UNIVERSITY OF EDUCATION, WINNEBA

THE STATUS AND IMPACT OF PRACTICAL ACTIVITY IN BIOLOGY AT KINTAMPO SENIOR HIGH SCHOOL

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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

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DECLARATION

CANDIDATE'S DECLARATION

I, Augustine Dampah Bazirizii declare that this dissertation with the expressions of quotations and references that is contained in published works which to the best of my knowledge have all been identified and duly acknowledged is sincerely my own original work and it has not been either partly or wholly submitted elsewhere for any another degree.

Signature: ……

Date: ……

SUPERVISOR'S DECLARATION

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

NAME OF SUPERVISOR: DR. CHARLES KWESI KOOMSON

Signature: ……

Date: ……

DEDICATION

I dedicate this work to my wife Mrs. Suzy Doe Dampah and my lovely children Fredrick Yuri, Benedict Wullim, Francisca Sugurum and Carly Tediaya for their resilient support. May we continue to live happily.

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I wish to appreciate my lovely family for been there for me always. May God richly bless you all. Finally, to my sweet wife Mrs. Suzy Doe, I say bravo, may God strengthen you. I am grateful to all who in diverse ways made this study to see light.

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ABSTRACT

The study investigated the status and impact of practical activity in biology at Kintampo Senior High School(SHS) in the Bono East Region of Ghana. The main objective of the study was to assess the status of practical activity in Biology and its impact on students' academic achievement in Kintampo SHS. The specific objectives were to determine the practical skills that are taught in Biology practical lessons in the school, to determine the practical skills that are taught in Biology practical lessons in the school; to find out the extent to which students' attitude towards Biology practical lessons affects their performance in Biology practical examination; to determine how often SHS 3 Biology students perform Biology practical to acquire practical skills in Biology and to determine the extent to which the organisation of Biology practical lessons impact the performance of SHS3 Biology students in Kintampo SHS.A sample size of 72 Biology students and 6 Biology Teachers were selected for the study. Biology Practical Performance Tests (BPPT), Questionnaire, structured interviews and classroom observation were used to collect data. Descriptive and inferential statistics was used in analysing the quantitative data. The findings show that, although there was evidence that Biology teachers in the school organise Biology practical lessons for their students, they did not use the appropriate pedagogy and methodology in teaching. The methods used in teaching the biology practical did not allow the students to inculcate the biology practical skills which were needed in their study of Biology. The following were some of the findings of the study; 1 out of the 4 Biology practical skills was taught by the Biology Teachers 87.5% of the respondents responded that poor attitude affects their perfomamce,84.73% of the Biology teachers organizes practical for their students,93.05% responded that frequent Biology practical influences performance. The following recommendations were made; Teachers in Kintampo SHS should teach; observation, interpretation, classification and drawing (biology practical skills) in their biology practical classes and the teachers should employ inquiry-based learning in their teaching of the biology practical skills.

CHAPTER ONE

INTRODUCTION

1.0. Overview

The chapter contains information on the background to the study, statement of the problem, purpose of the study, objectives of the study, research questions and the significance of the study addressed by the study. Also presented are the limitations and delimitations of the study. The chapter ends with the presentation of the operational definitions of terms used in the study as well as a description of the organization of the study.

1.1. Background to the Study

Biology as a science is a systematic process of obtaining verifiable and testable knowledge about nature through theoretical and practical activities (Tal & Morg, 2009). Development in Biology over the years has influenced and dominated every aspect of human endeavour such that any individual lacking in biological literacy finds it very hard to survive in contemporary society (Tal & Morg, 2009).

For any nation to attain this rapid scientific growth and advancement, such a nation must improve the standard of her educational system by setting up science laboratories in schools as a prime component of a school science programme because science has globally become a basis of an increasing workforce such that all students need a strong exposure to science (Biology) practical activities (Oredien & Olayede, 2017). .

The cardinal objectives of Biology education are to prepare students to acquire: adequate laboratory and field skills in Biology; meaningful and relevant knowledge in Biology; the ability to apply scientific knowledge to everyday life in matters of

personal and community health and agriculture; lastly reasonable and functional scientific attitudes. Biology in secondary schools is composed of practical activities. Practical work in biology is considered according to Iloeje (2007), as part of the study of biology that involved field work, observing, collection and laboratory study of specimens, drawing diagrams and conducting experiments. The 2010 elective biology syllabus emphasizes that instructional strategies in biology should be practical base to enable learners appreciate biology as a process. The justification for practical work in biology at the Senior High School level is supported by the aims of practical biology in the West African Examination Council Syllabus as follows:

1. To understand the structure and functions of living organisms as well as to appreciate nature
2. To acquire adequate laboratory and field skills in order to carry out and evaluate experiments and projects in biology
3. To acquire necessary scientific skills, for example, observations, classification and interpretation of biological data
4. To be able to interpret and illustrate knowledge of biology principles and to develop the ability to perform simple experiments and makes inferences from the results established.
5. To acquire scientific attitude for problem solving
6. To be able to apply biological principles in everyday matters that affect personal, social, environmental, community health and economic problems.

Despite the importance of Biology, students' achievement in the subject from West African Secondary School Certificate Examination (WASSCE) has been poor (Glasson, 2009). The chief examiner's reports (2017, 2018, 2019) of the West Africa

Examination Council reveal that, students' performance in Biology in the West African Secondary School Certificate Examination (WASSCE), on average, more than 70% of students scored below credit level in the past three years in the WASSCE.Students of Kintampo SHS have also been obtaining very low performance as per the analysis from the WASSCE results of the school. The aspects of biology which students find difficult in WASSCE are practical questions. Practical skills are tested exclusively in the practical paper. However, findings of practice may be tested in a theory paper. The level of competence in practical skills may determine performances in a class and ultimately at the final year examination (WASSCE).

1.2. Statement of the Problem

In recent times, observations on students' academic performance in Biology over the years in the results of the West Africa Senior Secondary Certificate Examination (WASSCE) conducted by the West African Examination Council (WAEC) revealed that very few numbers of students perform better in Biology examinations as compared with other subjects. Biology students do not perform creditably in the Biology practical examination. It has constantly been pointed out in the Chief Examiners report (2010, 2011, 2012; 2014; 2015; 2016; 2017; 2018, and 2019) that Biology students perform poorly in the Biology practical examination (Biology Paper 3). According to the reports, students' answers show that they had not been tested in any of the tasks that students were tested on during the WASSCE Biology practical examination. WAEC Chief Examiner's Reports (2017; 2018; 2019) on Biology practicals stated that candidates could not draw specimens, candidates drew specimens without adding magnification, candidates could not add titles to drawings and candidates could not label with ruled guidelines. These were some of the issues that were captured in the WAEC Chief Examiner's Reports (2017, 2018 and 2019).

Biology students of Kintampo Senior High School have for the past years not been performing well in this aspect as the analysis of the WASSCE results of the school indicates. The schools analysis records indicate that, 49% of the students who wrote WASSCE in 2017 passed, 46% passed in 2018, and 61% passed in 2019. Though there is evidence that some practical lessons take place in the school, there is a need to know exactly what practical work is taking place in the school. It is in this vein that this research sought to assess the status of Biology practical activity among SHS three Biology Students of Kintampo Senior High School.

1.3. Purpose of the Study

The purpose of this study was to assess the status of practical activity in Biology and its impact on students' academic achievement in Kintampo SHS.

1.4. Objectives of the Study

This study sought to determine:

1. The practical skills that are taught in Biology practical lessons in the school.
2. The extent to which students' attitude towards Biology practical lessons affects their performance in Biology practical examination
3. How often SHS 3 Biology students perform Biology practicals to acquire practical skills in Biology
4. The extent to which the organisation of Biology practical lessons impact the performance of SHS3 Biology students in Kintampo SHS.

1.5. Research Questions

This study answered the following research questions

1. What practical skills are taught to students in Biology at Kintampo SHS?

2. To what extent does students' attitude towards Biology practical's affect their performance in Biology?
3. How often do SHS3 Biology students perform Biology practical to acquire Biology practical skills?
4. To what extent does the organisation of biology practical lessons influence the academic performance of SHS 3 Biology students of Kintampo SHS?

1.6. Significance of the Study

This study would enable students to give serious attention to practical activity after knowing their performance. This would help them discover new ideas and knowledge for themselves as learning becomes students oriented allowing them to go through a series of activities themselves. Furthermore, the innovative practical lessons would enable students to easily retain concepts learned and develop their higher thinking skills as well as communication skills thereby improving examination results of the students. In addition, it would help reverse the negative impressions that students have towards the studying of Biology in general and Biology practical in particular which discourages them from pursuing Biology at a higher level of education. This is because students' frequent exposure to different practical lessons and the motivation derived from the successful completion of tasks in practical lessons would help improve their performance and confidence in tackling biology practical questions.

This study would also serve as a source of reference material for teachers to determine appropriate pedagogical tools and methodology to impart Biology practical skills to SHS form 3 Biology students in Kintampo SHS.

This study would give useful information to the Ministry of Education, curriculum developers and other educational stakeholders to undertake interventions to promote practical lessons in Biology in Senior High Schools in the country.

1.7. Delimitations of the Study

The study focused on only four process skills in biology practical work. These tasks are observation, drawing, interpretation and classification. These tasks were considered because they are frequently asked in almost every Biology practical examination. The study was also delimited to only SHS three elective Biology students in Kintampo SHS.

1.8. Limitations of the Study

There are two Senior High Schools in the Municipal (Dega SHS and Kintampo SHS) but due to financial constraints, the research was only conducted in Kintampo SHS.

Some students absenting themselves from school during the day of sampling also affected the sample size of the study. Also, because the task was done under examination conditions, there was pressure on the students in answering the questions which had an effect on their scores.

1.9. Operational Definition of Terms

Achievement: This is the academic performance of a learner measured by the school through test and examinations.

Assessment: This is viewed as the process of determining learners' achievement through assignments, tests, projects and examinations (Linquanti, 2014).

Biology Practical skills: An individual's competency and process skills acquired while performing a scientific activity (Bennet & Kennedy**,** 2001).

Biology syllabus: Refers to the recommended program of learning Biology as designed by the Ghana Education Service

Competence: Is the ability to do Biology practical tasks so as to show expected mastery of skills under review.

Constructivism: Constructivism is a teaching referent and learning theory which regard a science laboratory or classroom as a construction site (Roth, 1995). From a constructivist perspective, teachers are expected to socially engage learners in what they are teaching during practical tasks (Leach & Scott, 2000).

Science: Ofuebe (2007) defined science as a dynamic human activity concerned with understanding of the working of our world. Ali (2002), also believed that the word 'science 'stands for a variety of information, abilities and operations about the natural environment. He believes that science is more concerned with various investigative processes and activities with regards to developing, acquiring and controlling knowledge, skills, capabilities and attitudes about the natural factors of the environment.

Science Laboratory: Uche, (2018) defines science laboratory as a place where students may acquire new knowledge, concepts and skills, in order to achieve better understanding of rules, processes, principles, laws, theories and natural phenomena.

Poor Performance: Refers to the un-accomplishment of practical skills measured against the assessment objectives and the achievement of below 40% in practical works (Lunetta, 2007)

Practical Interpretation: Is the explanation of observations made in a particular task.

Practical Observation: Is the noticing and paying attention to results got in a task.

Practical Procedure: Is the knowledge of the items and manipulations required in carrying out a particular practical task.

Practical skills: An individual's competency and process skills acquired while performing a scientific activity (Bennet & Kennedy 2001). Practical skill is activity that involves operations and manipulations, through which one replicates or demonstrates a scientific process or theory.

Practical works: Any teaching and learning activity which involves learners observing or manipulating real objects and materials, extracting information from complex systems, testing hypotheses, analysing and evaluating variable data, demonstrations, discussions, simulations and exercises (Millar, 2004; Abraham & Miller, 2008).

SHS three students: Students in a level in the second cycle institution (final year)

Skill: is a developed proficiency acquired through specific training.

Social constructivism: Social constructivism is concerned with the acquisition of skills through social interactions. Teaching is seen as facilitating and providing opportunities where learners are able to mediate and construct meaning of what they

are taught through practical works and socially constructed teaching and learning tools that are used to distribute scientific knowledge (Liang & Gabel, 2005)

WAEC: West Africa Examination Council

WASSCE: West Africa Senior Secondary Certificate Examination

1.10. Organisation of Study

This study is presented in five chapters. Chapter One deals with the background of the study, statement of the problem, purpose of the study, research questions, significance of the study, delimitation of the study, limitation of the study, definition of terms and organization of the study. The review of the relevant literature on the study forms the Chapter Two with the Chapter Three dealing with the methodology. This comprises of the approach and design of the research, population, sampling and sampling techniques used, research instrument and data collection procedure as well as the procedure for analysing the data. Chapter four, dealt with the presentation of results, the discussion of the findings and ended with summary of the major findings. Lastly, Chapter five dealt with Summary, Conclusions and recommendations.

1.11. Summary

This chapter introduced the orientation of the study on the teaching of Biology and Physical Science practical works in senior secondary schools. The research problem, research questions, significance of the study, limitations and delimitations of the study, as well as definitions of the terms were highlighted. The next chapter provides the theoretical framework as well as the literature review relevant to the research focus

CHAPTER TWO

LITERATURE REVIEW

2.0. Overview

This chapter contains the review of the literature related to the study. It also contains the conceptual framework related to the important aspect of the study. The chapter explains Biology as a science. The chapter contains history of practical work in science, meaning of practical work in science and nature of biology practical work. Also present in this chapter are role of practical work in teaching and learning of Biology and performance of students in Biology practical work in secondary schools. Other topics discussed are; effects of practical work in the performance of students in Biology, difficulties in organising Biology practical's in Kintampo Senior High School. Importance of frequent performance of Biology practical, perception of teachers and students on the importance of Biology practical and summary were also discussed. The chapter ended with the effects of practical work in the performance of students in Biology.

2.1. Conceptual Framework

This study employs the constructivist paradigm. Constructivism is a dynamic learning process whereby students acquire and develop new thoughts which are related to their present knowledge (Alshalabi, Hamada & Elleith, 2013) in this theory, the learner builds their own understanding of concepts and phenomena through experiencing the things and reflecting on these experiences (Yadav,2017). The study was guided by the Constructivist Learning Theory (CLT). The theory is advanced from Russian psychologist Lev Vygotsky (1896-1934) who also came up with Social Development Theory (SDT) which is applied in education. Constructivism is active process whereby teacher collaborates with the learners who create their own new information

from prior knowledge during learning. The constructed knowledge in this study are observation, drawing, interpretation and classification skills used in selected tasks that constitute the independent variables while achievement or performance in the skills tested constitutes the dependent variable.

According to Vygotsky (1978) learning is a reciprocal experience for the teacher and the student. It emphasizes the affective domain, makes instruction relevant to the learner, help student develop attitudes and beliefs that support both present and lifelong learning, and balance teacher control with personal autonomy in the learning environment. According to this theory, students construct their own knowledge, from textbook, personal experience, the teacher explanation or any other mode of knowing. In trying to solve novel problems, perceptual or conceptual similarities between existing knowledge a new problem can remind people of what they already know, prior knowledge impacts the learning process. Information not connected with a learner's prior experiences is quickly forgotten. In short, the learner must actively enrich the existing information by construct new additional knowledge for meaningful learning to occur. This is due to the fact that, constructivism views learning as a process in which the student actively constructs or builds new ideas or concepts based upon current or past knowledge (Jones, Reeds and Weyers, 2003).There are two main perspectives under constructivism theory.

Cognitive Constructivism: This is based on the ideas of Jean Piaget (2013), (a psychologist) who assumes that knowledge acquisition is a process of continuous self-construction by the learner through experience.

