis of the data on Table 6 shows that twenty-four students out twenty-nine students present during the intervention also decreased from twenty-five to twenty-four.

Table 7: Students' weekly performance of experimental and process skills for week 4.

STUDENTS ID	DRAWING	MEASURING	RECORDING	INTEPRETATION	TOTAL
1	1	1	1	0	**3**
2	0	1	1	0	**2**
3	0	1	1	0	**2**
4	1	1	1	1	**4**
5	0	0	0	0	**0**
6	0	0	0	0	**0**
7	1	1	1	0	**3**
8	1	1	1	1	**4**
9	0	0	0	0	**0**
10	0	1	1	0	**2**
11	0	1	1	0	**2**
12	1	1	1	1	**4**
13	0	1	1	0	**2**
14	0	0	0	0	**0**
15	0	1	1	0	**2**
16	1	1	1	0	**3**
17	0	0	0	0	**0**
18	0	1	1	0	**2**
19	1	1	1	0	**3**
20	1	1	1	0	**3**
21	1	1	1	0	**3**
22	1	1	1	0	**3**
23	1	1	1	1	**4**
24	1	1	1	0	**3**
25	1	1	1	1	**4**
26	0	1	1	1	**3**
27	1	1	1	1	**4**
28	1	1	1	1	**4**
29	0	1	1	1	**3**
30	0	0	0	0	**0**
TOTAL	**15**	**24**	**24**	**9**	**72**

Source: Field work, 2020

The fourth week saw the number of students acquiring all the skills increased to seven (Table 7). The number of students that acquired three skills recorded an increase from six to ten, whiles the number of students that acquired two and one skills saw a decreased from twelve to seven.

To conclude, at the end of the intervention period, all the students present were able to acquire at least a skill.

At the end of the four weeks intervention, forty-three students were able to draw correctly; seventy students were able to measure some quantities. Ninety students recorded experimental results correctly and twenty-one were able to interpret results from experiments correctly.

From the data it could be observed that measuring and recording are the two major skills acquired by students. Measuring is basic process skills whose acquisition might lead to improving in the acquisition of recording which basic integrated skill. Therefore this study shows that there is direct relationship between the ability to acquire both skills. This finding seems to be in line with what Aka, Given and Aydogdu, (2010) reported in their study.

Also drawing and interpretation skills are also two corresponding basic process skill and basic integrated skill. Students‟ acquisition of in drawing skill also seemed to have some kind of effect on interpretation skill; however it seems the corresponding effect is not as strong as observed between measuring and recording.

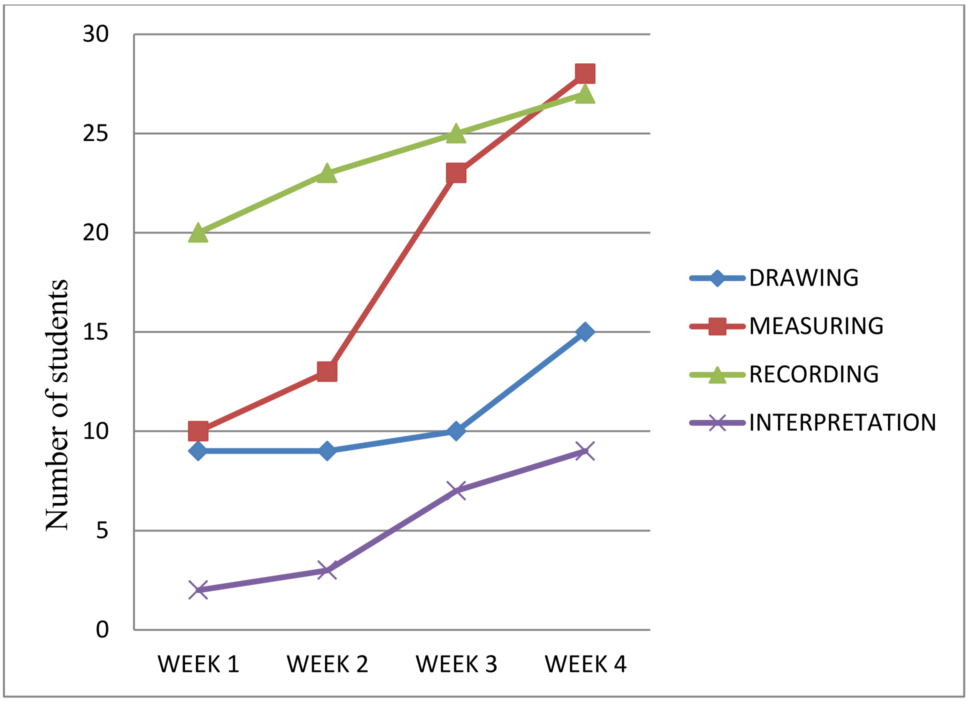


Figure 2: Comparison of the weekly acquisition of skills under the profile dimension, "experimental and process skills" throughout the entire period

