UNIVERSITY OF EDUCATION, WINNEBA

ASSESSING THE IMPACT OF SCIENCE RESOURCE CENTRE PROJECT (III) ON STUDENTS' PERFORMANCE IN BIOLOGY IN SOME SELECTED SENIOR HIGH SCHOOLS IN THE UPPER WEST REGION

ALBAN KANINGEN NUBAZUNG KPEMUONYE

2017

UNIVERSITY OF EDUCATION, WINNEBA

ASSESSING THE IMPACT OF SCIENCE RESOURCE CENTRE PROJECT (III) ON STUDENTS' PERFORMANCE IN BIOLOGY IN SOME SELECTED SENIOR HIGH SCHOOLS IN THE UPPER WEST REGION

ALBAN KANINGEN NUBAZUNG KPEMUONYE

(7140130030)

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

FEBRUARY, 2017

DECLARATION

Student's Declaration

I, ALBAN KANINGEN NUBAZUNG KPEMUONYE, hereby declare that this dissertation, with the exception of quotations and references contained in published and unpublished works which have all been identified and duly acknowledged, is entirely my own original work in both design and execution, and that it has not been submitted, either in part or whole, for another degree in this institution or elsewhere.

Signature:……..

Date: ……

SUPERVISOR'S DECLERATION

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

Name: Dr. ERNEST I. D. NGMAN-WARA

Signature:……..

Date: ……

ACKNOWLEDGEMENTS

I express my sincere appreciation and gratitude to the Almighty God, for His guidance without which this study would not have been possible at all.

My heartfelt thanks go to my supervisor, Dr. Ernest I. D. Ngman-Wara of the Department of Integrated Science Education, University of Education, Winneba, for his guidance, encouragement, constructive criticism, suggestions, time and energy in reading through the script during the period of this work. I am equally grateful to my wife, Aminata Kperihinaah and children Ammon and Abran whom I denied comfort and attention when I had to tread on this short but ambitious academic journey.

I express my profound gratitude to all the lecturers who had made me who I am. My special regards to Prof. K. D. Taale, Prof. Kolawole Raheem, Dr. J. Azure and Dr. Joseph Nana Annan all in the Faculty Science Education for transformation planted in me throughout my stay in the university.

My next thanks go to Mr. Guo P. Kilian (Headmaster, Nandom SHS) and Rev Bro. Joachim Naah, (Asst. Head Administration), and Mr. Rufus Puopele (Nandom education office) for the roles played during the period of this study. To those who wholeheartedly accepted to respond to the questionnaire, I say thank you. I also acknowledge the following personalities, Messrs. Johnson Goku course mate, Thomas Walier, Edmond Dakura, Vincent Ziema and all staff of Nandom SHS.

DEDICATION

I dedicate this work to my uncle, Mr. Emmanuel K. Kaningen, Isaac S. Kaningen, Edward M. Kaningen, my wife (Ms. Aminata Kperihinaah), my children (Ammon Y. Badia and Abran Y. Badia), my mother, (Mrs Elizabeth T. Kaningen) as well as my late Dad (Mr. Kpemuonye Die-eebu Kaninigen).

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

The study investigated the impact of Science Resource Centre Project III on students' performance in biology in some selected schools in Upper West Region, Ghana. The study adopted a quantitative survey design. The study involved 6 biology teachers and 6 heads of departments from 6 public senior high schools and two batches of final year biology students (2013 and 2015 batches) were used to collect data for the study. The 12 teachers and 6 schools chosen as participants were purposively selected. The instruments used to collect data in the study were document analysis (2013 and 2015 biology WASSCE results) and a questionnaire for teacher respondents. Data collected were analyzed using Microsoft Excel and Statistical Package for Social Sciences (SPSS) version 20. The results for analysis of WASSCE results showed that the average WASSCE pass rate in biology in 2013 (before the implementation of the SRC Project III) was 98.1% and that of 2015 (after the implementation of the SRC Project III) was 54.2%, indicating a decrease in pass rate of 43.9% in 2015. The study indicated that familiar and easy to manipulate materials and equipment were utilized to a greater extent while sophisticated biology laboratory material resources and ICT based equipment and materials were not used at all. Also the study identified some challenges teachers encountered and that hinder the operations of science resource centres. The study concluded that the SRC Project III did not improve on students' performance in biology. The Study recommended that further in-service training be done for biology teachers for them to effectively use these sophisticated equipment/materials. The study also suggested that further research be conducted in all parts of the country in other science subjects in order to ascertain an all-round impact of SRC Project III on students' performance in Science.

CHAPTER ONE

INTRODUCTION

1.0 Overview

The study assessed the impact of Science Resource Centre (SRC) Projects III on students' performance in Biology in some selected Senior High schools in the Upper West Region of Ghana. The study focused on the use of these resources (equipment and materials) by teachers in the selected schools. This chapter presents the background to the study, statement of the problem, the purpose and objectives of the study significance of the study, and the research questions addressed in the study. Also, presented in this section are the limitations and delimitation of the study. The chapter ends with definition of terms and abbreviations in the study and then organization of chapters.

1.1 Background to the study

Present and past governments of Ghana, over the years, have demonstrated their commitment to providing education of all forms to individuals in the country. Education is constantly changing with the aim of meeting the changing need of society.

In 1996, the SSS Science programme received a boost with the establishment of Science Resource Centres (SRCs). The main objective was to promote the utilization of ICT tools during science lessons. There is evidence that the SRCs had enabled a higher proportion of SSS science students to perform a variety of practical using equipment and materials that were not available in the conventional laboratories (Eminah, 2007). The students were also introduced to modern approaches to experimentation in science. Schools offering the science

ptogramme and who did not have the SRC projects planted on their campuses were considered as *satellite schools*. These *satellite schools* were to visit the SRCs in other schools at least twice a week and were to pay user fees which were to be used to mend the SRCs and replenish consumables (referring to materials and items that once used cannot be re-used in the SRC. Examples in chemicals, tissue paper etc.). In addition to these user fee was a yearly commitment of one thousand Ghana cedis (GHC 1000) from the government of Ghana for the coordinators of the centers and the head of the centre school for maintenance of the SRC bus (Miller, 2016).

After running the SRCs for about seven years, the Ministry of Education in 2003 still noted that less than 15% of Ghanaians aged 15 years and above are scientifically literate (M.O.E, 2010). Science and Technology thus do not seem to have any influence on the lives of the majority of people. It was also observed that the level of scientific literacy among the youth, who constitute about 44 per cent of the total population in the country, is very low; than that of the adult population is even much lower.

These revelations pushed the government at the time to adopt the Model Senior High School (SHS) project in each district. In this project, a senior high school in each district was to be upgraded to close gaps with modern facilities including well equipped laboratories and ICT facilities with the aim to improve the teaching and learning of science.

A study conducted by Gyamera (2006) on some beneficiary schools of the SRCs after SRCs had operated for ten (10) years revealed a lot of positive developments resulting from the establishment of the SRCs. Gyamera (2006)

also identified some challenges; for example 470 out of the 660 computers supplied to the SRCs in 1996 had broken down. The rest had serious defects that hinder their effective use. Additionally the spare parts of these computers were not readily available to be purchased. He also noted that the teachers who were originally trained to manage the SRCs were either transferred to other schools which had no SRC or had gone on retirement. The lack of replenishment of the consumables at the SRCs, the erratic payment of user fees by satellite and host schools and the inadequate motivation of centre staff together exerted a negative impact on the operations of the SRCs. The above challenges paint a picture of collapse of the programme. These, in turn, have negatively affected the quality of practical activities organized at the centres. If science resources are to continue to serve the purpose for which they were established then adequate material, financial and human resources should be supplied to make the centres fully functional.

In 2009, new equipment and materials were supplied to the existing centres to replace the old ones, also with the aim of incorporating ICT in the teaching and learning of science. After the supplies were made, training was given to teachers in the satellite schools and some of the old materials and equipment distributed to the satellite schools (Miller, 2016). After 2009, the yearly maintenance allowances of one thousand Ghana cedis (GHC 1000) stopped.

The weaknesses of the existing SRCs resulted in poor performance of students in sciences at the Senior High Level. For instance at the West Africa Senior Secondary Certificate Examinations (WASSCE), pass rate has been low in Mathematics and Science for the period 2005 to 2014. Within the period,

WASSCE pass rates averaged 48.1 per cent for Mathematics and 53.9 per cent for Integrated Science (GNA, 2012). This led to some policy reviews (2001-2005 reforms and the 2010-2020 Science, Technology & Innovation Policy document). Perry (2015) in her report titled 'developing practical work in Ghana: the Ghana Science Resource Centres, asserts that the challenges in using practical work in Ghanaian schools for many science teachers include: lack of funding, large class sizes, unsuitable classrooms and lack of specialist knowledge.