Social Constructivism: ISt is the idea of Vygotsky. This study is informed and built on the social constructivist theory of teaching and learning (Vygostsky, 1978), which

explains that knowledge as a human product is socially constructed. It assumes that construction of knowledge through social interaction and cultural context of the learner (Yadav, 2017). The emphasis of the social constructivist is that the teacher is not a person who is responsible for constructing knowledge for the learners but rather is responsible for providing learners with challenging activities that promote higher level thinking during classroom instruction (Nghipandulwa, 2011). According to Gray (1997), constructivist teaching is based on the assumption that learning occurs when learners are actively involved in a process of meaning and knowledge construction as opposed to passively receiving information

For students to have meaningful learning, it requires that the student engage in systematic process for coding and storing information in the long-term memory. Retrieving it, organizing it and interpreting it with existing knowledge (Tuckman & Monetti, 2011). Each learner is very important in constructivism in order to make teaching and learning meaningful (Mogashoa, 2014; Yadav 2017). According to Piaget (2013), the learner needs to adapt to the learning environment where the instructions are been given by altering the new knowledge and skill to fit into the existing knowledge in order to get the new knowledge accommodated

The following are the core perspectives in meaningful learning (Woolfolk,2001)

1. Learning is self-directed process: knowledge is constructed rather than directly received
2. The instructor acts as a facilitator
3. Learning occurs as a social process (IBO, 2012).

In order for students to construct their own knowledge and understanding the world by experiencing and reflecting on the experience, it demands that the constructivist

strategies such as inquire-based learning, problem-based learning and collaborative learning which are student cantered are employed in the teaching and learning process (IBO, 2012). Students should understand processes and structure; develop skills in manipulation, processing of Biological science information and conducting scientific investigations. Hence, the teaching methods such as learners design, inquiry, and inclusion, divergent and self-check could enhance the teaching of Biology practical lessons (Capel, Least & Turner 2019).

In student centred approach, students are active participants in the teaching and learning process. They learn at their own pace, they use their own strategies and they are more intrinsically motivated as they manipulate apparatus or specimen, follow procedure and interact with one another to generate Biological practical skills (Mido, 2017).

Scientific inquiry refers to the diverse ways in which learners study the natural world and propose explanations based on the evidence derived from the work (Anderson, 2002). Inquiry process involves asking question that stimulates students to think critically which enables students to develop scientific knowledge and scientific habit such as curiosity, creativity, and open minded etc that is needed for understanding biological concepts. Biology as science of life provides potentials for the use of many inquiry methods. In the science laboratory, students can practice individually or in groups to carry out task (Shakibu, 2013). According to Ongowo and Indoshi (2013), when students' participate in an inquiry by using the science process in the laboratory, they develop scientific knowledge and skills which is assimilated efficiently and at a much deeper level. According to Hmelo-Silver (as cited in Tuckman and Monetti

2011), problem-based learning is a student directed learning that focus on solving complex problems that do not have a single correct answer.

Ampiah (2004) asserted that collaborative learning method involves mixed-ability groups of students working together, contributing ideas and interacting with each other to solve a problem.in collaborative learning, the idea is to create interdependence in such a way that each individual's action benefits the group and the group's action benefits the individual (Ornstein & Lasley 2000). Kandjeo-Marenga (2011) states that when learners work in groups, they help each other provide suggestions and explanations, questioning others, signalling to others what next step needed to be taken, and exchanging views as they try to solve problems. Group experiments can also provide an opportunity for learners to restructure their thinking skills through interactions with peers (Muijs & Reynolds, 2011)

Alison (2013) said that, Biology is centred on problem-solving and the laboratory is the most convenient place for careful observations, accurate calculations and logical inferences, therefore, practical activities should be regarded as the main instructional procedures in which cause and effect of any concept are determined.

Problem-based learning, collaborative learning and inquire based learning are therefore essential in the dispensation of Biology knowledge the SHS. If Biology practical skills are taught with these theories, it will make the students own their learning environment that will lead to effective and efficient grasping of Biology knowledge. As indicated in the President's Committee on Review of Education Reform in Ghana 2002, Ghana educational system should help individuals to be innovative, adaptive and have the capacity to apply knowledge and skills to solve problems in their daily life. Alison (2013) said that, Biology is centred on problem

solving and laboratory is the most convenient place for careful observations, accurate calculations and logical inferences, therefore, practical activities should be regarded as the main instructional procedures in which cause and effect of any concept is determined.

Fishburne and Hickson (2001), proposed that appropriate teaching and learning methods in science, such as group work, laboratory investigations and problem–based teaching, allow learners to interact and help each other to attain better subject understanding and achieve practical skills. This theory, therefore, fits the purpose of this study, (assessing practical activities in biology and its influence on student's achievement in Kintampo Senior High School.Figure1, is a model developed by the researcher to elaborate the concept of how students will acquire biology practical skills through performing biology practical.

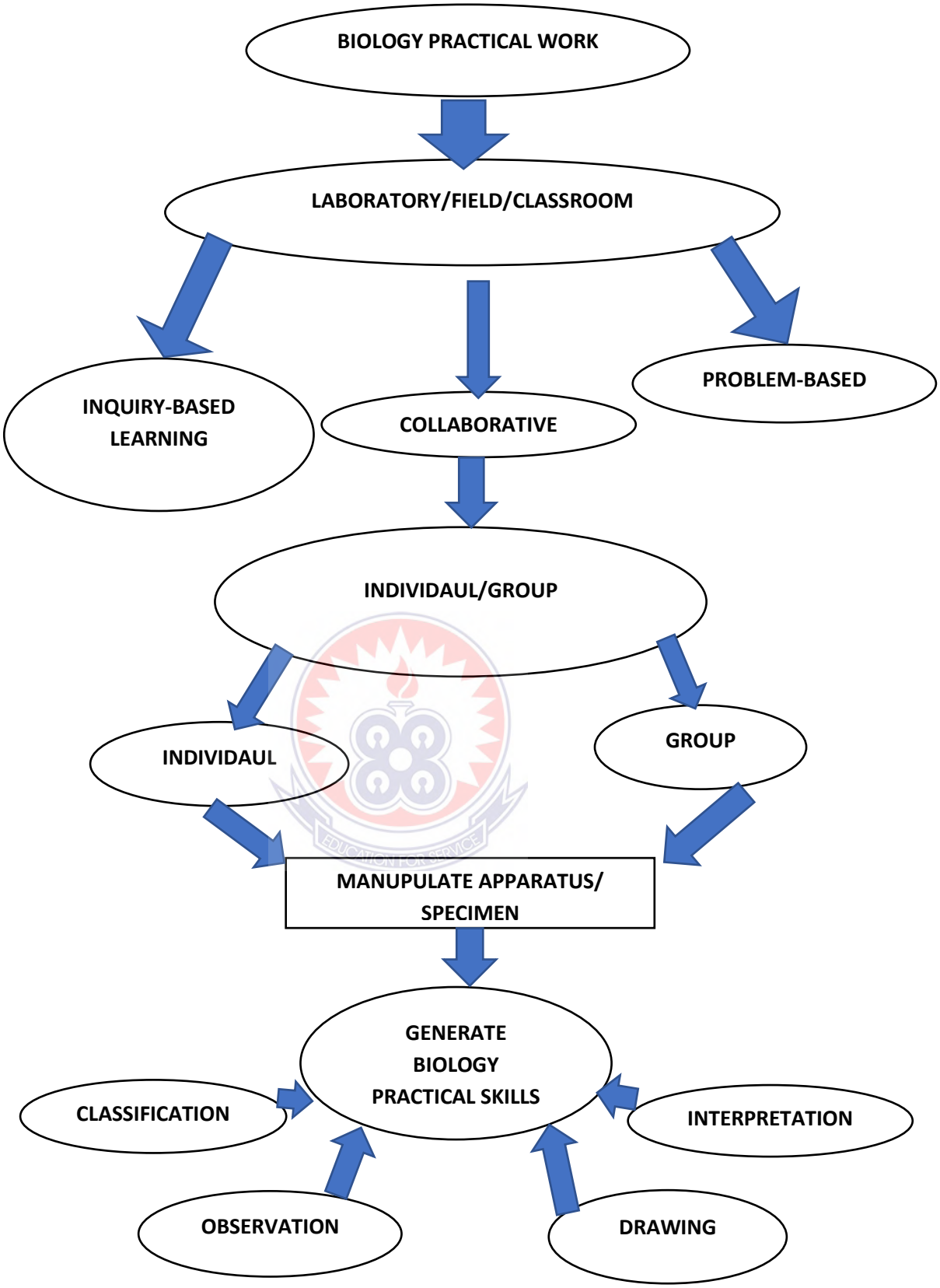

Figure 1: Framework for Acquiring Biology Practical Skills

Source: Researchers Model

2.2. The Concept of Assessment

Assessment is the systematic basis for making inferences about the learning and development of students. It is the process of defining, selecting, designing, collecting, analysing, interpreting, and using information to increase students' learning and development. It has a number of important characteristics which distinguish it from other forms of assessment. It involves the teacher from beginning to the end .It can adapted and modified by the teacher to match teaching and learning goals of particular class (Allen, 2009). Assessment begins with learning and is the process of gathering and discussing information from multiple and diverse sources in order to develop a deep understanding of what students know, understand, and can do with their knowledge as a result of their educational experiences; the process culminates when assessment results are used to improve subsequent learning (Huba & Freed, 2000).

2.3. Biology as a Science

Biology is a branch of science that deals with the study of living things, which includes human-beings (Ude, 2011). Biology has many branches which include; zoology, botany, ecology, genetics, morphology, anatomy, physiology, histology, microbiology, evolution, cell biology to mention but a few. Many societal issues are biology-based; these include biodiversity, genetically modified organisms, reproductive technologies, prolongation of life, food production, tourism industry (biological gardens) and processing industries

Biology as a branch of science is the study of plants and animals. Abugu (2017) agrees that biology is natural science in which we study living organisms' plants and animals The knowledge of biology as a subject by secondary school students makes

them well informed and motivated to assume roles in which the practical and theoretical aspects are used in unravelling some basic problems of life (Ude, 2011). In addition, Biology is one of the fields in the natural sciences that studies living things. The word 'Biology' is two Greek words; "Bios" meaning life, and logy ("logia") which means study (Abugu, 2017). That is, the concept of biology is concerned with the study of life. Ude (2011) state that biology in addition, is the study of life, structure, function, growth, origin, evolutions distributions, interrelationships, problems such as diseases, and adaptation of things and proposes solutions where possible. However, biology is the branch of science that studies life using inquiry methods and discoveries

2.4. History of Practical Work in Science (Biology)

The main feature of Biology education that sets it apart from other school subjects is that it involves practical work in which the students manipulate and observe real objects and materials (Abrahams & Millar, 2008).

The origins of modern practical work in Science (Biology) can be traced back to the 17th century (Abrahams & Millar, 2008). The first Science Society was founded in Florence in 1657, under the patronage of the Grand Duke Ferdinand di Medici and his brother Leopold, as a forum for consultation and discussion between scientists with a goal to promote experimental learning in sciences. The foundation, by Charles II, of the Royal Society for the Improvement of Natural Knowledge as the science society of Great Britain occurred in 1662. In France Louis XIV founded the Academie des Sciences in 1666. In 1700, Elector Frederick of Prussia founded the Berlin Academy, the corresponding organisation in Germany (Abrahams & Millar, 2008). A similar association, the Dublin Society, established the first recorded chemical laboratory in

1796. The Royal Institution of Great Britain was established in 1799, dedicated to scientific research and scientific education. The activities and interests of these scientific societies flowed through to education.

Practical work was introduced into schools at the beginning of the nineteenth century in both the U.K. and the U.S. The development in the U.K. has been fairly well documented by comparison with events in the United States. As early as 1802, Edgeworths in his work on 'Essays on Practical Education' wrote: "There is considerable pleasure in the pursuit of experimental knowledge; children especially enjoy this substantial pleasure. They (the children) love to see experiments tried and to try them. They show this disposition not whenever they are encouraged. But whenever they are permitted to show it. - Queenwood College, a relatively obscure Quaker School, was the first English school to introduce 'practical or laboratory teaching of science', to an extent which makes science teaching at Queenwood one of the most significant nineteenth century experiments in English education (Abrahams & Millar, 2008).

The achievement of Queenwood College was almost entirely due to a quite outstanding staff, of which Frankland, Tyndall, Barrett, Galloway, Hirst and Debus in later years occupied Professorial Chairs and were active members of the influential X Club. The latter group formed in 1864 by nine eminent scientists served as a highly significant fraternity of scientists (Klainin, 1995) . One of the major aims of the nine men in the X Club was to change science education to one that was more practically based. In the Queenwood Reporter, Thomas Edmonson, a member of the X Club and teacher at Queenwood College wrote: "Schools and Colleges seldom do more than afford opportunities for the acquirement of knowledge; for its right application and its

lasting retention, they scarcely profess to make any provision. One leading object at Queenwood is to remedy this defect. Our pupils' progress will be tested by their ability and not their amount of knowledge. So far as possible, everything will be taught and learned among us practically, that is, with a view to the business of life." The students at Queenwood, unlike their counterparts in the traditional English schools learnt their science in the laboratory and lived in a genuine atmosphere or research. Between 1867 and 1897 the number of students enrolled in some kind of science education program in Great Britain increased from 10,000 to 160,000. As the number of students increased so did the complaints from examiners that there was too much emphasis on bookwork and too little on practical work (Kerr, 1964).

Frankland and Tyndall carried into effect these principles of the teaching of science at Queenwood, expressed by T.H. Huxley in the following words: "If a man wishes to be a Chemist, it is not necessary that he should read chemical books and attend chemical lectures, but that he should actually perform the fundamental experiments in the laboratory for himself.". Robert Galloway, who later became Professor of Chemistry in the Royal College of Science for Ireland, commented on the excellence of the provisions at Queenwood for the teaching of chemical analysis: "Although only about four hours; in the week was devoted to the study of science, boys of fourteen (14) and fifteen (15) years of age became excellent analysts (Kerr, 1964).

Those of them, who on leaving the school became pupils with surgeons, could make medical, food and other analyses more accurate in every aspect than the surgeon to whom they were articled “Tyndall also felt that the link between mathematics and physics was achieved with some success. Tyndall wrote: "It was pleasant to prove by mathematics, and verify by experiment that the angular velocity of a reflected beam is

twice that of the mirror which reflects it. From the hum of a bee we were able to determine the number of times the insect flaps its wings in a second. Following up our researches on the pendulum, we learned how Colonel Sabine had made it the means of determining the figure of the earth; and we were also startled by the inference which the pendulum enables us to draw, that if the diurnal velocity of the earth were seventeen (17) times its present amount, the centrifugal force at the equator would be precisely equal to the force of gravitation, so that the inhabitant of those regions would then have the same tendency to fall upwards and downwards." That is, it is not too much to say that the germs of what was later to become the influential heuristic method (in which the pupils were required to solve problems by experimentation) in English education were nurtured in the science teaching at Queenwood (Kerr, 1964).

The widespread acceptance of science into the secondary school curriculum at the turn of the century was influenced by the writings of Henry Armstrong. Armstrong had been a pupil of Edward Frankland at Queenwood College, himself, and was a firm believer and advocate of Heurism. Armstrong maintains that "all science teaching should be as far as possible, a process of discovery". There are strong evangelical overtones in his credo: "I believe that gradually a complete revolution must take place in school procedure", and that "instead of being a place •fitted for the rearing of desk ridden emasculates, the school will be for the most part modelled on the workshop." He was also echoing what his teacher, Edward Frankland, and his friend, John Tyndall, had seen worked out in practice fifty years earlier at Queenwood College, Hampshire. The teaching of science was to be an affair of the laboratory and workshop rather than of the classroom. Edward Frankland maintained a strong interest in school science throughout his life (Kerr, 1964).

As incumbent of the Chair of Chemistry at the Royal Institute he persuaded the department of Science and Art. To provide grants for school science laboratories. Out of Frankland's experience came his monograph 'How to teach 'Chemistry' (in 1875). The book describes one hundred and nine (109) experiments that Frankland believed teachers should introduce to all pupils. These experiments became the chemistry practical syllabus for English schools for almost two decades (Abrahams & Millar, 2008).

Thomas Huxley also persuasively argued the case for first-hand experience in science. His work greatly influenced the use of individual laboratory work in the teaching of school science. Huxley himself was concerned with biological science both as a professional scientist and as a teacher. He saw training in science as part of the education of a cultured man. In general, a majority of outstanding scientists and science teachers by the turn of the century believed that if science teaching was to yield its most valuable results, it must be made practical. The "heuristic' or practical discovery method of science teaching was favoured by leading science teachers and science educators until as recently as the Second World War. To what extent it was genuinely adopted by the average science teachers in the U.K. is not recorded (Klainin, 1995; Lazarowitz & Tamir, 1994).