Table 3 shows that the number of students who acquired skills under the profile dimension "experimental and process skills" relatively increased consistently over the entire period. Further analysis as illustrated in Figure 2 revealed that there was a weekly increase in the number of students who acquired skills in "recording" and "measuring" as compared to "drawing" and "interpretation". This implies that the assertion by Aka, Guven, and Aydogdu (2010) that better acquisition of basic process skills such as recording and measuring should automatically results in equal improvement in acquisition of basic integrated skills like interpretation was not observed in this study.

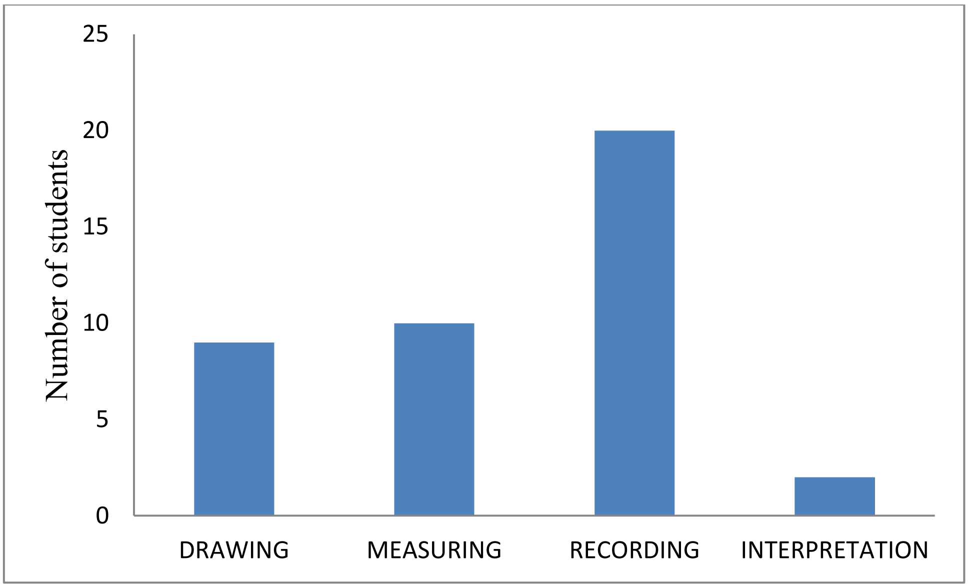


Figure 3: Comparison of the acquisition of skills under the profile dimension, "experimental and process skills" over the entire period

It is clearly shown in this study (Figure 3) that all the skills except interpretation saw some level of improvement in number of students acquiring it. The slow rate at which students are acquiring „interpretation" skill could be attributed to time constraint and how difficult it is to acquire basic integrated skills in science and therefore might need more time for more students to acquire as claimed by the integrated science (SHS) syllabus that interpretation is more important and will therefore needs more emphasis and time in the teaching and testing system (MOE, 2010). Again, the consideration of interpretation as a challenging cognitive skill utilized in establishing scientific logic out of data as reported by Tomkins and Tunncliffe (2001) can be supported by this study.

From the analysis of the result, it could be concluded that students have acquired wide range of experimental and process skills. Among the skills acquired by students was the ability to: measure quantities using instruments like rule, ammeter, and voltmeter, record data correctly, draw graphs, and circuit diagrams and interpret experimental results.

4.3. Research Question 3: What are students' perceptions about the use of teacher classroom activity in teaching direct current electricity?

This question was to ascertain students" view of the teacher classroom activity method after it was used to teach direct current electricity and also to seek their view about how they perceived the effectiveness of the teacher classroom activity method for teaching the topic. Students" perception about their teacher"s classroom activity method questionnaire (SPTCAQ) was used to collect the views of the students. The analysis of the responses was done to determine the mean score for each item and presented in Table 8 and also found in Appendix E. A high mean score indicates a positive perception about the use of Teacher Classroom Activity Method. Positive perception implies that the students appreciate the use of Teacher Classroom Activity Method. Table 8 shows the mean score on perception scale, as well as the overall mean score.