Many schools have no laboratory facilities, no technician support in many science laboratories and class sizes of 40-60 students. Perry (2015) also intimated that like many countries, the government has identified a shortage in workforce with appropriate technical and scientific skills and has chosen to start from the bottom up, by supporting science teachers to build these skills in their students. The government of Ghana, based on the aforementioned challenges, constituted a committee among others to ascertain the causes of low performances in Mathematics and Science in the country and the Committee to come out with a proposal for solutions. The committee came out with some key findings which corroborated the annual reports of the West Africa Examinations Council (WAEC) Chief Examiners. Some of the problems identified included: inadequate mastery of critical foundational skills, which creates gaps in learning that only accumulated overtime and is reflected in low Basic Education Certificate Examinations (BECE) and WASSCE scores: poor teaching methodologies inadequate numbers of teachers with requisite competencies to teach Mathematics and Science, inadequate teaching and

learning materials for Mathematics and Science as well as ineffective management and supervision of teachers in schools (GNA, 2012)).

To overcome the challenges identified with the operation of the first SRCs 200 senior high schools were provided with science resources (materials and equipment) through the Science Resources Centre (SRC) Project III between 2012 and 2014. This was done in addition to the old Science Resource Centres (SRCs) that were established between 1990 and 2009 in some selected districts throughout the country.

The Science Resource Centre Project III (SRCP III) is to move students away from rote learning and following of instructions, to questioning, designing, planning, carrying out, recording, analyzing and evaluating results as cited in the SRC Training Manual (2012). This has the potential to stimulate students' interest in science and development of scientific inquiry skills. This would enhance their acquisition of scientific knowledge and practical scientific attitude and attainment of scientific literacy skills.

The SRCP III package included the provision of a set of laboratory equipment and materials to each science laboratory; (Biology, Chemistry, Physics and Integrated Science laboratories). In addition to the normal equipment for the biology laboratory, a set of ICT equipment was provided. These items included; a modern digital microscope and software for recording, a digital flex camera also with the software, light, humidity, pH and temperature sensors with their softwares.

The package also included one month comprehensive training of three teachers (biology, chemistry and physics) and a laboratory technician from each beneficiary school. The SRCP III has been a comprehensive and well thought package by the Ministry of Education which when well implemented, it would yield the desired results of achieving scientific literacy and enhancing students' performance in science through practical teaching and learning of science subjects.

Three years after implementation of the SRCP III, there is the need for a study to assess the impact of the project on students' performance in WASSCE. The study intends to compare performance of students based on WASSSCE results before the project was implemented and that of three years after implementation of the project, to ascertain whether the provision of these resources and equipment through the SRC Project III has necessarily improved students' performance in biology.

According to Nweki and Onyegyegbu (2013), students taught with instructional materials performed better than those taught without. The use of instructional materials gives the students the opportunity to see, feel and touch the materials during the teaching process. All these will come to nothing if these Science Resource Centre (SRC) Project materials and equipment are not utilized fully and appropriately

1.2 Statement of the problem

Resources in a school setting provide strategic leadership, advocacy and advice to enable museums, archives and libraries mould people's lives and inspire their imagination, learning and creativity (Williams, Wavell & Coles, 2001). It

has been established that facilities are potent in high academic achievement of students therefore, stakeholders in education should provide adequate material resources to enhance teaching and learning processes (Owoeye & Yara, 2010). For instance, Balogun (1982) as cited in Sofeme and Andy (2012) asserted that no meaningful science education programme can be achieved without laboratory facilities. Laboratory facilities are indispensable to effective science teaching and learning.

In spite of the several interventions by central government to achieve scientific literacy and to enhance students' performance in science through provision of well-equipped laboratories, little or no effort has been made to assess the impact of these interventions on students' performance, in the sciences. Literature on Science Resource Centre (SRC) Project III and its impact on students' academic performance though scanty, suggests that SRCs correlates positively with students' performance (Mudulia, 2012). There is therefore the need to conduct further research in the area to refute or buttress this assertion. This study is envisaged to also add to the scanty literature in the area and close the knowledge gap.

A study conducted by Sofeme and Andy (2012), showed that there was no difference in the academic performance of schools with adequate laboratory facilities and those without them. The impact of laboratory equipment and materials through SRC Project III on students' performance in Ghana may not be different from the other findings.

This suggests that research efforts be directed towards this very important aspect in the educational delivery chain. Based on these positions espoused by

Mudulia (2012), and Sofeme and Andy (2012), the question, " is there any improvement in students' performance in Biology in selected schools which have Science Resource Centre Project III?"

1.3 Purpose of the study

The purpose of the study is to assess the impact of Science Resource Centre (SRC) Project III on students' performance in biology in some selected senior high schools in the Upper West Region.

1.4 Objectives of the Study

Three objectives guided the study. The study was to:

1. determine the impact of Science Resource Centre (SRC) Project III on students' performance in biology in selected senior high schools in the Upper West Region
2. Investigate biology teachers' use of the Science Resource Centre (SRC) Project III materials and equipment in biology.
3. Identify problems biology teachers of the selected senior high schools encounter in using of the Science Resource Centre project III materials and equipment.

1.5 Research questions

The research questions to be addressed are as follows;

1. To what extent has the SRCP III equipment and materials impacted on students' performance in biology in the selected SHS in the upper West Region?

2. To what extent do biology teachers' use the Science Resource Centre (SRC) Project III equipment and materials in the teaching of biology in selected senior high schools?
3. What problems are encountered by biology teachers in the use of Science Resource Centre Project III equipment and materials in the teaching of biology in the selected SHSs?

1.6 Assumptions of the study

i. The SRCP III materials and equipment are likely to be effectively used by teachers of selected senior high schools in the region.
ii. The SRCP III materials and equipment are thought to improve the teaching and learning of biology in selected senior high schools. This would have a positive impact on students' performance in biology at WASSCE in such schools.
iii. The respondents (biology teachers) would co-operate with the researcher and honestly and objectively complete the questionnaires.
iv. The WASSCE results obtained from heads of senior high schools involved in the study are assumed to the accurate and true reflections of the biology students' performance in such years (2013, 2015)

1.7 Significance of the study

Findings from the study would help to ascertain the extent to which Science Resource Centre Project III equipment and materials has improved senior high school students' performance in biology.

The findings would also help to identify the problems and challenges that biology teachers encounter in the use of the SRC Project III materials and equipment.

Also the study would inform educational authorities to ascertain whether or not biology teachers in beneficiary Senior High Schools use of SRC materials and equipment in teaching biology.

Findings from the study would provide a reference material to the schools and districts, and in the region as it would bring out the situation that exists with regard to the use of SRCs in the study schools, districts and regions on the current state of SRCs in the selected schools districts and region.

Though the findings cannot be generalized, it would be useful as a reference material for future evaluation of the SRC Projects at national level

It will also augment the data on the link between availability of educational resources, their use and academic performance of students needed by educational researchers.

1.8 Limitations to the study

Retrieval of data questionnaire from teachers and analysed WASSCE results from the schools was a challenge and this delayed the analysis of the data and earlier completion of the project.

Some biology teachers intimated that they make use of laboratory equipment during their lessons; this cannot be substantiated since the researcher did not actually observe any biology lessons during the study.

The study used WASSCE results analysed by the various schools for the study. It is assumed that the results analysed by the schools is accurate and a true reflection of the actual performance of the students.

1.9 Delimitation to the study

A Senior High School in every district in the country has benefitted from the SRC Project III. The vast nature and varied nature of the country, the study was limited to some selected beneficiary Senior High Schools in the Upper West Region of Ghana.

The study is additionally limited to only biology teachers of the selected beneficiary Senior High Schools, and WASSCE results of biology students of these schools.

1.10 Definitions of Terms

Centre Schools – are schools that host the Science Resource Centre Project.

100% Pass in WASSCE - refers to a situation where students who sat for a subject /paper all score between grade A1 and E8 in a WASSCE exam.

Satellite Schools – Schools that lack a Science Resource Centre and are to visit the Science Resource Centre in other Schools in order to access the facility

Co-trainers.- are Ghanaian science teachers and technicians, identified from the early cohorts of the CPD programme, who have the skills and confidence to become CPD leaders themselves.

Continuing Professional Development (CPD) this where for staff from the beneficiary schools were trained in the use of the equipment and materials that came with SRCP III. Each school sent four staff members (a teacher of each of chemistry, physics and biology and a technician)

1.11 Abbreviations

MOE SSS - Ministry of Education, Senior Secondary School Division

SRC Project III - Science Resource Centre Project Phase III

ITEC-International Training and Educational Consultancy

CPU-Continuing Professional Development

SHS-Senior High School

UWR-Upper West Region

WAEC. West African Examination Council

WASSCE-West African Senior School Certificate Examination

1.12 Organization of the Study

The study is be organized into five chapters. Review of relevant literature constituted chapter two and chapter three dealt with the methodology employed in the study. The chapter three comprised of the design of the study, population, sampling and sampling technique, instruments data and analysis procedures. Chapter four dealt with presentation of results and discussions of findings. Chapter five dealt with summary of key findings recommendations and conclusions.

CHAPTER TWO

LITERATURE REVIEW

2.0 Overview

This chapter discusses review of relevant literature related to the study. Areas touched on include Biology Education in Ghana, Historical Background of Science Resource Centres (SRCs) in Ghana, Science Resource Centre (SRC) Projects, Science Resources Centres and Instructional Strategies, Science Resource Centres (SRCs) and their use in teaching and learning of biology are discussed. The use of science equipment and materials in these Science Resource Centres and the challenges biology teachers encounter in the use of equipment and materials in SRCs are also touched on. Literature on students' academic performance in Senior High Schools will also be reviewed. The chapter ends with impact on students' performance in biology and a summary of the discussions on the literature review.