There is no doubt that an unguided heuristic approach represents a highly sophisticated teaching mode which places great demands on the personal characteristics of the teacher and is extremely time consuming. Reservations of this sort were reported from time to time in the School Science Review from well respected 'authentic teachers (Klainin, 1995). It may well be that a full heuristic treatment was never adopted in practice other than by an elite group but nevertheless

it represents an ideal for science teaching which remains quite deeply rooted in the English School system. Misgivings about its general usefulness gathered momentum during the 1920's. One interesting government report on science teaching produced by the Thomson Committee in 1918 is openly critical of laboratory exercises: in many schools, more time is spent in laboratory work than the results obtained can justify. We do not underrate the importance of such work. On the contrary, we regard it as an essential part of science teaching. But sometimes the performance of laboratory exercises has been considered too much an end in itself. Such an exercise loses the educational value of a real experiment when it becomes a piece of drill." Here is perhaps a clue to the nature of real practice in schools. One might have expected that a report chaired by an experimental scientist of the calibre of Thomson would have stressed the importance of the 'spirit of enquiry' - and so it did. However, according to the report, this quality was largely missing in school science and instead practical work was being interpreted as a series of essential experimental techniques.

Maintaining a balance between these two emphases, technique and inquiry is an intractable problem and remains as acute an issue today as it was when the Thomson report was written. Although no survey studies of school practice are available for that period the evidence is that the recommendations of the Thomson report were either ignored or could not be met. School practical work steadily metamorphosed further towards a technique dominated set of drills, so that by the 1950's the time was ripe for some reshaping of the laboratory enterprise. J.F. Kerr's survey 'Practical work in Schools' published in 1963, was much referred to in the early development of Nuffield Science. It represents the first attempt in the U.K. to ascertain the actual practice and perceptions of pupils and teachers with regard to practical work (Klainin, 1995).

Although essentially a first-order descriptive survey it did much to clarify the real situation and has since been used as a reference in comparative studies. The Nuffield Science Curricula that emerged in the U.K. once again laid considerable stress on extensive practical work, on 'finding out' and on the 'spirit of enquiry'. (Klainin, 1995; Lazarowitz & Tamir, 1994)

In Ghana, practical work in Science (Biology) was inculcated into the curriculum in the in 1985 (science 5-16: A statement of policy DES) which explains that, all students aged five to sixteen (5-16) should be taught science. There should be science for all in primary and secondary level of education. (retrieved from https//www.stem.org.uk collection).It is in view of the above that, Nwagbo (2016) stated that "the use of practical activities approach to the teaching and learning of Biology concepts should therefore be made mandatory other than an option to Biology teachers, "if we hope to produce students that would be able to acquire the necessary knowledge, skills and competence needed to meet the demands of the nation". This implies that, the academic performance of students in any science-based subject like Biology is closely related to both theoretical and practical knowledge.

2.5. Meaning of Practical Work in Biology and Nature of Biology Practical Work.

Biology practical is defined as any teaching and learning activity which involves learners observing or manipulating real objects and materials, extracting information from complex systems, testing hypotheses, analysing and evaluating variable data, demonstrations, discussions, simulations and exercises (Millar, 2004; Abraham & Miller, 2008; The Society of Biology, 2004). Lunette also defined Biology practical as the learning experiences in which students interact with materials or with

secondary source of data to observe and understand the natural world (Lunetta, 2017). According to The Macmillan Dictionary (2018), Biology practical are defined as an examination or lesson in which a students' makes things or does experiments. The term refers to what appertains to practice or action "doing". The "doing" depends on acquisition of the required skills. The terms practical and skills go hand in hand for effective learning of biology, as spelt out in the biology syllabus. In addition, biology practical is viewed as any science teaching and learning activity which involves students, working individually or in small groups, manipulating and observing real objects and materials, as opposed to the virtual world Biology practical are the scientific instruction, which brings about learning activities in science (Woolnough, 2013).

There are student-centred methods of doing school work, but laboratory work is the flagship for learning in science and extension of biology (Singer, 2015; Woolnough, 2013). According to Dikmenli (2009), the main purpose of practical work in science education is to provide students with conceptual and theoretical knowledge to assist them learn specific concepts and scientific methods to understand the nature of biology. That is, practical work stimulates learners interest in the biology they are studying when they are made to personally engage in useful activities; knowledge obtained through practical work and experience, promote long term memory that theory alone cannot do. From this reason, it becomes obvious that a learner acquired more in any science lesson if giving the opportunity to do activities, ranging from manipulating apparatus, classifying, designing, experimenting, hypothesizing to make inferences and verifying results. In addition, practical activities in biology provide opportunities for students to actually master Biology and become exposed to learning about science

Practical work is considered as hands – on learning experience, which prompts thinking about the world in which we live (Science Community Representing Education, 2008). The effectiveness of Biology practical activity depends on the practical knowledge level, skills and the ability of the Biology teacher to organise practical work (Copriady, 2015). Experienced Biology teachers have richer background of experience to draw from and can contribute to their practical work practices (Kosgei et al., 2013). Eunice (2014), on the other hand define practical work as being logical instruction that focus on knowledge, concepts and a range of skills that learners are to acquire on their own with the guidance from their teachers. Practical work offers tacit knowledge that cannot be verbally taught and can only be communicated by nonverbal interactions through hands-on activity. (Kibirige & Tsamago, 2017).

Scientific phenomena cannot be fully understood by neither practice nor theory alone. This is because the theoretical and empirical concepts are intertwined and can't be separated from each other (Jokiranta, 2014). This is supported with the fact that science (Biology) is a process and at the same time science (Biology) is a product. Science (Biology) a process entails procedures such as observation, measuring, collection of data, manipulation of materials, drawing, communication, recording, interpretation, predicting and experimentation are been used in achieving a particular solution in science (Biology). When these procedures are used by scientist to come out with theories, laws and scientific facts, then science (Biology) becomes a product (Sadhana, 2017). According to Adegbamigbe (2002), teaching practical work consist of a series of dynamic processes and activities that encourage inquiry and hands-on experiences within the classroom with a view to enhance learning, promote development of practical skills and learners' achievement.

Biology as a science is a special type of discipline with peculiar characteristics, the prominent among which is the approach through which knowledge is sought. This approach is known as scientific method. Scientific method is a logical, rational and systematic process by which knowledge in science is acquired. The steps involved in scientific method are observation, hypotheses, predictions, experimentations, conclusion and host of others (Ezeh, 2013). Practical work can be taken in diverse ways such as experiment, investigation and fieldwork

2.5.1. Experiment

Experimenting is testing by following procedures to produce verifiable results. It is process by which one carries a scientific test in order to study unfolding results and gain knowledge. It also involves, analysing and presenting. The experimental approach provides the opportunity for students to seek information using experimental procedures. It calls for careful observation and interpretation of data and has the qualities of questioning, investigating and confronting the unknown. If it is properly implemented, experiment can lead to increased motivation to learn, greater retention of knowledge, deeper understanding, and achievement of practical skills (Froyd & Simpson, 2008). Experimental activities in Biology could be seen as a method that could be adopted to make the task of teaching Biology more concrete or real to students as opposed to theoretical or abstract presentation of

principles, facts and concepts. Experimental activities in Biology are important to students' academic performance because, it is a teaching method that has to do with practical demonstration of scientific concepts, principles, theories and laws. From its experimental engagement, the students ultimately gain capacity to acquire new facts, develop concepts and principles and skills, which lead to the cultivation of scientific

attitudes and habits Onyegegbu (2006) Experiments are considered the hallmark of practical work teaching as teachers usually relate to the actual manipulation of apparatus and equipment (Tifi et al., 2006). According to Hodson (1993), experiments gives learners the opportunity to communicate with one another and to some extent, they might also interact with their teachers. He further states that in experiments, learners apply the methods, principles and concepts that they are being taught in their lessons. Experiments can allow learners active engagement in the construction of scientific knowledge and skills as well as in using science tools. Thus, learners become involved in task-oriented activities. Experiments can also provide an opportunity to learners to restructure their own thinking skills through interactions with peers (Muijs & Reynolds, 2011).

2.5.2. Investigations

Investigation is perceived as practical work that is carried out and involves testing of a hypothesis or solving a problem (Hofstein & Mamlok-Naaman, 2007). Investigations are identified as practical tasks which consider a problem for which there is no easily recalled solution (Roberts, 2004). He also explained that, an investigation is defined as a problem that is restricted to considering relationships between variables, and such tasks are known to be relatively short and focused tasks that can be completed within a short period of time. Rughill (2011) in his study on laboratory investigative approach for a successful teaching methodology for high school science instruction, revealed that, students showed significant high grade for this cognitive dimension.

The study of biology in senior secondary school can equip students with useful concept principles and theories that will enable them face the challenges before and after graduation. Practical biology is the scientific study of the life and structure of

plant and animals and their relative environment in real or experimental set-up rather than dwelling in the theory and ideas (Opuh et al., 2018). Rughill (2011) in his study on laboratory investigative approach for a successful teaching methodology for high school science instruction revealed that, students showed significant high grade for this cognitive dimension.

2.5.3. Fieldwork

Fieldwork is critical to the biological sciences, providing fundamental training for key disciplines such as behaviour, ecology, evolution, systematics, and conservation science (Eisner 1982; Fleischner 2005; Baggott and Rayne 2007). Tal and Morag (2009) described field trips as student experiences outside of the classroom at interactive locations designed for educational purposes. Field studies underlie the conceptual and technical bases for these disciplines and are required to ensure their healthy growth. Field biology is rooted in natural history but typically places greater emphasis on using observational and experimental data to advance conceptual models and theory. Biologists should be cautious about dichotomizing natural history and field biology (Greene, 2005). Planning a teaching approach that centres on learners via visual guide, fieldwork, and handling real objects are valuable assets in effective teaching than all talk. Biology is a science that involves both theory and practical work if it must be taught or learnt effectively. In such a case, a laboratory is crucial for effective practical actives in science. (Iloeje, 2005)

Field study also promotes the development of place-based understanding (Billick and Price, 2011) Field experiences create not only better science but also better scientists, citizens, and people, thereby substantially affecting the human–nature relationships

that form the basis for sustainability (Fleischner 2011, Mogk and Goodwin 2012, Barrows 2016)

2.6. Biology Practical Skills

These are process skills which are broadly transferrable abilities used in several science disciplines and are reflective of the behaviour of scientist (Idiegu et al., 2017; Jack, 2018). Akinbobola and Afolabi (2010) stated that, Biology practical skills are cognitive and psychomotor skills that are used I problem solving. These are skills which Biologist uses in problem identification, gathering of data, hypothesis of data, analysis of data, interpretation of data and communication of their findings. These skills can be classified as basic and integrated (Karamustefaoglu, 2011). Biology practical skills include; identification, observation, measuring, drawing, classification, communication, inferring and predicting (Mei et al.,2007; Karamustafaoglu,2011). In addition, Karamustafaoglu (2011) also pointed out that, the collection and transferring data, constructing tables and graphs of data, describing relationships between variables, manipulating materials and equipment, recording data, drawing conclusion from experiments and generalisation are integrated skills.

Biology practical skills provide a foundation for easy learning of Biology. They enable the students to take up more complex task and solve these tasks in Biology experiment (Rauf et al., 2013). Draghicescu (2014) opined that acquiring scientific skills must help individuals to have a better understanding of the progress, limitations and risks of the scientific theories, of the applications of technology in the society.

The skills that this research has considered include observation, drawing, interpretation and classification. These are the skills that are most required in the WASSCE examination by WAEC.

2.6.1. Observation.

Almost every activity of science begins with observation about all things around, using the senses as appropriate and safe; identifying similarities and differences; noticing details and sequence; ordering observations. One of the national goals of education is to enable the learners play a more effective role in the economic, technological and industrial development of the nation. Alkaslassy, O'Day (2002) noted that observing is a fundamental science process skill. We observe objects and events using all our five senses and this is how we learn about the world around us (Karamustefaoglu, 2011). supports this assertion and states that observing is not simply a question looking, but it involves the use of all the senses, that is, sight, sound, touch, smell and even taste. Observing is a fundamental science process skill.Observing is not simply a question looking, but it involves the use of all the senses, that is, sight, sound, touch, smell and even taste. One has to look at a specimen very carefully to be able to draw it accurately, and labelling of a drawing forces one to think about the component structures and their positions. Observation alone is not necessarily an accurate and reliable activity for gathering data. Observers often "miss seemingly obvious things" and "invent quite false observations." Nevertheless, the skill is valuable for and crucial to both the process of conducting scientific inquiry and to the process of teaching and studying the ways of biology. Observational skills expected in science are to read the instrument correctly, notice colour change, notice relevant details in given specimen, locate desired parts in specimen accurately, and take observations carefully in a systematic manner.

2.6.2. Drawing

In Biology, the study of life requires careful observation and description. One excellent way to describe an object is to draw it. The goal of the observer is normally to move beyond simple mental images of what he/she believes a particular plant or animal looks like, and instead concentrate on the unique identity of that specimen (Dempsey, 2001) Drawing skill subsumes other skills like observation; the learner is expected to make accurate well labelled biological diagrams. The role of drawing skills in the teaching and learning of Biology has often been underestimated. (Dempsey, 2001) says that the making of drawings in botany and zoology is an accepted technique. He noted that drawing in Biology had the following functions: Ensure that the student looks at and examines the details of the specimen with proper attention. This ensures meaningful learning which will be translated into good performance in Biology.

To provide avenues for learning through visual and kinaesthetic experience in addition to the auditory experience of listening to the teacher. This breaks monotony during the learning process, resulting in increased attention span, to provide a record of the work done by the student. It also provides the student with material useful for revision. In addition to the above it acts as a medium for analysis and synthesis that is to be a stimulus to think. The use of visual representations to learn can be traced to Louis Agassiz. In his approach, students were to study nature through carefully observing, drawing and making inferences (Karamustefaoglu, 2011).

2.6.3. Interpreting

Interpreting is a very important skill with respect to data from an investigation. The learners should be able to relate the data from an investigation to content and give out clear explanations (Karamustefaoglu, 2011). Interpreting and inferring are critical determinant of science activities. Information gathered from scientific investigation usually is not readily useful and meaningful; data have to analysed and interpreted.

As students perform these practices, they begin to inculcate these practices into their life style and it becomes a part of them. They are able to relate these skills in solving task as well as use these skills in answering question such as the Biology paper 3 of the WASSCE. The teacher should expose learners to situations where their ideas are matched against the biological concepts, which are backed up by evidence through experimentation. This may lead the learners to better understand Biological concepts and hence perform better in practical examinations. (Nghipandulwa, 2011).

2.6.4. Classification

The ability to classify in Biology is very important. Biological classification aims at simplify and order the diversity of life into coherent units called taxa that have widely accepted names and whose members share important properties. Biological classification can integrate diverse, character-based data in a phylogenetic frame logical property of taxa. With the several importance of classification, the researcher summarises it as, it makes identification easier for studies.

2.7. Role of Practical Work in Teaching and Learning of Biology

From the beginning of the 18th century to date, educators and researchers have studied the value of practical work and its important role in scientific fields such as chemistry and biology. Multiple studies showed that practical work confers many

advantages, including developing laboratory skills and scientific knowledge, as well as understanding science concepts and theories (Fadzil & Saat, 2013) Studies in science education worldwide have recognised that practical work plays a central role in the teaching and learning of science at different levels of educational system (Danmole, 2012 ;Motlhabane & Dibacha, 2013). Marques et al., (2010) alluded in their study of science (Biology) to the fact that currently practical work is the centre of the aims and procedures of science education I strongly agree with Poppe et al., (2010) who stated in the study that, overall, practical work has become a well-established and integrated component of secondary school science (Poppe et al., 2010).

According to the Macmillan Dictionary (2018), Biology practical is defined as an examination or lesson in which a student makes things or does experiments. The term refers to what appertains to practice or action "doing". The "doing" depends on acquisition of the required skills. The terms practical and skills go hand in hand for effective learning of biology, as spelt out in the biology syllabus. Practical skills are tested exclusively in the practical paper. However, findings of practical may be tested in a theory paper. The level of competence in practical skills may determine performances in a class. Practical classes in animal diversity, ecology and behaviour offer students opportunities to handle preserved specimens of animals and to see the external and internal structures of animals first- hand. The practical exercises allow students to review the lecture content and to fully understand the functions of the various structures. Students are arranged on benches in small groups. This gives them the opportunity to discuss concepts together. The teachers are available to identify structures and to interpret what they see in terms of their functions. All these benefits are lost if biology lessons follow literary approaches. Although there is some concern about the lack of biology practical activities in the senior high schools (Ajayi, 2010).