Table 8: Students' mean scores on perception

Questions	Means
1. I prefer to be taught using of teacher classroom activity method to conventional teaching methods.	**3.8**
2. The teacher classroom activity method arouses my interest in integrated science.	**3.6**
3. The teacher classroom activity method helped to focus my attention on the topic throughout the intervention period.	**3.5**
4. I could have understood the topic without the use of the teacher classroom activity method. (REVERSED)	**3.8**
5. I could have easily measured, read and recorded results of experiments during examinations without having the prior opportunity to use TLMs.(REVERSED)	**3.2**
6. The teacher classroom activity enhanced my skills acquisition in integrated science.	**3.4**
7. I find it difficult to comprehend the topic when the teacher classroom activity method is utilised.(REVERSED)	**3.7**
8. The teacher classroom activity method does not allow me to do independent work.(REVERSED)	**1.5**
9. Collaboration in TCAM helps me retain scientific facts learnt.	**2.9**
10. The teacher classroom activity method helped to interpret results easily.	**2.9**
OVERALL MEAN	**3.23**

Item 1 on the questionnaire was to explore students‟ preference of the Teacher Classroom Activity Method over the conventional teaching methods generally used in teaching integrated science. Analysis of students‟ responses to item one on the questionnaire shows that twenty-five students strongly agreed that they prefer the use of teacher classroom activity method of teaching science to any other method used in teaching science, four students also agreed that they prefer the teacher classroom activity method of teaching science to any other method of teaching science. Only one student disagreed that he preferred the teacher classroom activity method to any other method of teaching science (Appendix E). Item one yielded a mean score of 3.8 (see Table 4), which shows that majority of students in the class were strongly of the view that they preferred Teacher Classroom Activity Method to the conventional method used in teaching integrated science. Students‟ preference of Teacher Classroom Activity Method to the conventional method might be due to the positive influence the teacher classroom activity method might have had on them during lessons delivery as suggested by Oviawe (2016).

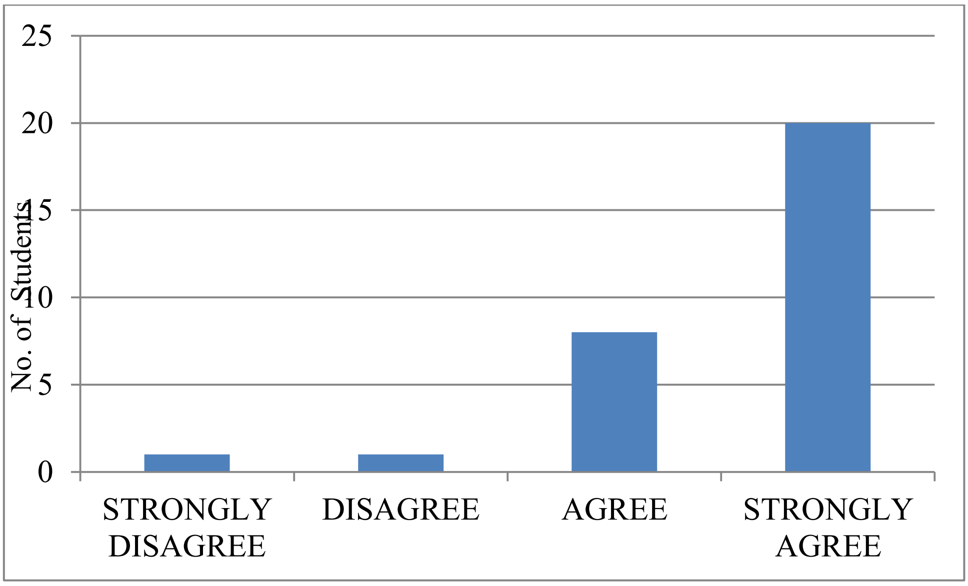


Figure 4: Number of students whose interest was aroused by the use of the teacher classroom activity

Item 2 on the questionnaire seeks to ascertain how interesting the topic was when the teacher classroom activity method was used to teach the Direct Current Electricity. Analysis of the responses indicates that twenty students representing 66.67% of the entire class strongly agreed that their interest was aroused when the teacher classroom activity method was used in teaching the topic, eight students representing 26.67% agreed to the question that their interest was sustain throughout the lesson when the teacher classroom activity method was used in teaching the topic. One student each representing 3.33% disagreed and strongly disagreed that their interest was aroused when the teacher classroom activity method was used to teach the topic (Figure 4). Item 2, with mean value of 3.6(Table 8) indicated that many of the students strongly agreed that the teacher classroom activity method aroused their interest throughout the lesson. The position held by the students in the class is in line with arguments put forward by researchers such as Cahyadi (2007), and Sokoloff, Laws, and Thornton, (2007) that the integration of demonstration and activity methods always arouse and sustains students‟ interest throughout the lesson.