2.1 Biology Education in Ghana

The need to teach Biology ultimately must be to explain the living world in terms of scientific principles. It is also to guide and inculcate in learners, skills in observing, measuring, formulating hypothesis, predicating and designing, investigating, recording data and interpreting results, drawing conclusions and communicating findings. The knowledge, skills and attitudes acquired through the study of biology equips learner with the necessary basic tools for employment in science laboratory, industry, agriculture, horticulture, forestry, health care, work with animals, marine and fresh water biology, information science, administration, finance, management and teaching. Its study further equips the learner for further studies and research in pure and applied science

and technology that are vital areas for the advancement of society. Teaching elective biology, in totality, guides the learner and makes him/her capable of critical thinking, making meaningful decisions and solving problems (Teaching Syllabus for SHS Elective Biology, 2010).

The content of the SHS teaching syllabus Elective Biology (2010) has been designed in such a way as to provide students with basic knowledge in biology for them to understand themselves and other organisms, which will enable them, make very informed choices as they interact with nature. The scope of the content of the syllabus will also enable the learner pursue specialized careers relating to biology and fully prepare students who wish to continue the study of biology at the tertiary level (Teaching Syllabus for SHS Elective Biology, 2010).

The biology syllabus seeks to make students more creative so that they use their own initiatives to solve problems of life. Agboala (1984) is of the view that some of the specific important human abilities in the domain are visualizing, thus, producing mental images, combining objects and ideas in new ways; offering explanations for objects and events encountered, questioning, producing alternate or visual uses of objects, solving problems and puzzles, designing devices and machines, producing ideas and devising tests for explanations. The development of the above domain will not be achieved if practical work is not effectively organized during biology lessons.

Teaching and learning are inseparable, in that, learning is a criterion and a product of effective teaching. In essence, learning is the goal of teaching. It is said that someone has not taught unless someone else has learned (Millar,

2004). After a few years of teaching, many teachers realize that students learn too little of what they are taught. Teaching of science requires attention to both the content of the course and the process of moving students from their initial state of knowledge and understanding to the desired level. In fact, teaching is a part of a whole that comprises the teacher, the learner, the disciplinary content, the teaching/learning process, and the evaluation of all these. (National Academy of Sciences-USA, 1997).

Research evidence shows that when confronted with a problem, strong scientists who excel in their respective fields of work develop a number of hypotheses within a short time, and design experiments to test how far each hypothesis is true. Weaker scientists on the other hand, tend to focus on only one or two hypotheses (National Academy of Sciences-USA, 1997). The implication of this for the biology teacher is to lead students to learn to generate a number of hypotheses for every problem tackled in class; critique each hypothesis generated before selecting the best one (Teaching Syllabus for SHS Elective Biology, 2010).

Undergraduate students value good teaching in science and its related subjects and many of those who switch from a science major to another field usually cite poor teaching as an important factor in their decision (Seymour & Hewitt, 1994). This is obviously not different in a developing country like Ghana as many students who offered science at the SSS/SHS are seen switching to the Business and Arts courses at the universities and polytechnics, etc.

Practical work done by students during biology lessons helps them to acquire knowledge in scientific concepts in everyday life. It also enables them to apply the learned biology concepts and skills to solve every day social problems, understanding scientific and technological principles involved in household technological devices and the evaluation of mass media reports of scientific development.

Observation of safety measures in the laboratory care and concern for the safety of one's self and for others; ability to work with and without others; good co-operative spirit, economical use of materials; maintenance of clean and orderly work area, persistence in achieving results and creative use of materials, all seek to make students more creative so that they use their own initiatives to solve problems of life.

2.2 Science Resource Centres (SRCs) in Ghana

The Science Resource Centre concept started in the 1960s with the establishment of Science Centres in Accra, Kumasi, Ho, cape Coast and Sekondi (Eminah, 2007). The main objective was to teach science at these centres to pupils from a cluster of elementary schools. Specialised science personnel known as Science Organisers were to manage the centres. After operating these centres for a while, the challenge of limited facilities arose, this could not meet the needs of the large number of elementary school pupils in the country. This led to the establishment of the Elementary Science Unit (ESU) around 1967 which was later developed into the Science Unit (SU). As a start, it organized science courses for elementary school science teachers from various parts the country (Eminah, 2007). A group of elementary science

teachers were sponsored by the Ministry of Education to do a one year course in United Kingdom at the University of Reading in 1969. On their return, they were appointed Regional Science Organizers to the various regions with the responsibility of ensuring the effective teaching of science in the elementary school Science Centres at the regions. These Regional Science Centres further underwent some reforms until modern SRCs were developed in a number of districts.

The modern Science Resource Centres (SRC) project was initiated by the United Kingdom government to enable schools to access global science education through the resource centres (Darkwa & Owerri, 2000). The project was as a result of the call for science for all, coupled with the poor performance of students in the then Senior Secondary School Certificate Examination (SSSCE) in 1994.

In 1996, the SSS Science programme received a boost with the establishment of the Science Resource Centres (SRCs). The main objective was to promote the use of ICT in teaching of science to explain some abstract scientific concepts. There is ample pieces of evidence to show that the SRCs enabled a higher proportion of SSS science students to perform a variety of practical activities using equipment and materials that were not available in the conventional laboratories (Eminah, 2007). The students were also introduced to modern approaches to experimentation in science. Schools offering science but who did not benefit from the SRC project were considered as *satellite schools*. They were to visit these SRCs in other schools/host school at least twice a

week and they were to pay user fees. These fees were to be used to run the centres and replenish 'consumables'.

A study conducted by Gyamera (2006) on some beneficiary schools of the SRCs after about ten (10) years of operation, revealed a lot of positive developments. For example, students could carry out some practical activities in the SRCs-resulting from establishment of the SRCs. The study however, identified some challenges. These challenges included virtual collapse of most SRCs. For example, Gyamera (2006) reported that 470 out of the 660 computers supplied to the SRCs in 1996 had broken down. The rest had serious defects that hindered their effective utilization. Additionally, the spare parts of such computers were not readily available in the ICT market for purchase. He also noted that some of the teachers who were trained to manage the SRCs were either transferred to other schools without SRC or had gone retirement. The inability to purchase consumables used at the SRCs, the erratic payment of user-fees by both satellite and host schools and the inadequate motivation of centre staff, all interacted to exert a negative impact on operation of the SRCs. These, in turn, negatively affected the quality of practical activities organized at the centres. If science resources are to continue to serve the purpose for which they were stablished then adequate material, financial and human resources should be supplied to make the centres fully functional.

In 2009, new equipment and materials were supplied to the existing centres to replace the old ones. After the supplies were made, training was given to teachers in satellite schools and then some of the old materials and equipment distributed to the satellite schools (Miller, 2016). After 2009, the yearly

maintenance allowances of one thousand Ghana cedis (GHC 1000) from Ghana government was stopped.. Miller (2016) also identified the following as the challenges that hindered effective operation of the old SRCs:

1. Refusal to pay commitment or user-fees by heads of satellite schools
2. Increasing cost of maintenance of SRC buses.
3. Teachers trained to manage the SRCs were fully engaged in teaching in the schools. The trained teachers also considered students from satellite schools as an extra work with no motivation. So lessons were then left in the hands of teachers from the satellite schools that had no or little knowledge in the use of the equipment and materials at the centres.
4. Refusal by host teachers to practise the skills learned during their training affected the operations of the SRCs.
5. Teachers who had the earlier training moved to other schools without SRC while others also left for other jobs or had gone on retirement.
6. According to Miller (2016), as long as the biology syllabus remains as bulky as it is, such facilities/interventions will never yield the intended results as most teachers will concentrate on finishing the syllabus.

With SRC project III, many of the senior high schools offering the science programme received materials and equipment since the new SRC project stopped those schools' from visiting science resource centre by the provision of the resources. Teachers in satellite schools were also trained, and traveling cost to host schools by satellite schools among others, have been minimized or stopped.

2.2.1 Interventions by other Partners Science

Non-Governmental Organisations (NGOs) and other partners of education in Ghana have also made significant contributions towards science education. One such NGO is the Japanese International Cooperation Agency (JICA) which has been in the fore front mainly in building teachers' capacity across all levels of education. According to Miller (2016) JICA through the project "Science Education in Secondary School Phase II," science teachers from beneficiary countries like Ghana, Zambia, Kenya, Tanzania Malawi and Losotto were offered a two-month training in Japan. This was to build their capacity in the teaching of science. Such teachers on their return were better and more effective in teaching and learning of Science than before. Miller (2016) admitted that selection of teachers for the training was based on schools with JICA volunteer teachers.

Another area where JICA has also contributed is voluntary teaching. JICA has been sending volunteers to some schools in Ghana. Some of these volunteer teachers are science specialists in various science subjects who help in the promotion of science teaching in these selected schools in Ghana. JICA gives the opportunity for schools that are interested in this volunteer teaching to apply and indicate the special area of interest. The volunteer teachers normally stay for two years in the school he/she is attached.