Chukelu (2010) reported from research findings that, “doing” has been found to be the easiest skill attainable by students’ respondents; many professed to like the “doing” aspect of Biology practical learning skills but the liking may not translate into performance in schools. Chukelu (2010) also conducted a study and noted that practical nature of Biology results in solving problems scientifically.

Millar (2008) claims that practical work can be used as a tool to fulfil the aim of giving freedom to the learner to think and act independently, as in inquiry based laboratory work the student is free to be in touch with natural word, create his/her own hypothesis and predict the result. To practice how to find the problem and their solutions is another aim of the practical work. This aim is based on the steps of scientific investigation, which means that the students by doing laboratory work should practice to create hypothesis, collect data, doing experiment, analysis and make result and conclusion. In addition, practical work is used to improve the analytical ability of students as well as working in groups and practice cooperative work and achieving practical skills (Dillon, 2008). Laboratory work includes both the observing of natural phenomena as well as the actual doing of laboratory work, and if the teaching is directed by constructive feedback from the teacher, the outcome usually is positive as Schunk (2012) claims. Learning can be achieved either vicariously or actively, the first happens through observing, the latter occurs when the learner is engaged in practical work by the learner.

According to (Hodson, 1990), practical work creates exceptional learning surrounding that helps students to construct their knowledge, enhance logical, inquiry and psychomotor skills. Also, practical work offers an interactive experience to students where they can broaden their scope of constructivism learning (Umar, et al., 2005)

and provides opportunities for students to actually do science as opposed to learning science. The value of teaching practical work has been recognised at the senior secondary level. Many teachers acknowledge the importance of teaching practical work because learners learn by doing rather than being told or shown (Nghipandulwa, 2011). This was further emphasized by Hodson who stated that practical work teaching is an important component of science subjects. He suggests five reasons for teaching practical works and involving learners in practical activities, namely: to teach practical skills, motivate interest in science, develop scientific attitudes, and enhance learning of scientific knowledge and to give insight into scientific method (Hodson, 1990). According to (Nghipandulwa, 2011), a student can easily understand the concepts when he/she is involved in the practical activities that are following procedure, collection data and concluding. A sense of achievement is felt by students and teachers alike when practicals coincide with theory. According to Dillon (2008), there are many reasons for doing practical work for scientific subjects in schools. Some of the reasons are to encourage accurate observations and descriptions, to change theories into real-life application, to keep the interest of students in scientific studies and promote a logical and reasoning method of thought. Sotiriou, Bybee and Bogner (2017) state that: The goals of practical work are to improve students' understanding, develop their skills in solving problems and understanding the nature of science, by replicating the actions of scientists practical work can motivate students, stimulate their interest in teaching and learning, enhance the learning of scientific knowledge, give them experience in using scientific knowledge and widen their way of thinking. While solving a scientific problem, students should act like a scientist and follow scientific processes. According to Piaget (2013), people construct increasingly sophisticated and powerful representations of the world by acting on

them in the light of current understanding. If one considers that Piaget is correct, then practical work is important in understanding sciences in general. The main role of practical work is to give support for students in their learning and to make a link between the domain of real objects and observable facts on one hand and the domain of ideas on the other.

Practical work in Biology helps students understand biological concepts better (Mwangu & Sibanda, 2017). Also, Gott and Duggan (2009) assert that students understand natural phenomena better when science teachers give students opportunities to engage with and fully participate in practical work. According to Gecer and Zengin (2015), during practical activities students learn Biology more effectively and discover basic concepts, principles and laws. In addition, practical work offers an essential opportunity for students to link first-hand experience with scientific concepts and ideas. (Killermann, 2010) indicated in his studies that visual sense is the highest of all senses, and it is necessary for effective biology practical activities. Learners tend to appreciate things seen more than spoken. (Cossa, 2007). The Ghanaian Senior High School Biology curriculum is designed to guide and inculcate in the learner skills of observation, measurement, formulation hypothesis, predication, designing, investigation, recording and interpretation of data, drawing conclusions and communicating them (Curriculum Research and Development Division, 2011). In support of practical work in the scientific fields, Roberts (2008) designed a booklet on high quality practical activities in science, in which she stated: "Students achieve a deeper level of understanding by finding things out for themselves and by experimenting with techniques and methods that have enabled the secrets of our bodies, our environment, and the whole universe – to be discovered.

According to Gott and Duncan (2003), teaching practical work is an approach that develops procedural understanding, allows learning by doing and provides opportunities for learners to touch and hold equipment themselves rather than being taught theoretically. Practical work would thus enable learners to do science using the ways of scientific inquiry. Furthermore, teaching practical work is meant to stimulate the development of analytical and critical skills and create interest in science (Ottander & Grelsson, 2006). Nzewi (2008) asserted that laboratory activities can be regarded as a strategy that could be adopted to make the task of teaching more real to the students as opposed to abstract or theoretical presentation of facts, principles and concepts of subject matters. Nzewi (2008) further maintained that practical activities should engage the students in hands-on and minds-on activities, using varieties of instructional materials/equipment to drive the lesson home.

For the interest of learners in Biology to be increased and for them to become motivated to do science, it is importance that the teachers teach and perform practical work with them. Teaching practical work with real objects and materials help both teachers and learners to communicate ideas and information about the natural world, and also provide opportunities to develop learners' practical skills of the scientific approach to enquiry (Nghipandulwa, 2011). Roberts (2010) also conducted a study and noted that practical nature of science results in solving problems scientifically It provides the learner with the necessary tools for employment in laboratory, industry, agriculture, forestry, health care, administration and teaching. Furthermore, it equips the learner for further studies and research in pure and applied science and technology that are vital areas for the advancement of society and make the leaner capable of critical thinking, making meaningful decisions and solving problems (Na'Omi, 2013). Practical activities in Biology is essentially important for concretizing theoretical

classroom learning experiences and stimulating the students urge to study Biology. It also provides opportunity for students to interact with materials and ideas, and by so doing, stimulate the development of affective and psychomotor dimensions of learning alongside with the cognitive dimension in order to ensure an all-round and comprehensive development of the student (Agbowuro, 2006).

The teaching of practical work in science subjects such Biology is widely accepted and it is acknowledged that it promotes the engagement and interest of learners as well as developing a range of skills, subject knowledge and conceptual understanding (Kasanda et al., 2001). Teaching is said to be effective when resources such as laboratory practical activities, diagrams, charts, models, field works and real objects are efficiently utilized to explain the subject matter Nwagbo (2016). Practical classes in animal diversity, ecology and behaviour offer students opportunities to handle preserved specimens of animals and to see the external and internal structures of animals first- hand. The practical exercises allow students to review the lecture content and to fully understand the functions of the various structures. Students are arranged on benches in small groups. This gives them the opportunity to discuss concepts together. The teachers are available to identify structures and to interpret what they see in terms of their functions. All these benefits are lost if biology lessons follow literary approaches. Alison (2013) said that, Biology is centred on problem solving and laboratory is the most convenient place for careful observations, accurate calculations and logical inferences, therefore, practical activities should be regarded as the main instructional procedures in which cause and effect of any concept is determined. (Gerber, 2015) Practical work is beneficial to learners through interactions, hands-on activities, and application in science

Chikelu (2017) conducted a research on effect of biology practical activities on student's process skill acquisition. A quasi experimental design was employed for the study. The study revealed that, biological practical work has great influence on the performance of students Based on the findings of this study, the use of practical activity method to foster the acquisition of science process skills in biology students was recommended. According to Piaget (2013), people construct increasingly sophisticated and powerful representations of the world by acting on them in the light of current understanding. If one considers that Piaget is correct, then practical work is important in understanding sciences in general. The main role of practical work is to give support for students in their learning and to make a link between the domain of real objects and observable facts on one hand and the domain of ideas on the other (Bryson, 2002). Lee and Sulaiman (2018) argue that practical work can serve as a useful platform to develop a positive effect on learners' motivation and understanding towards learning. Practical work also fosters interest, new experiences, excitement, and a better understanding of a subject in learners, which in turn increases their ability to collaborate with peers, and it becomes a great motivation to improve their performance as they gain confidence in subject content, motivation and understanding Science generally. In agreement with what was said by Lee and Sulaiman (2018), the current researcher postulates that Science education cannot be complete without practical work. Therefore, there is no doubt that practical work is a fundamental part of the teaching and learning of Science. The importance of practical work in Biology cannot be downplayed and several research works has proven that Biology practical is important in the learning cycle of the students. It is through practical work that learners may be involved in different activities that may enhance their abilities to handle information, solve problems, develop experimental skills and learn how to

plan investigations. According to Nakanyala (2015), learners are motivated not only by teachers who knows how to teach science but also those who help them learn through practical work and make learning fun.

2.8. Performance of Students' in Biology Practical Work in Secondary Schools.

The performance of students in West African Senior School Certificate Examinations (WASSCE) in Biology practical is not encouraging, even though, Ghana is said to be the first independent sub-Saharan African country to embark on a comprehensive drive to promote science education and the application of science in industrial and social development (Anamuah-Mensah, 1999). The performance of students who wrote the May/June West African Senior School Certificate Examination (WASSCE) Biology paper 2 (practical), improved in 2015 and 2016, declined significantly in 2017 and improved slightly in 2018 with raw mean performance scores of (29.0 ± 8.2), (31.0 ± 11.7), (24.0 ± 9.2) and (27.0 ± 10.3) respectively (WAEC Chief Examiner's Report, 2015; 2016; 2017; 2018).

2.9 Effectiveness of Practical Work

It is widely argued that practical work is essential to teaching and learning in the field of scientific studies and that good quality practical work helps develop students' understanding of scientific processes and concepts However, whether this has an effect on the attainment scores of the students is still under investigation. In a study done on a sample of 25 science lessons involving practical work, the results showed that the practical work supported the direction of the lesson in that it kept students focused on tasks and doing the hands-on work. However, practical work was proven less effective in getting those students to make a connection between concept and application in the lab and reflect on their collected data (Abrahams & Millar, 2008).

The study found that there was insufficient proof that linking concepts to observables is taken into consideration by the people who design these activities for the science lessons. Millar proposes that students' minds should be stimulated prior to starting any practical work by providing them with some background information on what it is they are investigating. Also, the task design should direct students' efforts to make links between the two domains of knowledge. Consequently, science teachers should be trained based on the most recent research studies to amend their practices and put forth more time and effort to reflect on linking scientific concepts with the natural world (Jokiranta, 2014).

However, one should keep in mind that the feedback from teachers of laboratory work is a vital source of information about its value. In previous studies, they mentioned that laboratory work is vital for studying sciences but there are certain problems they faced such as: lack of materials needed for the required experiments, insufficient information for carrying out the experiment, insufficient techniques followed during the experiment, lack of information about the glassware and the chemicals that are needed for the experiment, lack of information about safety rules, lack of information about the steps that should be followed to avoid any accident during the experiment and finally what should be done in case of an accident during the experiment (Aydogdu, 2015).

2.10. Effects of Practical Work in the Performance of Students in Biology.

Practical work has been able to promote students' positive attitudes and enhance motivation for effective learning in science as described by Oman and Zakari (2017). Consequently, a positive attitude toward the importance of practical work meaningfully affects students' achievement in science (Hinneh, 2017). Practical work

offers an interactive experience to students where they can broaden their scope of constructivism learning (Umar et al., 2005) and provides opportunities for students to actually do science as opposed to learning science. As students undertake Biology practical activities, they develop good scientific attitudes such as honesty, open mindness, tolerance, creativity, discipline and many others. They learn to practice the good behaviour of scientist and acts as such. The goals of practical work are to improve students' understanding, develop their skills in solving problems and understanding the nature of science, by replicating the actions of scientists. I agree more with Sotiriou et al., (2017) who state that: "While solving a scientific problem, students should act like a scientist and follow scientific processes."

According to Dillon (2008), there are many reasons for doing practical work for scientific subjects in schools. Some of the reasons are to encourage accurate observations and descriptions, to change theories into real-life application, to keep the interest of students in scientific studies and promote a logical and reasoning method of thought. Students should therefore set up work and observe the concepts in biology lessons on their own through practical activities in the laboratory. Students tend to understand better when they have practical experiences, when they are involved in experiments; they tend to understand better and come to develop interest in biology as a course (Watts 2013).

Biology is in its very nature tentative since knowledge is regarded as partial truth, and new knowledge is acquired through empirical observations and/or experiments. By teaching those phenomena, which are common in daily life, through experiments and practical work, and by being engaged in solving the problem and discovery better results for the students can be achieved. Practical work is one of the central parts of

biology education and seems to enhance students' understanding of biology when the leaner is involved in laboratory activities .Additionally, it gives chance to the learner to acquire laboratory skills such as knowing how to work with laboratory material and inquiry skills.

Practical activities in Biology is essentially important for concretizing theoretical classroom learning experiences and stimulating the students urge to study Biology. It also provides opportunity for students to interact with materials and ideas, and by so doing, stimulate the development of affective and psychomotor dimensions of learning alongside with the cognitive dimension in order to ensure an all-round and comprehensive development of the student Agbowuro (2006). Practical work has also been shown in some studies to help improve the communication skills of students in order to solve problems in science and thus become more motivated in science In addition to this, practical work encourages and increases students' interest in science and promotes it as an engaging subject. Practical work inculcates attitudes and conceptual perspectives which are necessary for scientific inquiry.

2.11. Difficulties in Organizing Biology Practical in Kintampo Senior High School

Over the years, science teachers have sent students into the laboratory with the general conviction that good science courses provide experience in doing and not just words about science. Laboratory activities have always been time consuming for teachers and students and they have always presented teachers with management problems. There are also important economic constraints at work associated with the very considerable costs incurred in the provision of laboratories and apparatus necessitated by practical work. Clearly, great demands are made on the time and

energy of teachers at school in order that students are able to derive the maximum benefit from practical work. Effective implementation of Biology practical activities in many developing countries including Ghana is a general problem as there are so many constraints (Cossa & Uamusse, 2015). Kintampo Senior High School as a leading second cycle institution in the Kintampo North municipality have the following as challenges that affect the organisation of Biology practical in the School;

Cossa and Uamusse, (2015) agrees to this as stated in their study ‘’Some of these constraints include the inexistence of adequate conditions and availability of equipment and laboratory materials, including financial resources, to teach practical Biology, poor preparation of teachers, poor implementation of practical procedures, overwhelming activities demanded by the curriculum and bad practical work practices teachers exhibit when organising practical work’’ (Cossa &Uamusse, 2015; Motlhabane, 2013).Also Mwangu and Sibanda (2017) posit that unavailability of science teachers in schools, lack of materials, lack of funds and time have constrained the teaching of Biology practical lessons

So many factors can be attributed to students’ poor achievement in biology practical; they include teachers’ use of inappropriate instructional approaches, lack of adequate laboratory facilities, poor organization of Biology practical activities, lack of commitment to Biology practical activities by both teachers and students, partial or total absence of laboratory, lack of qualified biology teachers and mode of Biology practical activities that are used in biology laboratory. Studies have shown that teachers use mostly teacher-centred approaches in carrying out Biology practical activities. Most instructional approaches such as lecture and demonstration used in teaching biology in the classroom or laboratory, promote rote learning and lack of

opportunity for students to manipulate materials and reflect on what they do during teaching and learning processes. Students' interaction during practical activities in the laboratory could play a key role towards concretizing learning. Mawazo (2010) reported that most learners tend to perform poorly in Biology and it is thought that among the reasons that has contributed to this poor performance might be the pedagogy used in the teaching of practical work.

In developing countries, practical work is rarely conducted and the traditional transmission method still prevails (Kandjeo-Marenga, 2008). The author argued that practical work is conducted mainly in the form of demonstrations. Kandjeo-Marenga asserted that such practices could deny learners the opportunity to develop practical skills as emphasized in the Biology syllabus.