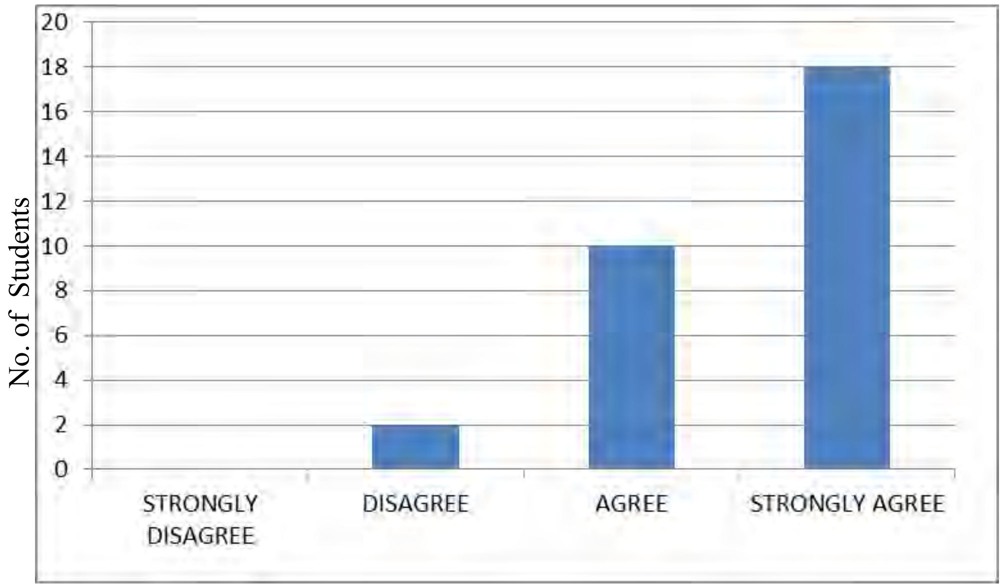


Figure 5: Number of students whose attention was focused when the teacher classroom activity method was used

Responses to item 3 on the questionnaire shows that eighteen students strongly agreed to the statement that teacher classroom activity method helped them focused their attention throughout the period, ten students agreed to the assertion that teacher classroom activity method focuses their attention on the lesson. Two students disagreed with the statement (Figure 5). Item 3 yielded a class mean score of 3.5 (Table 8) showing that most of the students in the class were of the strong view that the teacher classroom activity method is best at focusing their attention when used in teaching the topic. The observation of the class is similar to studies by Ameh and Dantani (2012) which clearly revealed that the teacher classroom activity method focuses attention and therefore makes learning permanent. Further arguments raised by Dumela and Bree (2016) imply that the ability to connect scientific concepts and skills to real life situations results from the ability to critically focus attention of the students.

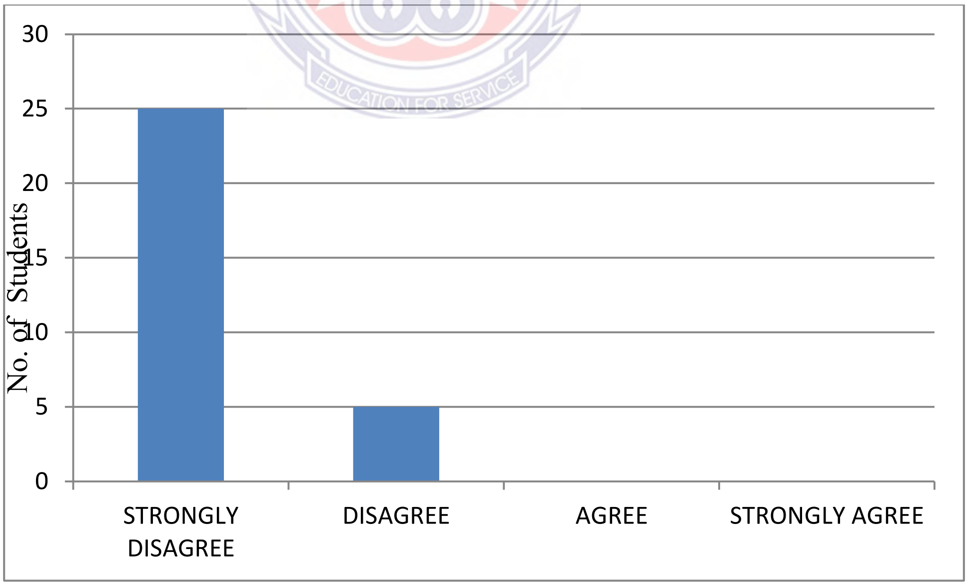


Figure 6: Number of students who could have understood the topic without the use of the teacher classroom activity method

Analysis of item 4 revealed that twenty-five students strongly disagreed that they could have understood the topic without the use of the teacher classroom activity method to teach the topic, five students disagreed to the item under consideration (Figure 6). A mean mark of 1.2(Table 8), shows that the majority of students in the class strongly disagreed they could have understood the topic without the use of teacher classroom activity method. Therefore, this perception of the students is likely to confirm that the poor performances of students in West Africa schools could be linked to the objective observations made by Ibe (2015) as well as Okoli and Azubuike (2012) which revealed that the persistence use of the teacher-centred methods in teaching science in most schools in West Africa is one of the main causes of students" failures in integrated science witnessed in most secondary schools in West Africa in recent years.