JICA volunteer teachers in the country, particularly those into Science and Mathematics, usually organize Science Technology and Mathematics Education (STME) clinics every year for Senior High School students across the country. At these STME clinics, students are camped at a particular location

where they present projects for critique by student colleagues and teachers. The students are also taken through practical work in science and mathematics.

Parents Teachers Associations (PTAs) have also contributed significantly to science education in the areas of infrastructure like (CT and Science laboratories), computers and the provision of chemicals and other items used in the teaching and learning process (Miller, 2016).

The sustainability of the Science Resource Centre (SRC) Project III therefore depends largely on government and other partners and stakeholders in education as these materials and equipment would be depleted and/or consumed up with time. The sustainability of the project largely depends on the frequency of replenishment of the materials and equipment.

2.3 Science Resource Centre SRC Project III in Ghana

Doucette (1999) defined Science Resource Centre (SRC) projects as structures consisting of planned teaching and learning materials and activities which support the school curriculum and contribute to the development of life-long learning in science. In addition, Loertscher (2000) suggested that an ideal SRC project is built on the foundation of an information infrastructure that includes materials, equipment facilities, and direct services to students and teachers.

The challenges that confronted almost the two decade's operation of the earlier SRCs coupled with some policy reforms and committees' findings as stated earlier, necessitated the Science Resource Centre Project III in 2012 through the Secondary Education Improvement Project (SEIP), SEIP facilities upgrade, E-Learning and Science Resource Centres (SRC) Project. This saw 200 senior

high schools across the country receiving huge shipping of equipment and materials to enable the teachers carry out practical work in science for the first phase of SRCP III. The equipment range from basic test tubes, voltmeters and measuring cylinders, microscope, magnetic stirrers and glass blocks to computers, modern digital microscope with software for recording, digital flex camera also with the software, light, humidity, pH and temperature sensors with their software and dataloggers were installed into 200 senior high schools in 2013, in addition to the already existing SRCs. The objective of the SRC project III is to demystify the teaching and learning of science and mathematics in senior high schools (SHSs) through hands-on science education and as a way of solving the problem of students' failure in science and mathematics in the country.

The second phase of the SRCP III included continuing professional development (CPD) for staff from the beneficiary schools. Each school sent four staff members (a teacher of each of chemistry, physics and biology and a technician) for a month long programme in Kumasi, in the Ashanti region of Ghana in May 2013 and September, 2013.

The final, and perhaps most important, phase of the SRCP III is the development of "Co-trainers". The Co-trainers are Ghanaian science teachers and technicians, identified from the early cohorts of the CPD programme, who have the skills and confidence to become CPD leaders themselves. By building the capacity of Ghanaian teachers to deliver CPD, the reliance on overseas consultancy may ultimately be reduced, leading to a more sustainable school improvement system. Co-trainers worked alongside, and were mentored by, the

UK trainers to deliver the CPD programme to later cohorts. They worked together to plan smaller packages of CPD which could be delivered in schools as needed.

2.3.1 Science Resources Centres and Instructional Strategies

Teaching and learning materials influence teacher's choice of teaching strategies in lessons. SRCs help teachers to select materials and equipment to be used in his/her teaching. These materials and equipment are used to engage the students in activities in the course of biology lessons, a strategy recommended in the syllabus.

According to the MOE Teaching Syllabus for SHS Elective Biology (2010), the teaching of biology should be student-centred and activity-oriented. The teacher here acts as only a facilitator. These instructional strategies coupled with the use of the SRCs share complimentary objectives of engaging students in the learning process and promoting higher thought processes and more authentic behaviors required for scientific and technological development. Effective science classroom is one in which students are active, kept aware of instructional objectives and receive feedback on their progress towards the stated objectives (Wise & Okey, 1983).

The resources in the centres help teachers through the use of student-centred and activity-oriented teaching methods to explain complex and abstract biological concepts. For instance, factors affecting enzyme action on food substrate can easily be explained with the use of *the Sunflower for Science* a programme that came with SRCP III. Concepts such as DNA replication, Protein Synthesis can also be taught through animations using either the

Sunflower for Science or using videos and projecting for the students to watch.. Translocation, Transpiration, in plants as well as movements in plants, can all be demystified using the ICT component of the SRC project III.

Aside the ICT component, other materials and equipment inherent in the SRC project III such as potometre, thermometres, Lung volume kit, and chemicals support the student-centred and activity-oriented teaching methods as they can be used in the process of teaching to engage students

In classrooms where elements of constructivism are incorporated in the teaching and learning of biology, students get the opportunities to physically interact with instructional materials and engage in varied kinds of activities through the use of the resources in the SRCs. Therefore, for effective learning of biology to take place, students must be actively involved in the teaching and learning process.

In all, the equipment and materials at the SRCs support student-centred and activity-oriented teaching methods. The SRCs have come to help teachers to effectively adopt the best teaching methods prescribed in the 2010 SHS elective biology syllabus. This positively affects students' learning, their understanding in biology and ultimately improves their performance in the subject.

A science resource centre enables learners to develop scientific reasoning as against rote learning. Another benefit is that learners discover information in the process and become motivated in doing biology. The availability of SRC can also empower science teachers to implement the learner-centred approach, as against the traditional and non-productive teacher-centred approaches.

Whatever the teaching strategy a teacher adopts, according to the MOE Teaching Syllabus for SHS Elective Biology, (2010) "should be student-centred and activity oriented. The teacher only acts as a facilitator. For effective teaching and learning in this course, it is recommended that schools establish small botanical gardens, animals in cages, fishpond and insects in cages. The SRCs support lessons that are student-centred or activity-oriented. Any strategy that will make the student so passive in the biology teaching and learning process means not be putting the SRC materials and equipment to use.

2.3.2 Science Resource Centres (SRCs) and their Use in Teaching Biology

One thing is providing teaching and learning resources, and other thing is use of resources such by teachers for the benefits of students. Chenwe and Chilee (2014), in their study on laboratory material resource utilization, found that majority of the readily available and less expensive materials such as textbooks, chalkboards and charts were utilized to a great extent while some expensive biology laboratory material or resources such as computers, overhead projectors and video-taped instructions were utilized to a lower extent. Consequently, Chenwe and Chilee (2014) outline the following implications from their findings;

1. The utilization of the available biology laboratory resources by COE lecturers for curriculum delivery implies that future College of education graduate teachers are likely to use them for teaching biology in secondary schools. This invariably would engender activity-based learning which enhances students' achievement in biology.

2. The low utilization of the modern technology equipment as a result of lecturers' lack of knowledge and skill in ICT will result to production of teachers that would not be able to use modern technologies for curriculum delivery in their schools, thereby depriving the students of the joy and excitement of the 21st century new technologies.

The implication of these findings for biology teaching is that the modern equipment and materials, which have been provided through the SRC Project III to generate interest and facilitate understanding of concepts being taught, are likely not be adequately and effectively utilized.by teachers Consequently, innovative teaching methods using these modern laboratory equipment and materials will not be used for students pursuing biology, resulting in the continued use of the old conventional teaching methods by biology teachers.

From the above implications, the aims behind the implementation of the SRC project III would not be achieved if biology teachers cannot use these ICT component and other modern laboratory equipment and materials in the project package.

Hofstein and Lunetta (2008) posited that laboratory has been given a central and distinctive role in science education, and science educators have suggested that rich benefits in learning accrue from using laboratory activities. It is through the use of laboratory equipment that the conceptual and experimental skills of students can be developed.

2.3.3 Science Resource Centres (SRCs) and Practical work in Biology Teaching

Wellington (1998) and Anderson (2007) argue that teacher demonstrations, class practical, with all learners on similar tasks, working in small group; a circus of 'experiments' with small groups engaged in different activities, rotating in a carousel; investigations, organized in one of the above two ways; and problem-solving activities constitute practical work. The different types of activities have different purposes (Gott & Duggan, 1995) but, as Wellington (1998) also points out, many 'experiments' are nothing of the sort, not least because no new knowledge is being made. Woolnough and Allsop (2005) have suggested three categories which might aid discussion about practical work: exercises, experiences and investigations: Over the years, there have been several studies that have reported teachers' views of the aims of practical work.

- to encourage accurate observation and description
- to make phenomena more real
- to arouse and maintain learners' interest
- to promote a logical and reasoning method of thought.

Four aims for practical activities were rated more in a study by Swain, Monk and Johnson (1998) than a study by Beatty and Woolnough (1982).

- to practise seeing problems and seeking ways to solve them
- to develop critical attitude
- to develop ability to cooperate
- for finding facts and arriving at new principles.

Millar (2008) argues that it is also important to distinguish, and keep in mind, two distinct purposes of school science curriculum in most countries. First, it aims to provide every young person with sufficient understanding of science to participate confidently and effectively in the modern world – a 'scientific literacy' aim. Second, advanced societies require a steady supply of new recruits to jobs requiring more detailed scientific knowledge and expertise; school science provides the foundations for more advanced study leading to such jobs. These two purposes may lead to different criteria for selection of curriculum content, areas of emphasis, and different rationales for the use of practical work (Abrahams & Millar, 2008).

The importance of practical work in science is widely accepted and it is acknowledged that good quality practical work promotes the engagement and interest of students as well as developing a range of skills, scientific knowledge and conceptual understanding.