Practical work needs to be carried out during Biology content lessons to change students' perception and improve on their academic work. However, the situation in most schools in Ghana is different. Teachers lack exposure to science process skills to carry out activities in class (Rose et al., 2013). As a result, teachers try avoiding the practical work in the laboratory and do not understand the importance of laboratory experiments. The findings of a research work carried out by Ghartey et al., (2004) on teachers view on the role of science practical activities in the teaching of science in Ghanaian Senior High Schools was that little emphasis was placed on the use of science practical work to develop students' cognitive skills. A study conducted by Mwangu and Sibansa (2017) revealed that the planning of Biology practical work by most teachers, lacked details and in some cases the objectives of the practical activity were poorly defined

Some other researchers attributed the low percentage of learners who pass practical examinations in science, to dissatisfaction with the syllabus, teachers 'qualifications, workload, experience, lack of teaching skills, and the ineffective style of delivery of subject matter (Millar, 2004).A study conducted by Buabeng and Ntow (2010) revealed a wide range of reasons which accounted for learners' poor performance in Biology in Ghana. Prominent among these factors were teacher factor. Most of the learners reported that there is poor performance in Physical Science at the Senior High School level because practical work was poorly taught to them. Teaching methods of practical work are the most important techniques employed by teachers to realize the objectives of a practical lesson (Buabeng et al., 2014). Thus, teachers of senior secondary Biology and Physical Science ought to use various teaching methods for achieving lesson objectives. For Biology and Physical Science learners to acquire practical skills, it would be essential that teachers engage in effective teaching practices (Buabeng, et.al, 2014).

2.12. Lack of Laboratory or Ill-equipped Laboratory

Aina (2012) also observed that the laboratory is an indispensable organ of the school if effective teaching and learning of science subjects are to be achieved and laboratory is a room or building or a special period of time equipped and set apart for practical or experimental studies to take place. Ude and Onah (2017) said, "it is an instructional facility used by the teacher to help students learn about science and how scientists investigate the world around them. It provides learners with opportunities to design and execute investigation, engage in scientific reasoning, manipulate equipment, generate record and analyse data and then discuss results''. This implies that science teaching and learning cannot be completely done in a secondary school where there is

no equipped laboratory. It is in this line that, Ajevalemi (2011) blamed the state of student's poor performance in Biology on lack of laboratories facilities.

2.13. Large Student to Teacher Ratio in Science Classes

The huge number of students in the science classes is also a factor why some teachers fail to organise Biology practical. Some of the teachers complain that due to the huge numbers, they have it difficult to attend to all the students when performing practical. this view is supported by Ramnarin as he states in his work, teachers also complain that due to the huge numbers in terms of number of students in each class that attends Biology practical, makes it so difficult for the teacher to organise and teach practical lessons (Ramnarain, 2014).

2.14. Student Attitude

Attitude has been described as the behaviour a person adopts toward other people, things, incidents, or happenings. In science education, it is noted that learners' performance is highly influenced by attitudes. According to Yara (2009), According to Chawla et al., (2013) attitude is a way of looking at things. Students' attitude towards Biology practical has been below expectation. Edu and Edu (2013),theorized that attitudes are relatively enduring orientations that individuals develop towards the various objects and issues encountered in life of which they attributed to the fact that attitude influences ones perceptual cognition. They said according to the Cognitive dissonance theory, every individual is motivated to escape any uncomfortable situation and they do this by putting up an attitude that will be consistent with the unpleasant state. This helps to ease up the discomfort associated with the state. Student's attendance to Biology practical lesson is very low when these practical are organised except when the practical is organised just before the final examination

(WASSCE). Some student finds themselves in the practical class also pay less attention to instructions and end up not achieving the purpose for which the practical is organised. Some student come to the lesson without pencils and rules which hampers their ability to draw etc.

2.15. Importance of Frequent Performance of Biology Practical

Biology practical is said to be a factor in the students' academic achievement.as students perform several hands-on activities, these activities tends to improve the learner's skills in observing, interpretation, classifying and drawing. When learners are allowed to manipulate specimen or equipment in a Biology practical, it enables the student to grasps the theory of how such activities utilized. Again, several practices in Biology practical draw the students understanding to the fact that Biology practical is important and as such the student puts up a good attitude towards Biology practical. The frequency of performing Biology practical has a great effect in the student's achievement (Emmanuel & Samuel, 2016)

2.16. Perceptions of Teachers and Students on the Importance of Performing Biology Practical

A person perception's is their ability to notice and understand things that are not obvious to other people. Perception may define from physical, psychological and physiological perspectives, which is the way we judge or evaluate others. Meaning individuals evaluate people with whom they are familiar in everyday life. Eggen and Kauchak (2001), gave cognitive dimension of perception. They see perception as the process by which people attach meaning to experiences. They explained that after people attend certain stimuli in their sensory memories, processing continues with perception. According to Davis (2010), perception is valuable because it influences

the information that enters a working memory. Background knowledge in the form of schemas affects perception and subsequent learning.

Perceptions of teachers about Biology practical is worrisome as some teachers perceive Biology practical as not necessary and hence should not be taught as it wastes much time. Some teachers argue that if the practical work was important, the curriculum designers would have allocated specific time on the time table for Biology practical.

This mindset of teachers of Biology has trickled down to the students hence the students also hold a similar view. Eggen and Kauchak (2001) opined that positive teachers' attitudes are fundamental to effective teaching. That is teachers' work students into such state of interest about what the teacher is going to teach the students so that other object of no interest is banished from the students mind. This implies that if teachers have higher perception about integrated science it means students would also have high perception. This is because teachers fill the students with devouring curiosity to know what the next steps in connection with the topic are. Students' perception is dependent on the fact that they have been taught by the teachers under evaluation and are familiar with them. They therefore, have minds already preoccupied with memories. Perception may be energized by both the present and past experience, individual attitude at a particular moment, the physical state of the sense organ, the interest of the person, the level of attention, and the interpretation given to the perception. Most of the students have the perception that biology practical is only necessary for the final examination (WASSCE).

2.17. Summary

Chapter 2 presented the related literature in this research. It discussed the conceptual framework, biology as a science, history of practical work in science, meaning of practical work and nature of biology practical work, role of practical work in teaching and learning of Biology. Other topics discussed are; performance of students in Biology practical work in Secondary School, effects of practical work in the performance of students in Biology, difficulties in organising Biology practical's in Kintampo Senior High School. Importance of frequent performance of Biology practical, perception of teachers and students on the importance of Biology practical and summary were also discussed. The next chapter will discuss the methodology, the procedures of data collection and the analysis of this study.

CHAPTER THREE

METHODOLOGY

3.1. Overview

In this chapter, the plan that was used in carrying out this study is described. The research design, the population, the sample, the sampling procedure, the research instruments, the data collection procedures and how the data were analysed are also described

3.2. Research Design

This study used an action research design. Action research design is the most appropriate approach for this study because it makes for practical problem-solving as well as expanding scientific knowledge and enhances the competencies of its participants (Creswell, 2014). Creswell maintained that action research is designed to bridge the gap between theory and what is practiced in the field of education. Action research is done to improve the quality of practice in the classroom through interventions while learning from the outcome of the resulting changes. Action research aims to practically solve immediate problems of students in a classroom situation and to further the goals of a lesson simultaneously.

3.3 Population of the Research

Johnson and Christensen (2008) defined population as the set of all elements. It is the large total group to which a researcher wants to generate his or her sample results In other words, it is the total group the researcher is interested in learning more about. This group is sometimes referred to as the target population. The target population of this study was all the science students of Kintampo Senior High School. However, the sample frame forming the student population from which the sample was drawn was

the form three Biology students (SHS Science 3A and Science 3B (72 students) and 6 Biology Teachers in Kintampo SHS). These students were selected because they had treated most of the biology topics.

3.3.1. Target population of the study

A target population refers to the entire group of individuals or objects to which a researcher is interested in generalizing the conclusions. The target populations usually have varied characteristics. The target population for this study was Senior High Schools in the Bono East Region (Johnson and Christensen, 2008).

3.3.2. Accessible population of the study

The accessible population is the population in research to which the researcher can apply the conclusions. This population is a subset of the target population and it is from this accessible population that a researcher draws his sample (Gill, Johnson, & Clark, 2010).

The accessible population for this study was Kintampo Senior High School Biology students and Biology Teachers. This class offers several subjects including Biology and has a sizable population of 72 students, which is suitable for this research.

3.4. Study Area

Kintampo Senior High School is located in the Kintampo North Municipality in the Bono East Region of Ghana. The school is one of the two government sponsored Senior High Schools in the Municipality. It is found in the core of the town Kintampo along the Techiman -Tamale high way. This Municipal is located in the northern part of the Brong Ahafo Region in Ghana as shown in figure 2. The study area shares boundaries with five districts in Ghana namely: Central Gonja District to the North,

Bole District to the West, East Gonja District to the Northeast (all in the Northern Region) as well as Kintampo South District to the South and Pru District to the Southeast (Both in the Brong Ahafo Region). The Municipality is strategically located in the middle belt of Ghana and serves as a transit point between the northern and the southern sectors of the country as indicated in figure 3.

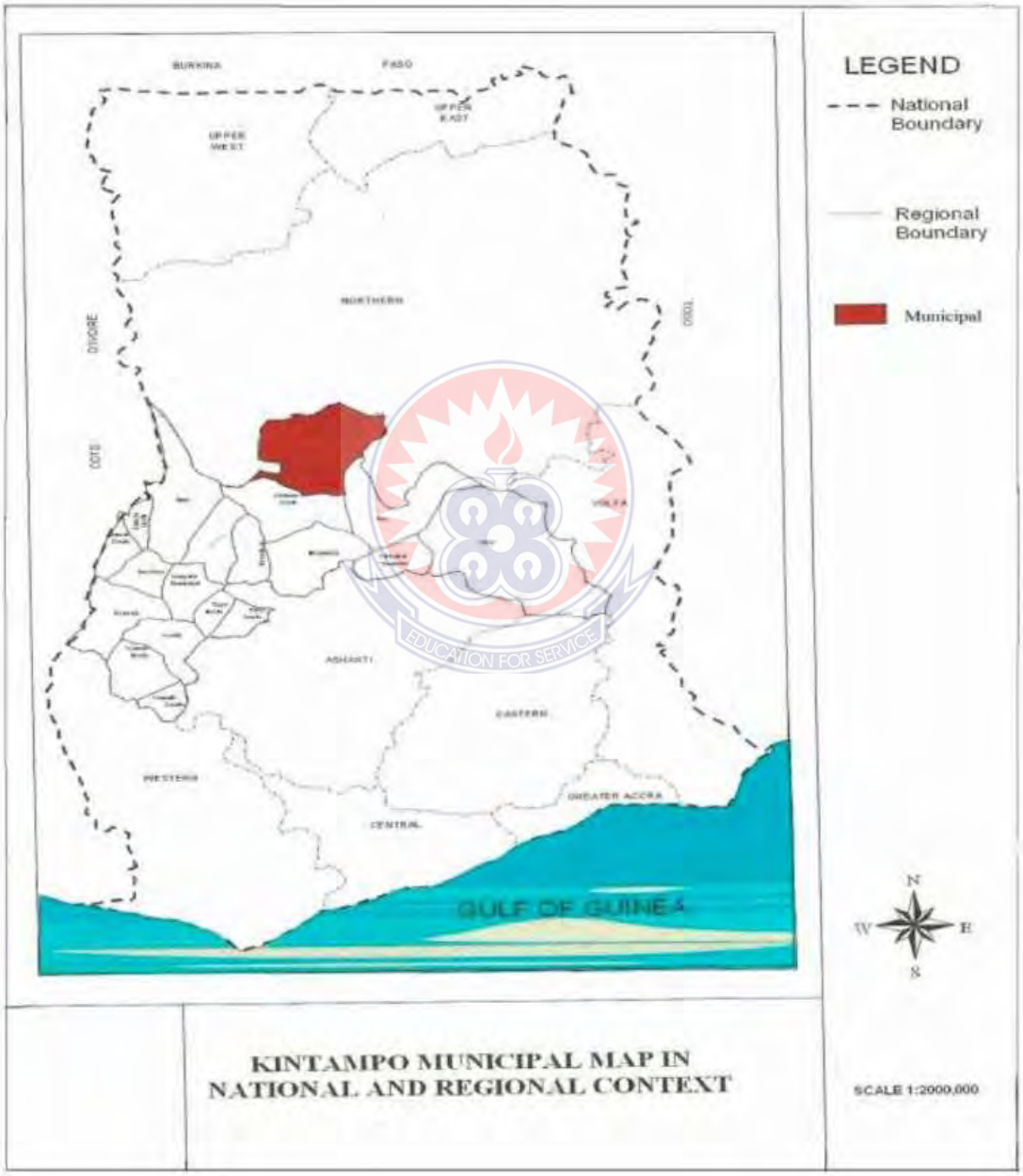

Figure 2: Ghana Map Showing Kintampo North Municipal

Figure 3: Map of Kintampo North Municipal

3.5. Sample and Sampling Technique

De Vos and Strydom (2005) defined a sample as the elements of the population considered for actual inclusion in the study. Purposive sampling was employed in this study. Purposive sampling technique was used because some of the Science classes do not offer Biology as an elective subject

The sample size of 72 students and 6 biology teachers were selected. These selected population under study comprised a group of (36) students each from science 3B and 36 from science 3A classes and six biology teachers.

3.6. Research Instrument

A research instrument is a device used to collect data to answer the research questions. In this research, the independent variable was the practical work undertaken by students in the school's laboratory, and the dependent variable was the academic achievement of the participants. All variables were the same, they include;

allocated time, curriculum content, activities and tests. The only manipulated variable is the independent variable

Other instruments used in this research are questionnaire and structured interviews. These two instruments were used to collect qualitative data on the frequency of performing Biology practical and attitude of students towards Biology practical.

In this study, four instruments were used to collect data. These include; Biology Practical Performance Tests (BPPT), Questionnaire, structured interviews and classroom observation. These four instruments were used to collect qualitative data on the kind of biological skills used during biology practical classes, the frequency of performing Biology practical, and attitude of students towards Biology practical.

3.6.1. Questionnaires

Johnson and Christensen (2008, p. 170) defined a questionnaire as a "self-report data collection instrument that each research participant fills out as part of a research study". They further indicated that researchers use questionnaires so that they can obtain information about the thoughts, feelings, attitudes, beliefs, values, perceptions, personality and behavioural intentions of the research participants. The researcher set up a questionnaire for the participants (students) to obtain information on their perception on Biology practical, how often Biology practical is organized for them by their biology teachers, whether the students are allowed to do the practical on their own and whether they know how important the biology practical is to their academic performance in biology. The questionnaires had closed ended questions which the student had five options of which the student was to choose one by ticking the suitable option. The responses for which the student was to choose from included; strongly agree, agree, not certain, disagree and strongly disagree as shown in

Appendix C. The questionnaire had 2 sections. Section 1 had questions on the Bio data of the participants and Section 2 had questions on the kind of biological skills used by teachers in biology practical class, the attitudes of the students towards practical work in Biology; questions on how frequent teachers organise Biology practical work in the teaching of Biology and questions on the perceptions of students and teachers on the importance of practical work in the learning of Biology.

3.6.2. Interview

The researcher conducted oral interview schedule. Structured interview was used in this study. This method was chosen to ensure that the questions were answered within the same context to minimize the impact of context effect when the answer given to a question can depend on the preceding question (Johnson & Christensen, 2008). It had two parts. The first part consisted of information on teachers' demography while the second part captured: the status of practical skills in the class taught, perception on the importance of Biology practical, to know whether the teachers taught the following Biological practical skills (observation skills, interpretations skills, drawing skills and classification skills) in biology practical lessons as shown in Appendix F. The interview guide comprises questions on the research objectives. Interview was important in this study since it allowed collection of information from Biology teachers. It also enabled the researcher to ask probing and supplementary questions as well as establishing a good rapport to obtain reliable and valid measures in the form of verbal responses from six form three teachers.

The interview schedule had eight questions which the six teachers were to answer all.

3.6.3. Test items (Biology Practical Performance Tests (BPPT))

Two tests will be used in the collection of quantitative data. These tests will be administered to the two classes. The test-1and test-2 will be used to assess the participants' knowledge on Biology practical skills. The test-1 will be conducted at the beginning of the research. The test-2 will be used to assess students' performance in Biology practical skills at the end of the research. Both tests will be constructed with reference to the objectives in the syllabus of SHS 3 of Biology.

Each of the tests compose of 4 questions from which a student will answer all as shown in Appendix A and Appendix C.