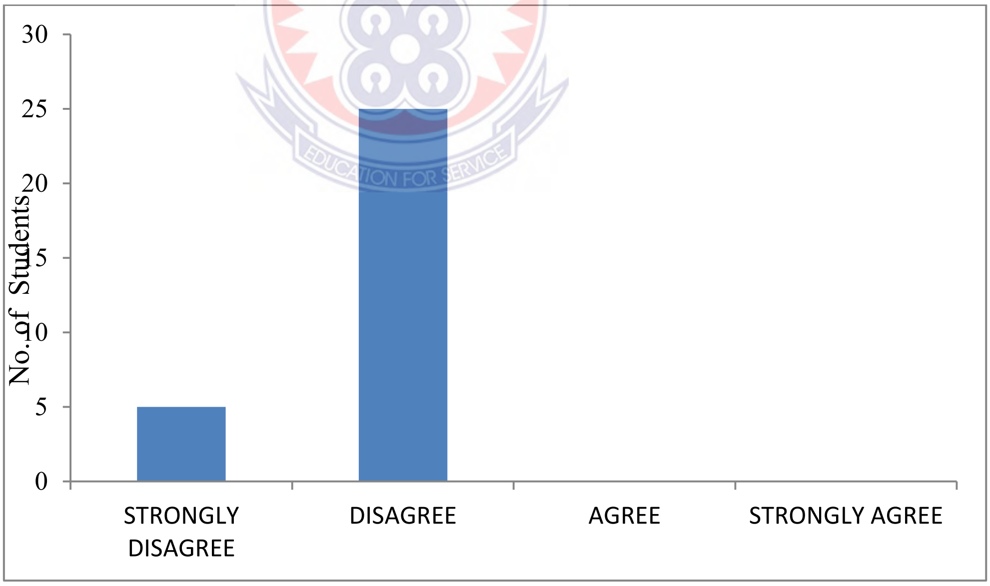


Figure 7: number of students who could have acquired skills without using TLM

Item 5 was a negative statement posed to avoid cursory response, which was reversed during the analysis. This item sought to assess students" perception of how the teacher classroom activity helped them to develop experimental and practical skills. Analysis of the responses showed that five students strongly disagreed that they could have acquired experimental and practical without the use of the teaching-learning materials used during the utilization of the teacher classroom activity to teacher the topic (Figure 7). Fifteen students agreed that they could not have acquired skills without the use of the TLMs during the intervention period. A mean score of this item was 3.2 (Table 8) suggesting that most of the students agreed TCAM enhanced their ability to acquire experimental and process skills needed in learning direct current electricity. This was consistent with Bencze, Alsop and Bowen (2009) and therefore, TCA might have accounted for the success of science students in acquiring skills during lessons, which contributed to success of students in examination. Therefore, the poor basic laboratory facilities in schools need to be improved for students use.

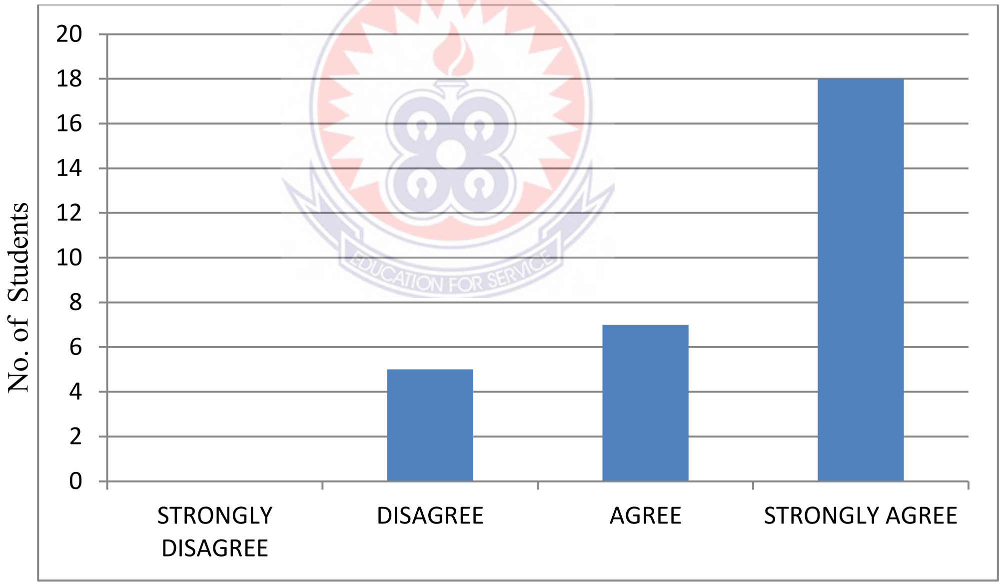


Figure 8: number of students whose skills was enhanced when teacher classroom activity method was used