Practical activities and experimental works prepare students to become problem-solvers concerned with societal issues and human needs. The experimental works allow students to conduct independent research and reach their own conclusions on all topics including societal issues and human needs (Office for Standards in Education Ofsted, 2010)

The student is enabled to visualize the application of concepts and principles in a concrete situation created by himself or herself with the help of the SRCs. To take a simple example, a student might gain a better understanding of a concept such as that of transpiration in plants by using the potometer in the SRC.

Ngman-Wara (2005) concluded that the practical activities will give the learners the scope to learn by: doing, thinking for themselves, acquiring skills of handling apparatus and instruments, following instruction and to record their observation and results, organising data and drawing conclusions.

The availability of teaching and learning materials for biology practical work plays an important role in the learning of biology. In his study, Bajah (1986) found a significant relationship between teachers, facilities and schools' academic performance. Adequate provision of instructional materials is an important method that science teachers use in promoting skills acquisition in consonance with the objective of developing manipulative skills in students (Eshiet, 1987). The provision of the SRCs has been an impetus to further make biology lessons more practical. These resources in the SRCs will help teachers engage students in their lessons and thus making the biology lessons more students-centred and activity-oriented.

When resources are provided to meet the needs of a school system, students will not only have access to work with the resources, but hey will t also develop multiple skills and proficiency by using the resources. The net effect is the overall academic performance of the students.

Many scholars such as Bajah, (1986); Akinwumigu and Orimoloye, (1986) are of the view that availability of physical and material resources are very important for the success of any worthwhile educational endeavour. These researchers agreed that, availability of adequate school buildings, number of classrooms, chairs, desks and laboratories for science teaching and learning are imperative for the attainment of any educational objectives. Hallak (1977) cited

in Adedji and Owoeye (2000) identified facilities as a major factor contributing to academic achievement in the school system. According to Adedji and Owoeye (2000), the facilities include; laboratories, equipment and other instructional materials. Gamoran (1992) thought that school resources and books in the library alone had little impact on students' achievement once student background variables are taken into account.

Obemeata (1995) provided evidence to support the claim that science resources are significantly related to students' academic performance. The provision of the SRCs, therefore improve students' performance in biology if only the equipment and materials are effectively used by both teachers and students, with other background factors of the learner taken into account.

In conclusion the SRCP III if well utilized would lead to incorporation of practicals in biology lessons by teachers. This would make the teaching of complex and seemingly difficult topics practical based and easier for students to understand through the use of computer stimulated approaches. These computer-stimulated lessons simplify these concepts for students to understand. This implies that teachers would use these materials and equipment that came with the SRCP III to teach complex concepts to the understanding the students.

2.3.4 Science Resource Centre (SRC) Projects III and Students' Performance in Biology

Effective science teaching depends on the availability and organization of materials, equipment, media and technology (National Academy of Sciences-USA, 1997). Nwike and Onyejegbu (2015): findings on resources and students' performance in Nigeria was in line with Olagunju and Abiona (2008) who

found that there was a remarkable difference in achievement scores of students taught with various instructional materials and those not exposed to any of instructional materials.

Sofeme and Andy (2012), in their study, assert that availability of qualified science teachers had no significant relationship on academic achievement of students in science subjects at secondary schools. The results also indicated that there was no difference in academic achievements in schools with adequate laboratory facilities and those without them. Mudulia (2012) reports on a relationship between availability of resources and achievement of science, arguing that high performing schools have higher availability of laboratory equipment and chemicals (consumables) than low performing ones. Kibirige and Hodi (2013) also reported that learners who use laboratory investigation improve their understanding of physical sciences. But Gemma, Carey, Levaãiç, Armstrong, Alejandra and Castle (2007), in a study, said that although the technology component of science resource centre projects was initially welcomed by students, any boost in motivation seems short lived. Statistical analysis showed no impact on students' performance in science.

This implies that whiles there is evidence that laboratory materials and equipment improve students' performance, it is absolutely not the case as the interest of students' in these new equipment and materials (particularly the technology component) is not usually sustained. The implication is therefore daring as the Science Resource Centre Project III is also likely to have its technology component failing to motivate students.

Kibirige and Hodi (2013) in Kenya on the importance of SRCs, underscore the importance of laboratories in providing learners with opportunities to experience science by employing scientific research procedures. One such opportunity is engaging learners in the inquiry processes through which they can acquire research skills. This eventually lead to an improvement in the academic performance of students in science and other science based subjects. Similarly, Owolabi and Oginni (2012) observed that one of the activities in science is experimentation because it provides a forum for practising the theoretical knowledge gained in the classroom and for demonstrating the psychomotor skills of the teacher and learners. This reinforces the fact that students engaging in laboratory equipment and processes are key to achieving the learning objectives and have a direct influence on their academic performance in science.

According to Manqele (2012) in his study in South Africa on the importance of learner and teacher materials on school performance, prioritized Learner and Teacher Materials (LTSMs) were found to be vital in modernizing, appropriating and improving a school performance and quality of education. In the study, Manqele (2012) argued that without relevant LTSMs, schools can neither hope nor manage to successfully implement performance or outcome based education. Hence, learners in those schools are still excluded from quality education. This position by Manqele (2012) supports the provision of the Science Resource Centre (SRC) Project III package.

The question of whether educational resources have impacted on learners' academic attainment has been a contest among scholars. Mangan, Hurd and

Adnett (2005) intimated that the total level of school resources is not closely related to students' performance, but Krueger (1988) challenges this interpretation of the research evidence for the case of class size. Vongoles (2000) as cited in Akinsolu (2011) in a survey in UK on educational expenditure and performance also concludes that the link between educational expenditure and performances or outcomes has not been proven though they point out that research has suffered from poor quality and failed to fully examine interactions between school inputs and resources. Mangan, Hurd and Adnett (2005) argue that, the apparent absence of resource effects is at odds with conventional economic reasoning. Woods and Jeffrey (1997) argue that there has been a general assumption that inspection is ultimately output focused. This position is further buttressed by Neji, Amba, Ukwetang, Nja, and Cecilia (2014). Their study also revealed that adequacy of laboratory facilities does not significantly contribute to the variance in students' academic performance in Chemistry. The conclusions drawn from these studies suggest that other factors may be contributing to the observations. Factors such as teacher competence, usability of resources, congruence of the resources with the subject content etc. all account for such observations.

Adeogun and Osifila (2008) emphasized that the availability, relevance and adequacy of education resource items contribute to academic achievement and that, unattractive school building, crowded classrooms, unattractive laboratories, non-availability of playing grounds and surroundings that have no aesthetic beauty can contribute to poor academic performance. Berg (2010) supported the position of Adeogun and Osifila (2008) by saying that absence of such basic resource and extreme overcrowding in many developing countries'

schools means that other factors that are crucial for quality education (teacher's subject knowledge and teachers' competencies) may initially play a similar role. Owoeye and Yara (2010) indicated that there was no significant difference in the performance of students between rural and urban secondary schools in terms of availability of laboratory facilities in Ekiti state in Nigeria though it has been established that facilities are potent to raise high academic achievement of students in the same study. Implying that school facilities were the most potent determinants of academic achievements in science and other science- related subjects.

The findings of Chinwe and Chilee (2014) revealed that less expensive materials were utilized to a greater extent while some more expensive biology laboratory material resources were utilized to a lower extent. In the study, it was found that the teachers were more likely to use equipment and materials (such as; charts, cardboards, models, clinical thermometer, beakers, etc.) that were less expensive but were less likely to use equipment and materials (such as; digital microscope, microscopes, projector and screen) which are very expensive. This implies that the modern equipment and materials which may generate interest and facilitate understanding of concepts being taught among students may not be adequately and effectively utilized by biology teachers in the study.

The utilization of the equipment and materials by teachers and students in the teaching learning process has a direct impact on the performance of students as stated earlier.

The inclusion of the ICT component in SRC project III called for the integration of ICT in the teaching of biology. The role of computer technology in the teaching of biology is the most useful requirement resource in education. This is because it covers all aspects of teaching and learning: as an information resource, as a teaching resource and as learning resource. Mokgehle and Guardian (2012) said technology is the best thing to have happened to teaching; it has revolutionized the profession and brought energy and innovation. Aside the fact that computers are capable of performing all tasks that other resources in the biology laboratory cannot do, they are also linked to improved performance in individual learning areas. Barrett, Clegg, Ali, Hinostroza, Lowe, Nikel, Novell, Oduro, Pillay and Beare (2012) maintained that for some tasks, the ICT component can provide distinct advantages over the more traditional teaching approaches. The use of a computer for listening exercises often provides not only sound, but also visual input providing students with more contextual clues. Students interacting with ICT components also develop the motor skills of students as well. This can have a strong reinforcing effect on the learning process by connecting physical actions (clicking) with desired results. Students are also allowed more control over their own learning process as they make the decisions when to repeat questions, exercises and sequences based on their own progress.

2.4 Challenges of Biology Teachers in the use of SRC Project III Equipment and Materials

A first time user of anything new is likely to encounter some challenges in his/her use of that thing. In this light, the teachers who are to use the SRCs for the first time are likely to meet some challenges in their respective schools.

Some of the likely challenges mostly encountered by biology teachers are as follows.