3.6.4 Classroom observation

Classroom observation was used to assess the biological skills that are been taught by teachers and used by students in the biology practical lessons. Observations are an effective way of watching and gathering live data about the activities and the people who participate in those activities that take place in actual classroom setting indicated that, the importance of using observation is to increase understanding of the classroom activities being studied. In other words, observations are an effective or useful way of describing the classroom setting, the activities that take place in that setting, the people who participate in those activities, and capturing the meaning of what is observed from the perspective of those being observed (Creswell, 2006).

The focus during the lesson observation was to find out the kind of teaching method used in the practical lesson, the teachers' interactions with the learners, the kinds of biology practical skills the teachers teaches in the biology practical lessons, the kind of assessment the teachers give to students during biology practical lessons and what the students do in the biology practical lessons.

3.7. Validity of Instrument

Validity describes whether the means of measurement are accurate and are actually measuring what they intend to measure. The primary objective of a research is to provide valid information that could be used in describing, predicting and explaining phenomena. Moreover, research data is considered valid if they provide a measure of what is intended to be measured (Cohen et al., 2000). The items were vetted by senior Biology tutors in Kintampo SHS and in terms of their relevance to the subject matter, coverage of content area, appropriateness of language usage and clarity of purpose.

3.8. Reliability of the Instruments

The test instruments: that were used to collect data for the study were pilot tested on representative 72 sample in a Jema Senior High School in the Kintampo South District of Bono East Region. Jema SHS was not part of the study but was used in the pilot study to obtain a normative data. The result of the pilot testing was subjected to SPSS analysis to obtain the reliability coefficient value. The pilot study enabled me to restructure the items on the performance tests in order to obtain correct responses from participants.

Reliability is the degree to which research findings could be duplicated if the study were to be repeated, with the aim of creating cause and impact relationship among factors (Creswell, 2012). Reliability is fundamentally not concerned with what is being measured, but with how well it is being measured. Cohen, et al., (2006) report that reliability in quantitative analysis has two main forms, aims which are to measure the internal consistency: the split-half technique and the alpha coefficient. After the pilot test, a reliability co-efficient of the instrument was determined using the

Cronbach alpha. The Cronbach alpha value for the instrument was 0.72. This was then compared with the tabulated coefficient of reliability which is acceptable at 0.7.

3.9. Data Collection Procedure

The researcher sought permission to carry out this study from the Regional Directorate of the Ministry of Education Bono East Region through the District Directorate. Letters were written to the Headmaster, Head of Science Department and the six Biology teachers of Kintampo SHS to seek permission to do the research at the school. Two SHS Form three classes were selected for the study.

Before the research started, all participating students were tested using test-1 to determine their level of the participants' knowledge on Biology practical skills. Also, this was done to ensure similarity/homogeneity of the two classes before starting the research. For a period of six weeks, students were taught using the practical method. They had their lessons in the Biology laboratory. At the end of the sixth week, the research was completed.Test-2 was conducted to measure the participants' knowledge on Biology practical skills. The scores (data) was collected and statistically analysed to determine any significant differences in the attainment mean scores of the two tests. Six biology teachers took part in this research. Seventy two (72) students were used in this research with each class consisting of 36 students each. At the end of the sixth week, the research was completed. The data was collected and statistically analysed to determine any significant differences in the scores of the participants in the two tests conducted.

Seventy two questionnaires were distributed to the students in the last week for the participants to respond to the questionnaire after which the questionnaire was collected at the end of the lesson to ensure that the researcher had 100% collection of

questionnaires. Six Biology teachers were interviewed and their responses were coded and analysed. The researcher then observed 12 practical lessons to ascertain the kind of biological skills that are used in the biology practical lessons.

3.10. Data Analysis using SPSS and Excel

In analysing data in this study, both quantitative and qualitative methods were used in the data analysis. Data from the interview and observation sessions were collected and analysed qualitatively whiles data from the pre-test, post-test and questionnaire were analysed quantitatively.

The researcher used descriptive and inferential statistics in analysing the quantitative data. The researcher determined the frequencies and percentages of the responses obtained from the questionnaire. A qualitative analysis was done on the data gathered through the interviews. The recorded sessions were transcribed, analysed and summarized

3.11. Ethical Considerations

The researcher informed the participants about the nature of the research. Participants were oriented that they were free to withdraw from the research at any time. According to Best and Kahn (2003: p .47), “ethical choices involve the fundamental rights, dignity and worth of all people”. The researcher received informed consent from the participants when they signed the consent form. Participants were also assured that they were to remain anonymous. This the researcher did by making sure that the respondents did not give their names when answering the questionnaire and that the researcher did not write down the names of the teachers who were interviewed.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.0 Overview

This chapter deals with presentation of the data collected and analysis of the results. The data collected in this study was analysed using percentages, mean, standard deviation and t-tests.

4.1 Demographic Data of the Students

Table 1: Distribution of Students by Sex

Sex	Frequency	Percentage
Male	48	66.67
Female	24	33.33
Total	**72**	**100**

Table 1, indicates the number of male and female students who participated in the study. The numbers of male students were 48 and that of female student was 24 with respective percentages of 66.67 and 33.33

Table 2: Distribution of Age of Students of the Study (students)

Age in Years	Frequency	Percent
16-17	0	0.000
18-19	53	73.611
20-21	19	26.389
Total	**72**	**100.0**

Table 2, is the ages of students .Student ages ranged from 18 to 21 years. Majority of the students 53 (73.611%) were of age group of 18-19 years and followed by age group 20-21 years and 19(26.389%) students.

4.2. Results of the Questionnaire

Table 3: Number of Students and Percentages of Students' Responses to items of the questionnaire

S/N	Item	Strongly Agree	Agree	Not Certain	Disagree	Strongly Disagree
1	Biology students consider Biology practical as very important in achieving good performance in Biology.	22 (30.55%)	45 (62.50%)	3 (4.17%)	2 (2.78%)	0 (0.00%)
2	Biology student perform the following biological practical skills in practical lessons: observation, drawing, interpretation and classification	0 (0.00%)	0 (0.00%)	1 (1.39%)	46 (63.89%)	25 (34.72%)
3	Poor attitude towards biology practical affects student performance negatively	17 (23.61%)	46 (63.89%)	6 (8.33%)	2 (2.78%)	1 (1.39%)
4	Biology students are allowed to do the practical themselves to gain biological practical skills	0 (0.00%)	2 (2.77%)	11 (15.23%)	39 (54.20%)	20 (27.80%)
5	The biology teacher does not organize biology practical regularly	6 (8.33%)	55 (76.40%)	0 (0.00%)	5 (6.94%)	6 (8.33%)

Research Question 1

What practical skills are taught to students in Biology at Kintampo SHS?

Item 2 on the questionnaire Biology student perform the following biological practical skills in practical lessons: observation, drawing, interpretation and classification answers research question one which reads; Which Biology practical skills are taught in Biology practical lessons? As indicated in table 3. For item 2 on the questionnaire, no student (zero) student strongly greed or agreed to the statement that, biology students in Kintampo SHS perform any of the four biological skills under study. 25 students representing 34.72% and 46 students representing 63.89% however very strongly disagreed and agreed respectively to the statement.

Research Question 2

To what extent does students' attitude towards Biology practical affect their performance in Biology practical?

From Table 3, 23.61% and 63.89% of the research participants (students) strongly agree and agree respectively that poor attitude towards biology practical affects student performance negatively This answers the research question 2 that says, to what extent does students' attitude towards Biology practical affect their performance in Biology practical?

Item 4 on the questionnaire (Biology students are allowed to do the practical themselves to gain biological practical skills)

From Table 3, item 4 had the following responses from the participants. No student (0.00%) strongly agreed, 2 students (2.77%) agreed that students are allowed to do the practical themselves while 11 students representing (15.23%) were not certain. On the contrary and in high percentages, 39studnts representing (54.20%) disagreed with the statement and 20 students representing (27.80%) of the participants strongly disagreed to the statement.

Research Question 3

How often do SHS3 Biology students perform Biology practical to acquire Biology practical skills?

From Table 3, student's response to question 6 (The biology teacher does not organise biology practical regularly) gives an impression that Biology Teachers in Kintampo SHS do not organize Biology practical for the students. Six students representing 8.33% strongly agree that the teachers do organize practical regularly for the students. Fifty five students representing 76.40% agree that the teachers do organize Biology

practical for the students. Contrary, six students, representing 8.33% strongly disagree and five students disagree that Biology teachers in Kintampo SHS do organize practical lessons for the students. No students (zero) representing 0.00% was not certain .this answers research question 3 which reads; How often do SHS3 Biology students perform Biology practical to acquire Biology practical skills?

Research Question 4

To what extent does the organization of biology practical lessons influence academic performance of SHS 3 Biology students of Kintampo SHS?

From Table 3, item 1 on the questionnaire (Biology students consider Biology practical as very important in achieving good performance in Biology) had 22 students representing 30.55% and 45 students representing 62.50% of the research participants (students) strongly agreeing and agreeing respectively that biology practical is very important in achieving good performance in Biology. Another 2.78% (2 students) and 0% (no student) disagreed and strongly disagreed respectively that biology students consider biology practical as very important in achieving good performance in Biology.3 students (4.17%) however were not certain. This answers the research question 4 (To what extent does the organization of biology practical lessons influence academic performance of SHS 3 Biology students of Kintampo SHS?

4.3. Results of the Interview Session

Table 4: Teachers Demography

Sex of Teacher		Age of Teacher				Number of years the teacher has been teaching biology		
Female	**Male**	**20-25**	**26-30**	**31-35**	**36 +**	**1-5yrs**	**6-10 yrs**	**11yr +**
2 (33.33%)	4 (66.67%)	0 (0.00%)	0 (0.00%)	1 (16.70%)	5 (83.30%)	0	2 (33.333%)	4 (66.67%)

Table 6 depicts the demography of teachers who teach biology in Kintampo SHS and participated in this research. Out of the 6 teachers who teach biology in Kintampo SHS, 2 are females and 4 are males representing 33.33% and 66.67% respectively. 1 teacher had taught range between 31 and 35 representing 16.70 % with 5 teachers falling within the brackets of 36 and above representing 83.30%.2 teachers had been teaching biology for the range of 6-10 years representing 33.33% and 4 teachers representing 66.67% have been teaching biology for 11 years and above.

Interview Question 1

How often do you organise biology practical for your students?

Table 5: Percentage of Number of Practical Lessons Organized within a Semester for Biology Students

Item	Frequency	Percentage
1-4 times	0	0
5-8 times	0	0
9-12 times	3	50
13-15 times	3	50
16 and above	0	0
Total	**6**	**100**

Table 5 shows that out of their 6 teachers who teaches biology in Kintampo SHS, none of them organises biology practical within the ranges of 1-4 and 5-8 for their students representing 0.00%. 3 of the teachers organises biology practical between the range of 9-12 times in the semester for the biology students representing 50 %and 3 other teachers organises biology practical 13-15 times in the semester for biology students also representing 50%. No teacher organises biology practical 16 times and above for the biology students.

Interview Question 2

Which biological practical skills do you teach your students?

Table 6: Frequency and Percentages of Biology Practical Skills Taught by Teachers

Item	Frequency	Percentage
Observation	5	83.3
Drawing	1	16.7
Interpretation	0	0.0
Classification	0	0.0
Total	**6**	**100**

From table 6, all the 5 teachers who teach biology taught the observation skills representing 83.3%.1 teacher representing 16.7% teaches drawing method in teaching biology practical.no teacher taught the interpretation and classification skills.

Interview Question 3:

Do you allow the students to perform the task on their own or you perform the task for the student s to only observe?

Table 7: Frequencies and Percentages of Student's Performance of Practical Task

Item	Frequency	Percentage
I do it for the student to only observe	5	83.3
I allow the students to do the task themselves	1	16.7
Total	**6**	**100**

Interview Question 4

What is your perception about teaching biology practical and students' performance?

Table 8: Frequencies and Percentages of Teacher's Perception about Teaching Biology Practical and Student's Performance

Item	Frequency	Percentage
It is not necessary	0	0
It is very important for the students	6	100
It enables the students to learn biology practical skills	3	50
It should be given more time on the time table	3	50
I don't know	0	0

Table 8 indicates that,0 response was given to the perception that biology practical is not necessary representing 0.0%. 6 teachers responded that biology practical is very important for the students representing 100%.3 out of 6 teachers responded that biology practical enable students to learn biology practical skills representing 50%.3 teachers responded that biology practical should b given much time on the time table representing 50 %. No teacher responded to I don't know, representing 0.0%

Interview Question 5

How many of your students apply all of the biological practical skills adequately in their internal examination?

Table 9: Frequencies and Percentages of Number of Students who Apply Biological Practical Skills Adequately in Internal Examinations

Item	Frequency	Percentage
Only a few	2	33.30
Most of them	1	16.7
None of them	3	50
All of them	0	0
I don't know	0	0
Total	**6**	**100**

From Table 9, it shows that two biology teachers responded that only few of their students are able to apply the biology practical skills in the internal examination presenting 33.30%. 1 teacher responded that most of the biology student applied the biology practical skills in their internal examinations representing 16.7 %. 3 biology teachers responded that none of their Biology students did apply the biology practical skills I their internal examination. Representing 50% and lastly, no teacher had the entire biology student applying the biology practical skills in the internal examination. 0.00%. Represents teachers who did not know what to say

Interview Question 6:

Do you carry out your biology practical work in the laboratory?

Table 10: Frequencies and Percentages of the Performance of Biology Practical in the Laboratory

Item	Frequency	Percentage
Yes	6	100
No	0	0.00
Total	**6**	**100**

Table 10 indicate that, all the biology teachers in Kintampo SHS conduct their biology practical lessons in the laboratory. The frequency of teachers who responded yes is 6 representing 100% and 0.00% for no.

Interview Question 7

Which type of practical work do you teach to learners in your biology practical class?

The researcher further asked the Biology teachers about the type of practical work they taught their learners in order to develop their (learners) practical skills. The responses obtained are presented in Table 11

Table 11: Frequencies and Percentages of the Type of Practical Work that Teachers Teach in the Biology Practical Class

Type of Practical	Frequency	Percentage
Investigations	2	33.3
Experiments	6	100
Fieldwork	1	16.7
Problem solving activities	1	16.7
Projects	2	33.3
Exercises	6	100
Excursion	0	0.00
Observations	6	100

The data in Table 11 reveal that investigation (33.3%) was used by 2 teachers .6 teachers used experiments in their practical work representing 100%.1 teacher representing 16.7% used field work to teach the biology practical. another 1 teacher uses problem solving to teach the practical representing 16.75. 2 teachers used project work representing 33.3%.6 teachers used exercise and observation ach representing 100% each. And no teacher used excursion in teaching biology practical.

Interview Question 8

What are your views on the teaching of practical work in Kintampo Senior High Schools?

Different views were expressed by both the Biology teachers in describing the teaching of practical work in the school. Some of the teachers indicated that they sometimes taught practical work, while others indicated that the teaching of practical work was very much reduced, emphasizing that they didn't teach practical work in their school due to the challenges of overcrowded classrooms and lack of laboratory facilities that are needed to teach practical. Other comments included

Teacher 1: Currently I will say the practical part is very much neglected. In other words we are not putting much emphasis in them. We don't do them.

Teacher 2: Teaching of practical work in my class is done but it is not as effective as it is supposed to be.

Teacher 3: The teaching of practical work in my class is something that is not done in the way it should have been done due to several reasons. Example, Teachers are not doing any experiments with their learners because we have too many learners in our classes.

4.4. Results of Observation of Biology Practical Lessons in the Laboratory

Observations were made in both class (SHS3 Science A and SHS 3 Science B) in all these lessons the researcher observed, it was evident that

1. The biology teachers perform the biology task for the student to observe (the lessons were teacher centred)
2. Biology students were not given the opportunity to handle equipment or perform the practical by themselves even though learners were expected to do practical under the guidance of the teacher
3. Biology teachers were in a rush to complete the syllabus rather than the students learning the biology practical skills
4. The biology students did not present any work to the teacher to mark
5. Biology teachers did not assess the students at the end of the lessons to assess their biology practical s
6. Observations show that not all the prescribed practical skills were observed in the practical work the teachers taught the learners.
7. Observation of the workbooks of the students indicated that assessment of practical skills was mainly in terms of post-practical questions, written work, class work and past examination questions.