Item 6 on the questionnaire sought to consolidate students‟ responses as presented in item 5. Five students disagreed that the teacher classroom activity method influenced their ability to acquired skills during the lesson, however seven and eighteen students agreed and strongly agreed that the TCAM helped them in acquiring skills during the intervention (Figure 8). The class average score for item 6 was 3.2 (Table 8) showing that the majority of the students were of the opinion that their abilities to acquire skills in the topic were greatly influenced by the use of the TCAM. The opinion of the students supported the suggestion made by Amadola (2012) that the intention of the teacher classroom activity method was to properly enhance the acquisition of knowledge and skills. Though several studies connect effective teaching to skills acquisition, a major hindrance identified by McKee, Williamson and Ruebush (2007) against the procedure was time availability. It should be objectively stressed that most teachers who would want students to acquire practical skills were still engaged in teacher-centred methods due to limited time allocated for science in Ghanaian schools.

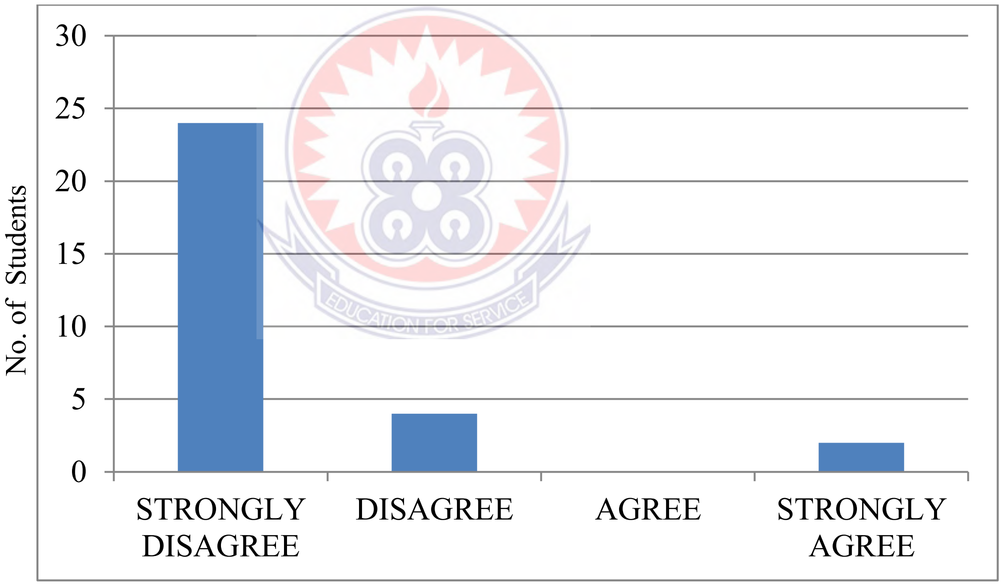


Figure 9: number of students who understood the lesson when teacher classroom activity method was used

Item 7 sought to obtain students‟ perception on how the teacher classroom activity method influenced their understanding of the topic. Twenty-four students strongly disagreed that the teacher classroom activity method does not enhance their understanding the topic, four students disagreed with item 7, and two students strongly agreed that the teacher classroom activity method the teacher classroom activity enable them to understand the topic (Figure 9). The mean score for this item was 3.7 when reversed indicating that most students in the class strongly disagreed that they found it difficult to understand the topic when TCAM was utilized in teaching the topic. This indicated that the task of teaching turned so real to students and therefore could support a recommendation by Nzewi (2008), which was specific on making teaching real using the teacher classroom activity method (TCAM). Real teaching had also been described as effective teaching; hence this study reinforced studies by researchers such as Akomolefe (2010); Omoifo and Urevbu (2007); Mukolwe, Kadenyi, and Mukuna, (2018).

On item 8, five students strongly disagreed that the teacher classroom activity method do not allowed them to do independent work, two students disagreed that they did not do independent work, when the teacher classroom activity method was used to teach the lesson. Eight and fifteen students agreed and strongly agreed respectively that they did not do independent work (Appendix E). When reversed a mean score of 1.5(Table 8) suggested a level of disagreement that independent work was not the norm when the teacher classroom activity method was used in teaching the topic. The absence of individual work among students was due to lack of laboratory equipment during the practical lessons and this was consistent with Anderson (2004). Poor learning environment and the non-availability of infrastructural facilities are contributing factors to negative learning outcomes such as students lazing about during practical (Anderson, 2004).