Lack of teachers' adoption of innovative approaches in the teaching of biology is a potential challenge. Some teachers learn to handle some equipment and materials and in the process may see that effort as a complete waste of time and energy. This has the potential to hinder the use of some of the materials and equipment that come with the Science Resource Centre Project III.

Umeh (2006) is of the view that audio visual aids such as television, computers and projectors are not utilized in schools due to lack of knowledge on proper use of such resources for teaching. The use of the above mentioned facilities which are the electronic component provided in the SRC Project III, is a major challenge in Ghana as many teachers handling biology are not so much conversant and well vested in ICT. For example Friedman (2005) noted that while ICT applications on the education system might change the future of underdeveloped world fundamentally through the connections to the flat worlds, some challenges can impede its adoption and use in the education sectors among developing countries. These challenges include; teacher competence/lack of trained teachers in ICT, limitation on cost, and internet access. These challenges cut across all developing countries of which Ghana is no exception. Many teachers tend to use the materials and equipment they are familiar and conversant with. Jatua and Jatau (2008) expressed that material resources utilized by teachers in teaching science (biology) were textbooks, chemicals, charts, microscopes, chalkboards and flasks which are cheap and have wider applicability in the teaching and learning of biology in schools.

Onyeji (2013) in Nigeria reported that none of these new media (audio, visual and audio-visual) was available, accessible or used in Science, Technology and Mathematics (STM) in secondary schools. From the research findings, biology teachers agreed that lack of skills/competencies required for using resources is insufficient for practical work, inadequate laboratory and instructional materials, heavy teaching loads and large class size are the biggest factors hindering the use of resources in teaching biology. Here in Ghana, lack of skills/competencies required by teachers for using some of the resources, lack of innovativeness in handling materials and equipment, insufficient periods for practical work, inadequate laboratories as against the large class sizes and lack of laboratory technicians are likely to hinder teachers' use of the resources provided by the project.

Imogie (2010) attributed the problem of resource utilization by science teachers to increase in students' enrolment into science subjects (especially biology) which makes the available resources to be grossly insufficient for any meaningful activity-based learning. If biology teachers in the respective schools are not trained on the use of the modern biology laboratory resources or by the project consultant on the use of the equipment and materials, poor performance of biology students' in secondary schools will continue, since these teachers cannot give what they do not have. Consequently, a good knowledge on equipment and material utilization by biology teacher is essential for effective biology teaching and learning which can lead to improved students' performance in the subject.

2.5 Impact of SRC Project III and students performance in biology

Gyamera (2006) in his study of SRCs in Ghana observed that students could carry out some practical activities in the SRCs-resulting from establishment of the SRCs. This has the potential to improve students' performance in biology and other science related subjects

A science resource centre like the SRCP III enables learners to develop scientific reasoning as against rote learning. Another benefit is that learners discover information in the process and become motivated in doing biology. According to Hofstein and Lunetta (2008), his availability of SRC can also empower science teachers to implement the learner-centred approach, as against the traditional and non-productive teacher-centred approach. These all have a positive impact on students' performance the long round.

Nwike and Onyejegbu (2015): findings on resources and students' performance in Nigeria was in line with Olagunju and Abiona (2008) who found that there was a remarkable difference in achievement scores of students taught with various instructional materials and those not exposed to any of instructional materials.

Also Adeogun and Osifila (2008) emphasized that the availability, relevance and adequacy of education resource items contribute to academic achievement and that, unattractive school building, crowded classrooms, unattractive laboratories, non-availability of playing grounds and surroundings that have no aesthetic beauty can contribute to poor academic performance

2.6 Summary

This chapter began with issues surrounding the rationale for biology education in Ghana at the senior high school level. It has been established that the need senior high school (SHS) biology curriculum must ultimately help the students to explain the living world in terms of scientific principles and also to guide and inculcate in learner skills in observing and measuring, formulating hypothesis, predicating and designing, investigating, recording data and interpreting results, drawing conclusions and communicating them.

The historical basis for the establishment of the SRCs has been reviewed and these SRCs were established to encourage teachers to adopt an inquiry based approach to their science lessons, making critical investigations central to students' learning. Clearly, the SRCs influence the choice of teaching strategies by the teacher. Practical are extremely important in the teaching and learning of biology and practical work seeks to encourage accurate observation and description; to make phenomena more real; to arouse and sustain interest; and to promote logical and reasoning method of thought. Student' engaging in laboratory equipment and processes is key to achieving desired learning objectives and has a direct influence on their academic performance in sciences and this, the SRCs plays the role in achieving.

Utilization of science materials and equipment was also reviewed and found that majority of the easily available and less expensive materials such as textbooks, chalkboards and chats were utilized much more than the more expensive biology laboratory resources such as computers, overhead projectors and video-taped instructions by biology teachers.

Science resource centres and students' performance in science have also been reviewed. Factors such as teacher qualification and experience, teaching methodology,, attitude of both teachers and students, and the teaching and learning environment all seriously impact (negatively or positively) on students' academic achievement in science.

The challenges that biology teachers encounter in the use of SRC project III resources includes: teachers lack of skills and competencies, insufficient time allotted for practical work, inadequate laboratory and instructional materials, heavy teaching loads and large class size.

CHAPTER THREE

METHODOLOGY

3.0 Overview

The chapter discusses the methodology employed in conducting the research. Among other things, it describes the area where this study has been carried out. The chapter also describes the research design used for the study, the instruments used for collection of data for the study and the validity and reliability of the instruments. The chapter ends with the method of data collection, and analysis procedures as well as ethical consideration.

3.1 Study Area

The Upper West Region of Ghana is located in the northwestern corner of Ghana between latitude 9.8°- 11.0° north and longitude 1.6°- 3.0 west (Fig 1). It covers a geographical area of 18,476 square kilometres which represents 12.7% of the total land area of Ghana (Ghana Statistical Service, 2010). It is bordered by Upper East Region to the east, Northern Region to the south, and Burkina Faso to the west and north. The Upper West Regional capital and largest settlement is Wa. Upper West is the youngest region in Ghana. The area was carved out of the then Upper Region in 1983. It is the seventh largest region in Ghana and it is made up of one municipal and ten districts. The region has a total human population of about 702,110 representing 2.8% of Ghana's population (Ghana Statistical Service, 2010).

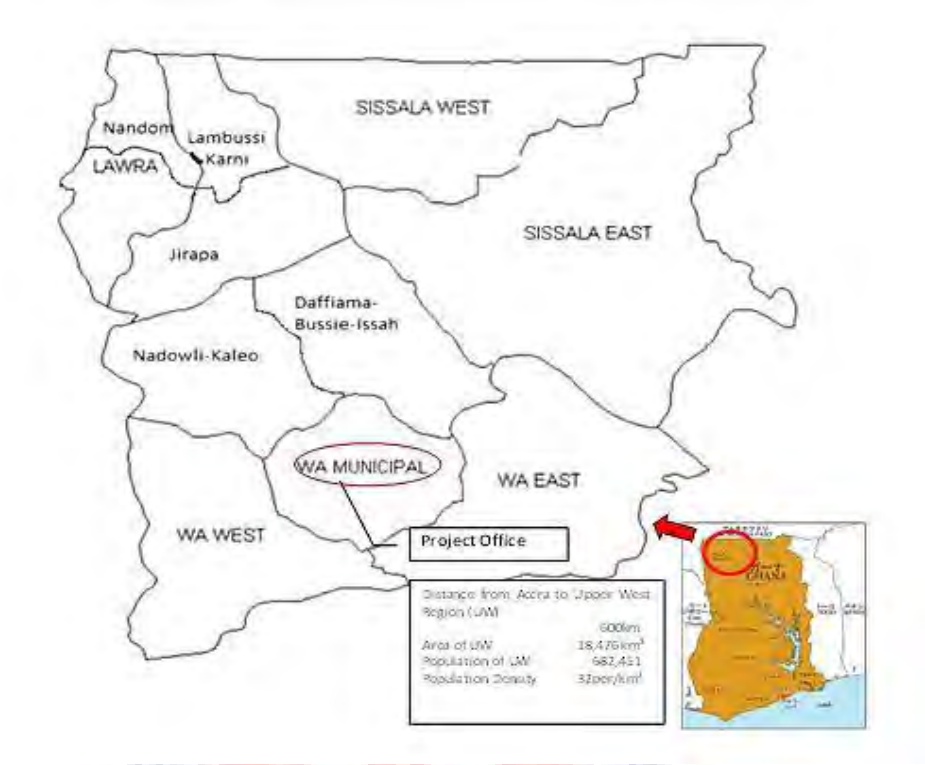

Fig. 3.1: Map of Upper West Region

3.2 Research Design

The study employed a descriptive survey research design which sought to evaluate the impact of SRC Project III on students' performance in biology in the region.. It employed the mixed-methods for data collection. The mixed-method of data collection is characterized by a focus on research problems that require an examination of real-life contextual understandings, multi-level perspectives, cultural influences and an intentional application of rigorous quantitative research assessing magnitude and frequency of constructs. and rigorous qualitative research exploring the meaning and understanding of the constructs. It has an objective of drawing on the strengths of quantitative and qualitative data gathering techniques to formulate a holistic interpretive framework for generating possible solutions or new understandings of the problem (Creswell & Tashakkori, 2007). Other proponents of mixed methods

argue that the design encompasses more than simply combining qualitative and quantitative methods but, rather, it reflects a new "third way" epistemological paradigm that occupies the conceptual space between positivism and interpretivism (Greene, Caracelli & Graham, 1989).