4.5. Test-1 and Test-2 Results

Table: 12: Results of Participants in Test-1 and Test-2 (t-Test: Paired Two Samples for Means)

	Test- 1	*Test 2*
Mean	13.88889	13.34722222
Variance	21.33959	17.44111894
Observations	72	72
Pearson Correlation	0.342968	
Hypothesized Mean Difference	0	
Df	71	
t Stat	0.909335	
P(T<=t) one-tail	0.183125	
t Critical one-tail	1.6666	
P(T<=t) two-tail	0.36625	
t Critical two-tail	1.993943	

Table 12 indicates that, there was no significant difference in the performance of the participants in test -1 and in test-2

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS, RECOMMENDATIONS AND AREAS FOR FURTHER STUDIES

5.0 Overview

This chapter contains the summary of the findings, conclusion and recommendations as well as suggested areas for further studies.

5.1 Summary

The main purpose of this study was to assess the status of practical activity in Biology and its impact on students' academic achievement in Kintampo SHS. Four main research questions were formulated to guide the process of the research.

1. What is the difference in the mean achievement scores of students taught Biology using practical activities and students taught using non-practical activities?
2. To what extent does students' attitude towards Biology practical affect their performance in Biology practical?
3. How often do SHS3 Biology students perform Biology practical to acquire Biology practical skills?
4. To what extent does the organization of biology practical lessons influence academic performance of SHS 3 Biology students of Kintampo SHS?

Case study method was employed in this research. Quantitative data and qualitative data were collected using close ended questionnaire, structured interviews, Biology practical test and classroom observations. Purposeful sampling method was used to select the two Form three science classes that were used in the research. Six Biology teachers of Kintampo SHS were also used in this research.

The results of questionnaires and observation were analysed using descriptive statistics to determine the frequencies and percentages. The results were presented using frequency tables. The qualitative data from the interviews were analysed using the content analysis technique and organised into categories guided by the research questions and the data that emerged from the study. Responses from the questionnaire indicates that students are aware of the importance of biology practical work to their academic performance in biology especially for the WASSCE biology paper 3. It revealed that biology students have a positive attitude towards biology practical lessons. The study also made it clear that biology teachers organises biology practical regularly but unfortunately, they do not allow the students to actively perform the practical task that will enable them to acquire the biology practical skills needed. According to Dinah (2013) designing learning instructions, setting goals and structuring teaching steps are important in achieving good academic performance of biology students. The biology practical test results show that student performance in biology practical is not good since the students are unable to apply biology practical skills in their examinations. Responses from the interview session indicate that the use of a classroom or a laboratory could have an impact on the teaching of Biology practical work (Nghipandulwa, 2011). This study revealed that biology teachers in Kintampo SHS used the laboratory for their biology practical lessons. This is a good practice since it motivates the students to be interested in the biology practical because in the laboratory, the students are exposed to a variety of models, charts and other specimens that makes their learning interesting.

This study revealed that the duration of biology practical is not enough for the teachers when they are teaching biology practical sic nth data indicates that all the teachers complained about the short time for the biology practical on the time table.

5.2. Findings of the Research

5.2.1 Practical skills that are taught to students in Biology at Kintampo SHS.

Data were collected from the respondents of the study using questionnaires. Respondents were asked to respond to statement; I perform the following biological practical skills in practical lessons: observation, drawing, interpretation and classification. For this statement,0.00% and 0.00% of the respondents answered that they strongly agree and agree respectively.1.39% of the respondents were not certain,63.89% and 34.72% respondent that they disagree and strongly disagree respectively. Responses from the interview session indicated that observation was the only process skill that was been taught by teachers in the School.

5.2.2 Extent to which students' attitude towards Biology practical's affect their performance in Biology in Kintampo SHS.

Respondents were asked to respond to statement; Poor attitude towards biology practical affects my performance negatively. Data were collected from the respondents of the study using questionnaires. The responses from the participants showed; 23.61% of the respondents strongly agreed,63.89% selected agreed 8.33% were not certain.2.78% and 1.39% selected disagree and strongly disagree.

5.2.3 Frequency of how SHS 3 Biology students perform Biology practical to acquire Biology practical skills in Kintampo SHS.

Data was collected using the questionnaires and interview sessions. From the questionnaire, the students responded to the statement; My biology teacher does not organize biology practical regularly. Responses skewed towards the negative with 8.33 % and 76.40% of the respondents selecting strongly agree and agree

respectively.6.94 % and 8.33% of the respondents selected disagree and strongly disagree respectively.

From the interview sessions, the teachers responded that; they organise practical for the students but not often (11-13) times in a semester.

5.2.4 Extent of how the organization of biology practical lessons influence the academic performance of SHS 3 Biology students of Kintampo SHS.

Data was collected using the questionnaire. Students responded to the statement; I consider Biology practical as very important in achieving good performance in Biology. The responses from the participants indicated that; 30% and 62.50% of the respondents selected strongly agree and agree respectfully. 4.1% were not certain. 2.7% and 0.00% selected disagree and strongly disagree respectfully.

5.3. Conclusion

Findings of the practical lesson observations indicated that teachers did not assess the learners at the end of the practical work, to determine if they had acquired the practical skills. Furthermore, the study found that the learners did not submit any work to the teacher for assessment. It can be concluded that the absence of assessment of the practical skills at the end of the practical work negatively affected the achievement of the envisaged objectives of the practical work. Learners' workbooks indicated that assessment of practical skills was mainly in terms of post-practical questions, written work, class work and past examination questions. In the absence of assessment, it can be concluded that the teachers seemed not to connect practical work they taught to the practical skills they intended their learners to achieve. This might have adverse impact on learners' performance in Paper 3. Oredein and Olayede (2017) concluded that teacher's management of homework and assignments given to

students have an impact on students' achievement especially when it is well explained, motivational, corrected and reviewed during class time and used as an occasion for feedback to students.

It was also observed that, the biology teachers performed the biology task for the student to observe (the lessons were teacher centred) and also used the lecture method during the practical lesson. This finding conforms to the findings of Mawazo (2010), who stated that, these are some of the methods that are also employed by Biology teachers in their classrooms. This method of teaching does not favour the students who need to learn and apply the biology practical skills. AL Maghraby and Alshami (2013) also indicated that science teachers need to use teaching methods which are flexible, creative and more learner-centred, in order to accommodate differ ent learning styles of learners. Mawazo (2010) also indicated that teaching methods do make a difference in learners' performances. It can be concluded that the kind of teaching method applied by the biology teachers contribute to the failure of the students in their academic performance in the WASCE.

Using teaching methods that involve learners socially actively in Biology such as group experiments and investigations could increase learning and subsequently the achievement of scientific skills.

The research can conclude that since biology teachers were not using the right pedagogical approach and methodology in the teaching of the practical, the students had no better understanding of the lesson hence were unable to use the biology practical skills and that lead to the performance. This is also the findings of Hills (2012) that, Poor performance of students in biology is as a result of poor state in

which biology in general are taught in the secondary school. “Chalk and Talk” method has been the most widely used science teaching method.

5.4. Recommendations

The researcher recommends that;

1. Teachers in Kintampo SHS should teach the biology practical skills in their biology practical classes.
2. The teachers should employ the right methodology (student cantered method like inquiry-based method) in their teaching of the biology practical skills

5.5. Areas for Further Research

Further studies should be conducted on the effect of practical activity on biology students’ academic performance.

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APPENDIX A

TEST USED IN THE STUDY

KINTAMPO SNIOR HIGH SCHOOL

BIOLOGY PRACTICAL PERFORMANCE ASSESSMENT TEST

TEST-ONE TIME: 30MINS

SERIAL NUMBER _____SEX: MALE/FEMALE AGE _____

QUESTIONS

Study carefully the following specimen and answer the questions that follow

1. State the phylum and classes of each of specimen A, B, C, and E (4marks)

SPECIMEN	PHYLUM	CLASS
A		
C		
D		
E		

2. State four (4) observable features of specimen D (4marks)

_____

_____

_____

_____

_____

_____

3. Name the habitats of specimen A, B, C, D (4marks)

SPECIMEN	HABITAT
A	
B	
C	
D	

4. State four (4) adaptive features of specimen A that enable it to survive in its habitat (4marks)

_____
_____
_____
_____
_____
_____
_____
_____

5. Make a drawing 8-10cm long of dorsal view of specimen E and label fully (4marks)

APPENDIX B

FINAL MARKING SCHEME FOR THE STUDY

KINTAMPO SNIOR HIGH SCHOOL

FINAL MARKING SCHEME FOR TEST -ONE

LIST OF SPECIMEN

A. Adult Grasshopper

B. Fern

C. Moss plant

D. Grain Weevil

E. Adult Cockroach

1. CLASSIFICATION OF SPECIMEN

SPECIMEN	PHYLUM	CLASS
A	Arthropoda	Hydrozoa
C	Filicinophyta	Pteropsida
D	Arthropoda	Insecta
E	Arthropoda	Insecta

Any 8 x ½ = 4marks Note: Correct Spelling to score

2. OBSERVABLE FEATURES OF SPECIMEN D

Presence of wings, Presence of antenna, Presence of two rostrum, Presence of jointed legs

Presence of eyes, Presence of cape, Smaller in size

Any 4 x 1 =4marks

3. HABITAT OF SPECIMEN

SPECIMEN	HABITAT
A	Farms, Forest, Fields, Leafy vegetation
B	Moist soil, footpath Tree trunk, moist soil, forest floor, footpath
C	In stored grains eg. Maize, millet, beans
D	Septic tanks, Cupboard, Crevices

Any 4 x 1 = 4marks

4. A WELL LABELLD DIAGRAM SHOWING THE DORSAL VIEW OF SPECIMEN E

Title = ½ mark, 4 correct labelling = 2marks, magnification = ½ mark, size of diagram = ½ mark, clarity of lines = ½ mark. Total = 4marks

5. ADAPTIVE FEATURES OF SPECIMEN A

Presence of tentacles for catching prey, Presence of enteron for digestion

Presence of basal disc for firm attachment to substratum, Presence of gonads for reproduction

Presence of mouth for ingestion and egestion, Presence of cnidoblast around the mouth for defence

Any 4 x 1 = 4marks

QUESTION TOTAL: 20MARKS

APPENDIX C

TEST USED IN THE STUDY

KINTAMPO SNIOR HIGH SCHOOL

BIOLOGY PRACTICAL PERFORMANCE ASSESSMENT TEST

TEST-TWO TIME: 30MINS

SERIAL NUMBER _____SEX: MALE/FEMALE AGE _____

QUESTIONS

Study carefully the following specimen and answer the questions that follow

1. Give the classes of each of specimen A, C, D and E (4marks)

SPECIMEN	CLASS

2. State four (4) observable features of specimen A (4marks)

_____

_____

_____

_____

_____

3. Name the habitat of each of specimen A, B, D and E (4marks)

SPECIMEN	HABITAT

4. Make a drawing 8-10cm long of specimen C and label fully (4marks)

5. State any four (4) features that adapt specimen C to its habitat (4marks)

_____

_____

_____

_____

_____

_____

APPENDIX D

FINAL MARKING SCHEME FOR THE STUDY

KINTAMPO SENIOR HIGH SCHOOL

FINAL MARKING SCHEM FOR TEST TWO

LIST OF SPECIMENS

A. Domestic fowl

B. Rabbit

C. Tilapia

D. Agama Lizard

E. Young Toad

1. CLASSIFICATION OF SPECIMEN

SPECIMEN	CLASS
A	Aves
C	Osteichthyes
D	Reptilia
E	Amphibia

2. OBSERVABLE FEATURES OF SPECIMEN B

Presence of feathers, Presence of scales on legs, Presence of beak, Presence of wings

Presence of comb, Presence of wattles, Presence of eyes, Presence of claw digit

Any 4 x 1 = 4marks

3. HABITAT OF SPECIMEN

SPECIMEN	HABITAT
A	Homes, Poultry farms
B	Homes,
D	On walls, on trees, around uncompleted buildings
E	Under stones, In packed blocks, in moist places, under tree trunks

Any 4 x 1 = 4marks

4. A WELL LABELLED DIAGRAM 8-10CM LONG OF SPECIMEN B

Title ½ mark, 4 correct labelling = 2marks, correct size ½ mark, magnification ½ marks, clarity of lines = ½ mark Total = 4marks

5. FEATURES OF ADAPTATION OF SPECIMEN C

Presence of lateral line for detecting vibration, Presence of fins for movement

Presence of streamlined body for easy movement in water, Presence of lidless eyes for vision

Presence of nostrils for smelling food in water, Presence of operculum for covering gills

Any 4 x 1 = 4marks

QUESTION TOTAL = 20MARKS

APPENDIX E

QUESTIONNAIRE

This questionnaire forms part of the study. There is no right or wrong response. Your opinion about each item is very important. Tick (√) the appropriate column corresponding to your opinion about the item. Please be sure to respond to all items. If you change your mind about your response to an item, just cross it out and tick (√) another. You are assured of the confidentiality of your opinion. Thank you.

BIO DATA

GENDER (TICK): MALE FEMALE……. AGE (write)

SERIAL NUMBER (write)

S/N	Item	Strongly Agree	Agree	Not Certain	Disagree	Strongly Disagree
1	Biology students consider Biology practical as very important in achieving good performance in Biology.					
2	Biology student perform the following biological practical skills in practical lessons: observation, drawing, interpretation and classification					
3	Poor attitude towards biology practical affects 4student performance negatively					
4	Biology students are allowed to do the practical themselves to gain biological practical skills					
5	The biology teacher does not organize biology practical regularly					

APPENDIX F

INTERVIEW SCHEDULE

Dear Participant,

This study is for academic purpose. You will be contributing to the success of this study if you provide responses to the items honestly. Your response will be kept confidential. Please your responses are confidential and will not be used against you in any way.

Serial number of teacher:……

Sex of teacher:…….

Age of teacher:

20-25years	26-30 years	31-35 years	36 years +

Number of years the teacher has been teaching biology

1-5yrs	6-10 yrs.	11 yrs.+

INTERVIEW QUESTIONS

1. How often do you organise biology practical for your students?
2. Which biological practical skills do you teach your students?
3. Do you allow the students to perform the task on their own or you perform the task for the student s to only observe?
4. What is your perception about teaching biology practical and students' performance?

5. How many of your students apply all of the biological practical skills adequately in their internal examination?
6. Do you carry out your biology practical work in the laboratory?
7. Which type of practical work do you teach to learners in your biology practical class?
8. What are your views on the teaching of practical work in Kintampo Senior High Schools?

Thank you for your time

APPENDIX G

SAMPLE OF TEST-SCRIPT

KINTAMPO SNIOR HIGH SCHOOL

BIOLOGY PRACTICAL PERFORMANCE ASSESSMENT TEST

TEST-ONE **TIME: 30MINS**

SERIAL NUMBER 17 SEX: MALE/FEMALE AGE 19

17½/20

QUESTIONS

Study carefully the following specimen and answer the questions that follow

1. State the phylum and classes of each of specimen A, B, C, and E (4marks)

SPECIMEN	PHYLUM	CLASS
A	Arthropoda ✓	Insecta ✓
C	Felicino phyta ✓	Pteropsida ✓
D	Arthropoda ✓	Insecta ✓
E	Arthropoda ✓	Insecta ✓

4

2. State four (4) observable features of specimen D (4marks)

They posessed Lolug(s)
They posesses a pair of Lolugs ✓ 1
They posesses two (2) rostrum 1
They posesses Spiracles. ✓ 1

3. Name the habitats of specimen A, B, C, D (4marks)

SPECIMEN	HABITAT
A	farms
B	Moist Soil
C	In Stored grains. Eg Maize
D	Cupboard

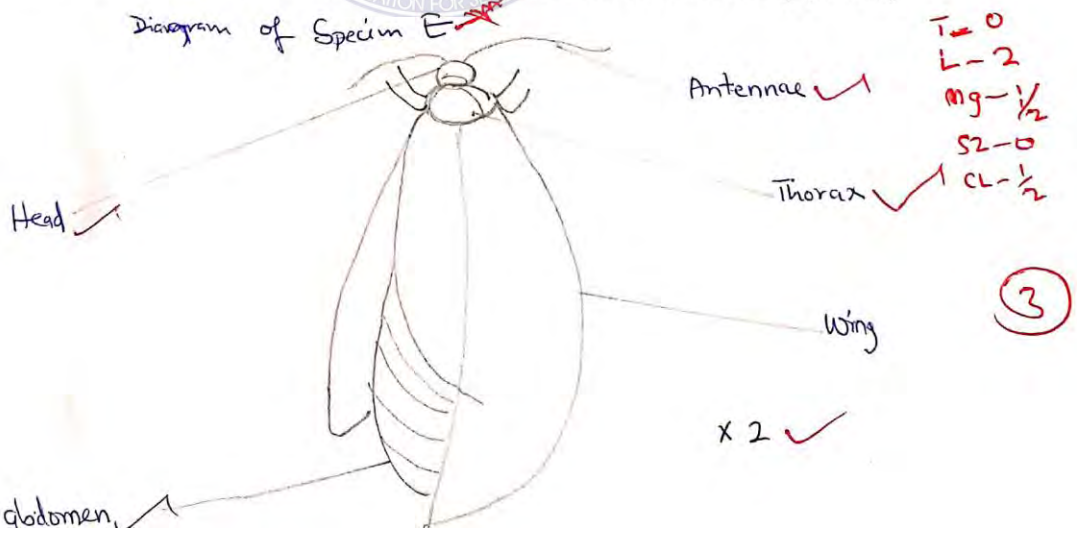
4

4. State four (4) adaptive features of specimen A that enable it to survive in its habitat (4marks)

Possession of tentacles for catching prey
Possession of mouth for ingestion
Possession of gonads for reproduction
Possession of Chidoblast around the mouth for defence.