Item 9 on the questionnaire seeks to get students perception on the impact of class collaboration on retention of scientific facts. Students" responses indicate a class average score of 2.9 which indicates that most of the students were of the agreement that collaboration in TCAM helps them retain scientific facts learnt. The stand of majority of the class is in line with the view held by Nguyen, Williams and Nguyen (2012) that teacher classroom activity method promote collaboration among students. Such collaboration guarantees an efficient and effective teaching-learning procedure which creates opportunities for students to deliberate on scientific concepts, verify hypothesis, retain ideas and concept and further use such ideas to solve real life problems.

Item 10 was posed to ascertain the perceptions of students about how the TCAM assisted them to interpret results obtained from experiments during teaching and learning Direct Current Electricity. Table 8 shows a mean class score of 2.9 indicating that the majority of the students agreed that the TCAM help them in interpreting experimental results easily. But it could be augured that the students view could not translate into how they perform the task in interpretation over the period. The low number of students that could perform the task of interpretation might be due to time constrains and the consideration of interpretation as a challenging cognitive skill (Tomkins & Tunncliffe, 2001).

In conclusion, the overall perceptions mean score of 3.2 (Table 8) shows that the students agreed that the teacher classroom activity method helped them to understood concept and acquired experiential and process skills and also improve their academic performance in the topic. The academic performances achieved by the students make them developed positive perception toward the teacher classroom activity method; a positive perception implies that the students appreciate the teacher classroom activity method when used to teach direct current electricity.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

This chapter presents summary of findings, draws conclusions, and makes recommendations and suggests areas for future studies. The chapter is accordingly divided into four sections. Section one summarizes the main findings of the study. Section two presents the conclusion of the study. In section three the recommendations of the study are made whilst section four presents areas for future studies.

5.1 Summary of findings

The findings of this research outlined the influence of the teacher classroom activity method on students" understanding of concepts and the acquisition of requisite skills in learning Direct Current Electricity. The study also assessed the perceptions students had about the use of the teacher classroom activity method in teaching Direct Current Electricity.

Research Question One: This question was to determine the performance of students in learning direct current electricity after they have been exposed to the teacher classroom activity method. The finding of the study revealed that;

1. The students" performance was improved during the 4 weeks period when the teacher classroom activity method was utilized. The data obtained showed that though the second week saw some improvement in performance over the first week but it was not significant whiles the third

and the fourth weeks saw significant improvements in performance of students over the preceding week.

Research Question Two: This question was formulated to determine how the teacher classroom activity method enabled students to acquire the necessary skills needed in learning direct current electricity. This study showed that;

2. Wide range of experimental and process skills was acquired by students during the period of the study. Among the skills acquired by students was the ability to: measure, record data, draw graphs, draw circuit diagrams and interpret experimental results.
3. Students‟ ability to record data properly was the major skill acquired by the students. This was followed by measuring using appropriate instruments and drawing of graphs and circuit diagrams of experimental set ups.
4. Though, interpretation skill was acquired by students, the number of students was not as many as compared to the other skills.

Research Question Three: This question was to ascertain students‟ perceptions of the teacher classroom activity method after it was utilised to teach direct current electricity.

The study showed that:

5. Students have positive perception towards the use of teacher classroom activity method used to teach direct current electricity. This is because, majority of the students indicated that the teacher classroom activity method enable them to have better understanding of concepts learnt, retain scientific facts learnt, perform measurement, record data, draw graphs, and draw circuit diagrams.

5.2 Conclusion of the study

The goal of this study was to use teacher classroom activity method to improve the performance of students in learning Direct Current Electricity, and also assist students acquire the necessary experimental and process skills needed for learning direct current electricity. The study used a sample size of 30 students, who were taken through a 4-week intervention based on the use of the teacher classroom activity method to teach direct current electricity. Intervention implemented enable students to improve on their academic achievement; this implies that the intervention impacted positively on students understanding of concepts learnt. These achievements are likely to motivate students to learn more on their own and also provide opportunity for students to apply skills during experimental tasks. For these reasons students had positive perception toward the use of teacher classroom activity method in teaching direct current electricity.

5.3 Recommendations of the Study

Based on the findings and conclusion of the study, the following recommendations were made

1. Teachers especially science teachers in Swedru School of Business should be encouraged to use teacher classroom activity methods to teach students.
2. Teachers in Swedru School of Business are to pay critical attention to skills development of students during teaching since it motivates students to learn during practical lesson.
3. Teachers in Swedru School of Business should be encouraged to use teacher classroom activity method to engage students in measuring and recording in order to sustain their achievements in those skills.