3.3 Population

In this study, the target population consisted of the entire 14 beneficiary Senior High Schools of SRC Project III in the region. The accessible population however comprised all Senior High Schools that benefited from the project in 2013 which were 9 schools and heads of department of Science and biology teachers in the selected schools.

3.4 Sample

The WASSCE results biology students for 2013 and 2015, the six (6) biology teachers (one from each selected school) and six (6) heads of science department of the beneficiary school formed the sample for the study.

3.5 Sampling Technique

A sample of 12 biology teachers from the six selected beneficiary schools was used in the study. Purposive sampling technique was used for both the teachers and the in the selection of the school. This technique is normally used to focus on particular characteristics of a population that are of interest, and to best enable the researcher answer his/her research questions. The specific purposive sampling type used was the homogeneous. This sampling type was used because it gave the researcher the opportunity to reach the targeted sample quickly with the specific characteristics. Additionally it helped to draw on a wide range of qualitative research designs. The homogeneous purposive

sampling technique was specifically used since the teachers were all teaching biology in beneficiary schools of the SRC Project III. The selection regarding the teachers in each beneficiary senior high school was done such that two biology teachers (one head of department for science and one biology teacher in the school) from each beneficiary school were chosen purposefully.

3.6 Instrumentation

The major instruments used to collect data in the study were questionnaire and document analysis.

3.6.1 The Questionnaire

A questionnaire is a research instrument consisting of a series of items and other prompts for the purpose of gathering information from respondents (Creswell, & Tashakkori, 2007).The questionnaire used was the mixed type. Some of the items were both close-ended (about 67%) open-ended (33%). The items were spread over the following areas: Biodata, Training and Management Information, Utilisation and Challenges in the use of Project Equipment/Materials, and Evaluation. Each closed-ended or structured item contained a statement followed by two or four options that the respondent has to choose. The closed-ended also has a four point Likert scale item. The respondent was expected to choose the option that best represented his/her opinion on the issue addressed.

The closed end items were scored by tallying to get a frequency for each respondent using the SPSS version 20. The open-ended items were coded and tallied manually based on the responses and then tallies.

3.6.2 Documents analysis

Document or Documentary analysis is a social research method and is an important research tool in its own right and it is an invaluable part of most schemes of triangulation. It refers to the various procedures involved in analyzing and interpreting data generated from examination of documents and records relevant to a particular issue at study.

Official documents are intended to be read as objective statements of fact but they are themselves socially produced. For the purpose of this study, the documents analyzed included: WASSCE results for 2013 and 2015 and SRC project III documents.

Leedy and Ormond (2005) argues that a case study does not have to be a narrative; learners, teachers and children's artefacts (for example observing labs, analysis of WASSCE results of 2013 and 2015 candidates) equally provided viable connections to real world classroom context. Gall (2009) adds that documentary evidence is necessary because it provides a rich discourse of facts punctuated with opinions making it useful in cross referencing of present findings.

3.7.1 Validity of the instruments

Validity determines whether the research truly measures that which it was intended to measure or how truthful the research results are (Joppe, 2000). To ensure the validity of the questionnaire, it was given to colleagues to go through and make their comments after which it was given to the supervisor who painstakingly went through it. The expertise of some senior Science Education lecturers and senior research fellows at the Institute for Educational

Research and Innovative Studies (IERIS) of the University of Education, Winneba was also sought to face-validate the questionnaire. Suggestions and comments there off were used to improve the face and content validity of the instrument.

The document analysis (WASSCE results for 2013 and 2015) were validated through the securing copies of the same documents to the secondary schools, districts and regional offices of the Ghana Education Service in the region. These documents were compared with those given by the study schools.

3.7.2 Reliability of instruments

A reliable self-report measure produces consistent results every time it is executed. To achieve this, a pilot test of the questionnaire was carried out with four science teachers consisting three biology teachers and one head of science department in Jirapa Senior High School (not part of the selected schools) in the Upper West Region of Ghana. The school was selected because it benefited from the SRC Project III. This was done to improve the validity and determine the reliability of the questionnaire. This pilot study enabled the researcher to restructure the questionnaire to elicit the right responses.

To the determine the reliability of the documents on the 2013 and 2015 analysis of WASSCE results in biology, the researcher made efforts to get copies of these documents which were copied to all Heads of SHSs and GES Offices in the region. These copied documents were used as standard to check any possible manipulations by heads of the schools involved in the study.

3.8 Data Collection Procedure

Letters of introduction were obtained from the Head of Department of Science Education, University of Education, Winneba and from researcher's supervisor (appendix) to obtain permission from the Headmasters/Mistresses of the selected schools for the conduct of the study in their schools. The letters were also used to obtain WASSCE results on biology for 2013 and 2015 from the schools selected for the study.. The researcher administered the questionnaire personally. This enabled the researcher to get to the respondents directly and to establish rapport with the respondents. It also enabled him to explain further parts of the questionnaire items that appeared problematic for some of the e respondents. After the questionnaires were issued out to the respondents, a time interval of three (3) weeks was allowed for respondents to respond to the questionnaire not only as appropriate as possible, but also at their own convenience. The respective heads of departments in selected beneficiary senior high school were tasked to collect the questionnaires from the other respondents and then for onward collection by the researcher.

The researcher also gave a time frame of three (3) weeks after serving the letters for the collection of documents on WASSCE results of 2013 and 2015 on biology at the selected schools. This was equally done to give the heads of the selected schools some time to do the analysis well and at their convenience.

3.9 Data Analysis

Descriptive statistics was used to analyze the data obtained from the questionnaire. Microsoft Excel Spreadsheet was used to organize the WASSCE results into meaningful categories. Analyzed WASSCE results were converted

to frequency counts and in simple percentages and presented in in frequency tables

Coding schemes were developed for open-ended items on the questionnaire to organize the data obtained into manageable and meaningful forms. This forms the second part of the questionnaire.

3.10 Ethical consideration

The study was conducted within the confines of the norms and standards of educational research. The following practices in particular were taken into consideration during the conduct of the study;

1. The privacy of teachers and other respondents to questionnaire was observed. Sex and age of respondents was the only biodata collected to aid in the analysis.
2. All sources (published and unpublished) from which information was gathered for use in the study have been duly cited and recognized.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.0 Overview

This chapter presents the results gathered from the study and discussions of the results. It contains the analysis of the various responses from the various respondents (teachers) and performances of the students in biology in the years under study (2013 and 2015).

Two sets of WASSCE results that is 2013 and 2015 were gathered on students and questionnaires were administered to the biology teachers. The aim of analyzing the 2 sets of WASSCE results was to find out whether there was improvement in students' performance in biology with the provision of SRCs in beneficiary Senior High Schools. The questionnaire was aimed at finding out; the availability of laboratory, extend of utilization of the SRCs. Challenges encountered by biology teachers in the used of equipment and materials in the SRCs and to further find out whether the SRC Project III has impacted positively the modes of teaching of teachers and students' attitude towards practical lessons and their performance in biology.

4.1 Presentation of the Results

Analyzed data based on the research questions formulated for the study are now presented as follows.

Research Question 1

To what extent have science resource centre project III equipment and materials impacted on students' performance in biology in selected schools?

In an attempt to answer this question, WASSCE results for 2013 and 2015 in biology from the selected schools were analysed. Sample responses to some items 12, 13, 14 and 15 in the questionnaire were also analysed to answer this question. Table 4.1 shows that the total number of students who sat for the biology paper in 2013 and 2015 in each beneficiary school and percentage passes of students.

Table 4.1: Number of Students who sat for 2013 and 2015 WASSCE Biology Papers in the Selected Schools.

School	No. of Biology Students and Percentage (%) Passes			
	2013 Candidate	% Pass	2015 Candidate	% Pass
Eremon Snr High Tech. Sch	119	97.9%	101	8.9%
Islamic Snr. High Sch, Wa	254	100.0	103	45.6%
Lassia Tuolu Snr. High Sch.	203	94.1%	129	86.8%
Queen Of Peace Snr High Sch.	68	98.5%	58	98.3%
Tumu Snr High Tech Sch.	131	100.0%	133	63.2%
Wa Snr High Tech. Sch.	120	98.3%	174	22.4%
Total & Average percentage	**895**	**98.1%**	**698**	**54.2%**

From Table 4.1, candidates who sat for the exam, there was a reduction in the overall candidature from 895 to 698 a shortfall of almost 200 students. This could however be attributed to the fact that the 2013 candidates was a combination of two batches (last batch of the four year SHS group and first

batch of the re-introduced three year group). In the same vein, with the exception of Lassia Tuolu Senior High School and Wa Islamic Senior High School, with a variance of -151 and -74 respectively, all the other schools had virtually the same number of students with even a school like Wa Senior High/Tech. School having more students offering biology in 2015 than in 2013 (though a double stream). That notwithstanding, this still poses a lot of questions and doubts for some schools particularly those with virtually the same numbers of candidates in both years on the positive impact of the intervention (SRC). Meanwhile a school such as Wa senior high technical school had 120 and 174 students who wrote the biology paper in 2013 and 2015 respectively. This could be attributed to the number of students admitted to offer science due to enough infrastructure and not the issue of students' interest in offering science.