3½

5. Make a drawing 8-10cm long of dorsal view of specimen B and label fully (4marks)



T – 0
L – 2
mg – ½
S2 – 0
CL – ½

3

APPENDIX H

SAMPLE OF TEST-SCRIPT

KINTAMPO SENIOR HIGH SCHOOL

BIOLOGY PRACTICAL PERFORMANCE ASSESSMENT TEST

TEST-TWO **TIME: 30MINS**

SERIAL NUMBER: 2 SEX: MALE/FEMALE AGE : 18

17/22

QUESTIONS

Study carefully the following specimen and answer the questions that follow

1. Give the classes of each of specimen A, C, D and E (4marks)

SPECIMEN	CLASS
A	Aves ✓
C	osteichthyes ✓
D	Reptilia ✓
E	Amphibia ✓

4

2. State four (4) observable features of specimen A(4marks)

They have feathers, They have scales on legs
They have claws digits ✓
They have beaks ✓
Presence of wings ✓

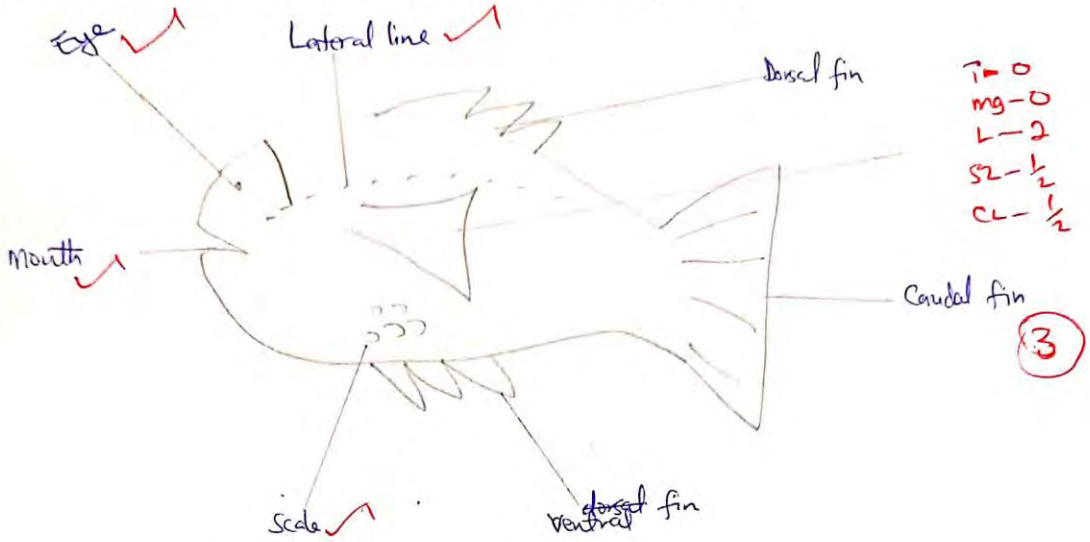
3½

3. Name the habitat of each of specimen A, B,D and E (4marks)

SPECIMEN	HABITAT
A	nest ✓
C	Homes ✓
D	walls ✓

3

4. Make a drawing 8-10cm long of specimen B and label fully (4marks)



T- 0
mg- 0
L- 2
SL- ½
CL- ½

3

5. State any four (4) features that adapt specimen C to its habitat (4marks)

They have lateral line to detect vibration in the sea.
Presence of gills for respiration.
They have fins to enable them escape from their predators.
Presence of eyes to see.

4

APPENDIX I

SAMPLE OF QUESTIONNAIRE

QUESTIONNAIRE

This questionnaire forms part of the study. There is no right or wrong response. Your opinion about each item is very important. Tick (√) the appropriate column corresponding to your opinion about the item. Please be sure to respond to all items. If you change your mind about your response to an item, just cross it out and tick (√) another. You are assured of the confidentiality of your opinion. Thank you.

BIO DATA:

GENDER (TICK): MALE ☐ FEMALE ✓

AGE (write) 17

SERIAL NUMBER (write) 26

S/N	Item	Strongly Agree	Agree	Not Certain	Disagree	Strongly Disagree
1	Biology students consider Biology practical as very important in achieving good performance in Biology.		✓			
2	Biology student perform the following biological practical skills in practical lessons: observation, drawing, interpretation and classification		✗	✓		
3	Poor attitude towards biology practical affects 4student performance negatively	✓				
4	B5iology students are allowed to do the practical themselves to gain biological practical skills				✓	
5	The biology teacher does not organize biology practical regularly				✓	

APPENDIX J

BIOLOGY PRACTICAL PERFORMANCE ASSESSMENT TEST

SCORES OF STUDENTS IN TEST ONE

S/N	3 SCIENCE A CLASS	3SCIENCE B CLASS
1.	9	6
2.	7	8
3.	6	6
4.	10	10
5.	9	6
6.	7	9
7.	9	13
8.	10	10
9.	7	9
10.	14	7
11.	9	10
12.	7	7
13.	10	8
14..	6	11
15.	12	9
16.	11	4
17.	14	4
18.	10	5
19.	4	7
20.	4	8
21.	7	7
22.	3	5
23.	8	9
24.	9	10
25.	9	8
26.	10	8
27.	6	8
28.	9	6
29.	6	13
30.	10	11
31.	7	11
32.	4	12
33.	7	4
34.	6	4
35.	5	9
36.	8	4

APPENDIX K

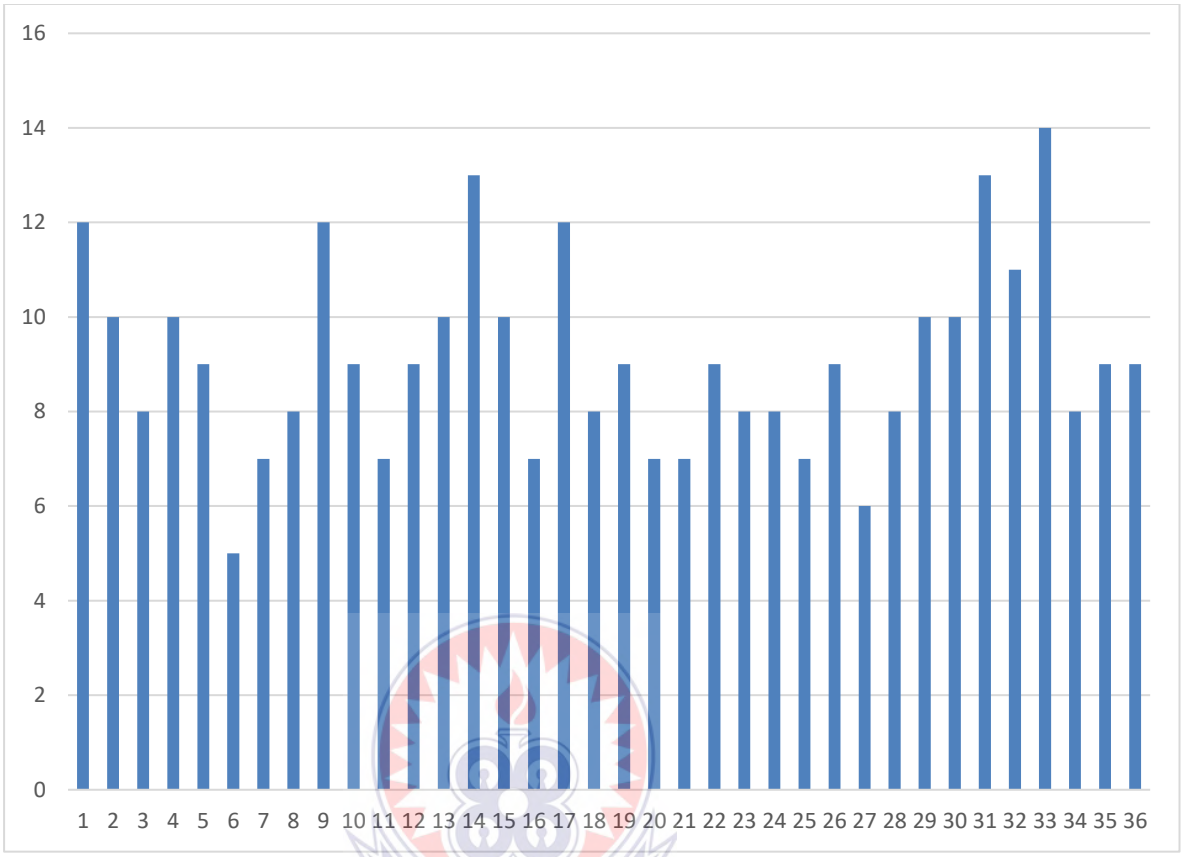
BIOLOGY PRACTICAL PERFORMANCE ASSESSMENT TEST

SCORES OF STUDENTS IN TEST TWO

S/N	3-SCIENCE A CLASS	3-SCIENCE B CLASS
1.	9	12
2.	11	10
3.	8	8
4.	10	10
5.	12	9
6.	7	5
7.	9	17
8.	9	8
9.	8	12
10.	10	9
11.	6	7
12.	18	9
13.	9	10
14..	9	13
15.	7	10
16.	4	7
17.	10	12
18.	6	8
19.	8	9
20.	19	7
21.	10	7
22.	9	9
23.	18	8
24.	7	18
25.	9	17
26.	11	9
27.	8	6
28.	10	8
29.	7	10
30.	9	10
31.	9	13
32.	6	11
33.	10	14
34.	12	8
35.	7	9
36.	9	9

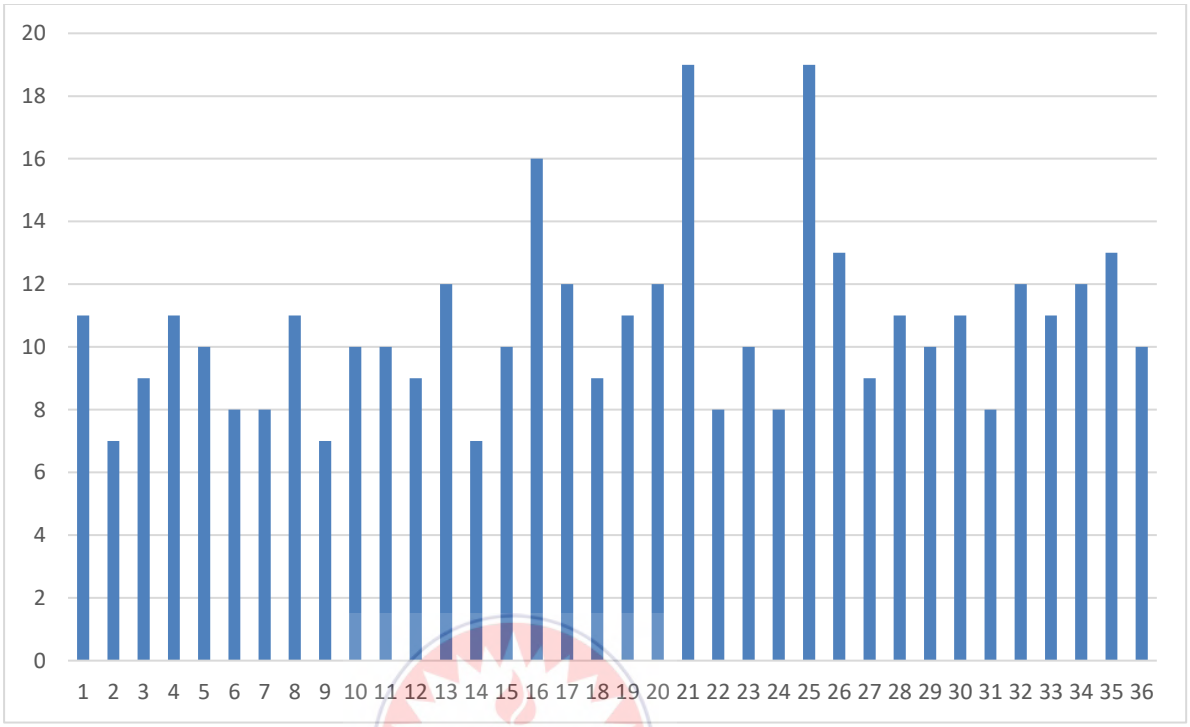
APPENDIX L

GRAPH OF STUDENTS SCORE AT TEST-TWO



APPENDIX M

GRAPH OF STUDENTS SCORE AT TEST-ONE



APPENDIX N

INTERVIEW SCHEDULE

Serial Number 04

Good morning madam

Please this study is for academic purpose. You will be contributing to the success of this study if you provide responses to the items honestly. Your response will be kept confidential. Please your responses are confidential and will not be used against you in any way

Interviewer: Please how old are you

Interviewee: I am 31 years

How long have you been teaching biology?

Hmmm about 4 years now

Interviewer: How often do you organise biology practical for your students in a semester?

Interviewee: It depends on the semester ooo. For m sometimes I do about 6-8 practical if the semester is a long on like if it is 13 or 14 weeks long, but if the semester is a short one , I may just be able to do maximum 5 practicals

Interviewee: Can I add something? In some of the semesters too, there will be many activities like 6th march parade, interschool's sports activities and a lot more so when it happens that way, I will not have ample time to prepare any set up for the students

Interviewer: Which biological practical skills do you teach your students?

Interviewee: drawing, observation, classification, prediction and others. But it is not all of them that are taught in a single practical class. Sometimes, in a practical lesson I end up using may be 3 or 4 of them but I can say I do teach them all of the skills.

Interviewer: Do you allow the students to perform the task on their own or you perform the task for the student s to only observe?

Interviewee: mmmm not exactly.. Due to time constraints, most times I just do it for them to observe but when I have good time example when it is getting to the WASCE, that time I get time to take them through the practical ideally where I allow them to do it themselves. Because these times the masters leave the students to learn on their own so I take advantage of that.

Interviewer: What is your perception about teaching biology practical and students' performance?

Interviewee: the practical is good for the students but there are a lot of limitations .financially, when a teacher asks for materials for practical from the school, the school is unable to provide for the several numbers of the class. The time for practical should be allocated separately to give us time to do it well. Because w are not able to do it well, the students don't s th importance of it hence there do not have interest and it lads them to poor performance.

Interviewer: How many of your students apply all of the biological practical skills adequately in their internal examination?

Interviewee: eeeiish hahaha!!!! Only a handful of them. Like 6 out of 40 students.

Interviewer: Do you carry out your biology practical work in the laboratory?

Interviewee: Yes but sometimes w go to the field especially when w are doing ecology

Interviewer: Which type of practical work do you teach to learners in your biology practical class?

Interviewee: experiments

Interviewer: What are your views on the teaching of practical work in Kintampo Senior High Schools?

Interviewee: well! The teachers are trying their best. but there is more room for improvement. What happens is that the teachers are willing to take up the practical seriously but there are so many hindrances like I said earlier. But in gnarl, the practical lessons are well taught in the school.

Interviewer: thank you madam. I am very grateful for you time

Interviewee: you're welcome