4. Teachers in Swedru of Business should be encourage to organise more practical lessons in which more time should be allotted to interpretation skill.
5. Since students had positive perception about teacher classroom activity method, teachers are to be encouraged to use the teacher classroom activity in teaching students in Swedru School of business.

5.4 Areas for further research

It is suggested that further research is recommended to use the teacher classroom activity method to teach direct current electricity to large sample size for longer period of time, and also to investigate extensively and comprehensively challenges in using teacher classroom activity method in teaching Direct Current Electricity and other physics related topics in integrated science.

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APPENDIX A

Questionnaire for collecting data on Students" Perception about the Teacher Classroom Activities (SPTCAQ).

Please tick where appropriate.

1-Strongly Disagree 2- Disagree 3-Agree 4-Strongly Agree

1. I prefer to taught using of teacher classroom activity method to traditional teaching methods.

   1 ☐ 2 ☐ 3 ☐ 4 ☐

2. The teacher classroom activity method arouses my interest in integrated science.

   1 ☐ 2 ☐ 3 ☐ 4 ☐

3. The teacher classroom activity method helped to focus my attention on the topic throughout the intervention period.

   1 ☐ 2 ☐ 3 ☐ 4 ☐

4. I could have understood the topic without the use of the teacher classroom activity method.

   1 ☐ 2 ☐ 3 ☐ 4 ☐

5. I could have easily measured, read and recorded results of experiments during examinations without having the prior opportunity to use TLMs.

   1 ☐ 2 ☐ 3 ☐ 4 ☐

6. The teacher classroom activity enhanced my skills acquisition in integrated science.

   1 ☐ 2 ☐ 3 ☐ 4 ☐

7. I find it difficult to comprehend the topic when the teacher classroom activity method is utilised.

   1 ☐ 2 ☐ 3 ☐ 4 ☐

8. The teacher classroom activity method does not allow me to do independent work.

   1 ☐ 2 ☐ 3 ☐ 4 ☐

9. Collaboration in class does not help to retain scientific facts.

   1 ☐ 2 ☐ 3 ☐ 4 ☐

10. The teacher classroom activity method helped to interpret results easily.

   1 ☐ 2 ☐ 3 ☐ 4 ☐

APPENDIX B

	WEEK 1	*WEEK 2*
Mean	2.857143	3.448276
Variance	3.608466	6.399015
Observations	28	29
Hypothesized Mean Difference	0	
Df	52	
t Stat	-0.99987	
P(T<=t) one-tail	0.161002	
t Critical one-tail	1.674689	
P(T<=t) two-tail	0.322004	
t Critical two-tail	2.006647	

APPENDIX C

t-Test: Two-Sample Assuming Equal Variances

	Week 2	*week 3*
Mean	3.448276	5.344828
Variance	6.399015	4.376847
Observations	29	29
Pooled Variance	5.387931	
Hypothesized Mean Difference	0	
Df	56	
t Stat	-3.11127	
P(T<=t) one-tail	0.001465	
t Critical one-tail	1.672522	
P(T<=t) two-tail	0.00293	
t Critical two-tail	2.003241	

APPENDIX D

t-Test: Two-Sample Assuming Unequal Variances

	Week 3	*week 4*
Mean	5.344828	6.583333
Variance	4.376847	5.036232
Observations	29	24
Hypothesized Mean Difference	0	
Df	48	
t Stat	-2.06198	
P(T<=t) one-tail	0.022323	
t Critical one-tail	1.677224	
P(T<=t) two-tail	0.044646	
t Critical two-tail	2.010635	

APPENDIX E

Students mean scores on perception

S/N		Strongly Disagreed	Disagreed	Agreed	Strong Agreed	Mean
1.	I prefer to be taught using to teacher classroom activity method to conventional teaching methods.	01	00	04	25	3.8
2.	The teacher classroom activity method arouses my interest in integrated science	01	01	08	20	3.6
3.	The teacher classroom activity method helped to focus my attention on the topic throughout the intervention period	00	02	10	18	3.5
4.	I could have understood the topic without the use of the teacher classroom activity method	25	05	00	00	3.8
5.	I could have easily measured, read and recorded results of experiments during examinations without having the prior opportunity to use TLMs	05	25	00	00	1.8
6.	The teacher classroom activity enhanced my skills acquisition in integrated science	00	05	07	18	3.4
7.	I find it difficult to comprehend the topic when the teacher classroom activity method is utilised	24	04	00	02	1.3
8.	The teacher classroom activity method does not allow me to do independent work	05	02	08	15	3.1
9.	Collaboration in class does not help to retain scientific facts	02	08	10	10	2.9
10.	The teacher classroom activity method helped to interpret results easily	02	08	10	10	2.9