Table 4.2: Comparison of Performance of Biology Students In the 2013 and 2015 WASSCE Examinations

S/N	Schools	Candidates Presented	GRADES OBTAINED IN 2013								
			A1	B2	B3	C4	C5	C6	D7	E8	F9
1	Eremon Snr High Tech. Sch	119	0	0	0	0	0	58	44	15	2
2	Wa Islamic Snr. High Sch,	254	0	0	17	21	44	123	32	15	2
3	Lassia Tuolu Snr. High Sch.	203	2	7	68	24	26	39	5	20	12
4	Queen Of Peace Snr. High. Sch	68	0	0	10	8	12	23	9	5	1
5	Tumu Snr High Tech Sch.	131	0	0	16	22	40	48	5	0	0
6	Wa Snr High Tech. Sch.	120	0	0	0	0	2	44	33	37	4
	Total	**895**	**2**	**7**	**111**	**75**	**124**	**335**	**128**	**92**	**21**
	School		**GRADES OBTAINED IN 2015**								
1	Eremon Snr High Tech. Sch	101	0	0	0	0	0	0	3	6	92
2	Wa Islamic Snr. High Sch,	103	0	0	1	1	2	17	9	17	56
3	Lassia Tuolu Snr. High Sch.	129	0	5	23	7	13	32	15	17	17
4	Queen Of Peace Snr High Sch	58	1	2	17	3	11	12	5	6	1
5	Tumu Snr High Tech Sch.	133	0	0	0	1	2	22	16	43	49
6	Wa Snr High Tech. Sch.	174	0	0	0	0	0	4	15	20	135
	Total	**698**	**1**	**7**	**41**	**12**	**28**	**87**	**63**	**109**	**350**

Table 4.3: Percentage of Pass in Biology in WASSCE for 2013 and 2015

School	Percentage (%) Pass	
	2013	2015
Eremon Snr High/Tech. Sch	98.3%	8.9%
Wa Islamic Snr. High Sch,	100.0%	45.6%
Lassia Tuolu Snr. High Sch.	94.1%	86.8%
Queen Of Peace Sen. High Sch.	98.5%	98.3%
Tumu Snr High /Tech Sch.	100.0%	63.2%
Wa Snr High /Tech. Sch.	96.7%	22.4%
Total	**98.1%**	**54.2%**

Table 4.3 shows the results of the students' performance in biology in the 2013 and 2015 WASSCE. From the table, it could be seen that in Eremon Senior High Technical School, 98.3% of 119 students, that sat for biology, scored grades between A1 to E8 in biology in 2013 whiles only 8.9% of the 101 students that sat the biology paper in 2015 scored grades between A1 to E8 as show in Table 4.2 above. Also in Wa Islamic Senior High School, the school got 100% pass in biology in the year 2013. This implies that all the 254 students who wrote the biology paper got between grades A1 and E8 (the average of grade considered "pass") in 2013 as indicated in Table 4.3 above. In 2015 however, Wa Islamic Senior High School had only 45.6% pass of the 103 students who sat for the WASSCE. Tumu Senior High School equally got pass rates of 100% and 63.2% in the subject in 2013 and 2015 respectively. Wa Senior High/Technical School also got pass rates of 96.7% and 22.4% in 2013 and 2015 respectively in the subject biology. In the whole, the average pass rate in biology in 2013 and 2015 for the schools under investigations in the region was 98.1% and 54.2% respectively. The overall picture is that more students

passed in the subject in 2013 than in 2015. This implies that the intervention has no impact on the students' performance in subject. This further implies that, the SRC Project III equipment and materials seems not to have impacted on students' performance in biology. This was because it was expected that the provision of the materials and equipment coupled with the relative drop in the numbers of students in most of the schools, performance of students should have been better in 2015 than that of the 2013 where numbers of students for most schools were higher and the materials and equipment were not available at the time.

Table 4.4: Comparison of Percentage Passes (PP) in WASSCE with Qualification into Tertiary Institutions (QTI).

	PERCENTAGE (2013)		PERCENTAGE (2015)	
	PP	QTI	PP	QTI
School	A1-E8	A1-C6	A1-E8	A1-C6
Eremon Snr High Tech. Sch	98.3%	48.7%	8.9%	0.0%
Wa Islamic Snr. High Sch,	100.0%	80.7%	45.6%	20.4%
Lassia Tuolu Snr. High Sch.	94.1%	81.8%	86.8%	62.0%
Queen Of Peace Snr High Sch	98.5%	77.9%	98.3%	79.3%
Tumu Snr High Tech Sch.	100.0%	96.2%	63.2%	18.8%
Wa Snr High Tech. Sch.	96.7%	38.3%	22.4%	2.3%
Average	**98.1%**	**70.6%**	**54.2%**	**30.5%**

Table 4.4 presents a comparison of WASSCE percentage pass (PP) and the number that qualified to go into tertiary institutions (QTI) I Ghana. According to the WASSCE standards, a student that scores grades from A1-E8 has passed but for qualification into any tertiary institution in Ghana, a student must score grades between A1-C6. From Table 4.4 therefore, while Eremon Senior High

Technical School had a WASSCE pass rates of 98.3% and 8.9% for 2013 and 2015 respectively, the percentage qualified to enter tertiary institution was 48.7% and 0.0% for 2013 and 2015 respectively. Also Wa Islamic Senior High School got WASSCE pass rates of 100% and 45.6% for 2013 and 2015 respectively but those that got tertiary institution qualification were 80.7% and 20.4% for 2013 and 2015 respectively. Queen of Peace Senior High School in 2013 had a WASSCE pass rate of 98.5% and 98.3% in 2015 but out of this, 77.9% and 79.3% for 2013 and 2015 respectively obtained between grades A1-C6 in biology in. Significantly, Queen of Peace Senior High School seems to have improved the quality of the students' grades though there was a relative drop in the overall performance of the students in biology for the two years. In all the average WASSCE pass rates for all the selected schools in 2013 and 2015 were 98.1% and 54.2% respectively whiles those that qualified to enter tertiary institution was 70.6% and 30.5% for 2013 and 2015 respectively with a regional qualified variance of -27.5% and -23.7% for 2013 and 2015 respectively.

Table 4.5: Years of Teaching Experience of Biology in the Selected School

Years of Teaching Experience	Frequency	Percentage (%)
1-3yrs	2	16.7
4-6yrs	7	58.3
7-10yrs	2	16.7
11 and above	1	8.3
Total	**12**	**100.0**

Table 4.5, seven teachers (58.3%) taught biology between 4 to 6yrs in their respective schools while 16.7%of the respondent taught in the school between

7-10 years and a similar number had taught for 3 years or less. This implies that 83.3% (representing10 out of the 12 teachers) may have gained some level of experience from the long years of teaching of biology. They have also been in their respective schools since the inception of the SRC Project III.

Table 4.6: Entry Behavior of Students in the Selected Schools

Grades	Frequency	Percentage (%)
11-20	4	33.3
21-30	6	50.0
31-40	2	16.7
Total	**12**	**100.0**

This part was to determine the entry behavior of the students admitted into the respective schools to study biology. From Table 4.7, 6 out of the 12 respondents (50%) said that most students are admitted with aggregate between 21-30 whiles 33.3% and 16.7%, representing 4 and 2 respondents respectively said the students entered the schools with aggregates 11-20 and 31-40 respectively. No respondent from any of the schools said students come into the school with an aggregate of between 6-10. This implies that in most of these schools, students' entry behavior is average and therefore is likely to have an effect on their performance in biology.

Tables 4.7: Average size of Biology Classes in Selected Schools

Average Class Size	Frequency	Percent
20-30	1	8.3
41-50	2	16.7
51 and above	9	75.0
Total	**12**	**100.0**

This section was to find out the class size of biology classes in the selected schools and compare that with nationally accepted class size for science lessons. In Table 4.7, as many as 9 respondents (75%) said their average class size was 51and above whiles 8.3% and 16.7% representing only1 and 2 teacher(s) respectively said their class size was between 20-30 and 41-50 respectively. No respondent had the class size between 31-30. The average class size of above 50 students is far above the national figure of 30 students in a class at the second cycle level. The matter becomes worse when the class is a science class. With such alarming figure it hinders the organization of demonstration and practical activities which are characteristics of science classes.

Table 4.8: Teacher's Familiarity with the SRC Project in their respective schools

Teacher's Familiarity	Frequency	Percentage (%)
Yes	11	91.7
No	1	8.3
Total	**12**	**100.0**

Item 6 on the questionnaire sought to find out the familiarity of teachers with the SCR project in their schools. Out of the 12 teacher respondent, 11 of them representing (91.7%) said they were familiar with the project and only 1(8.3%) responded No as shown in Table 4.8 above.

Table 4.9: Mode of SRC Training Teachers' Participation in the SRC Training

Training	Frequency	Percentage (%)
Participated	8	66.7
Did not Participate	4	33.3
Total	**12**	**100.0**

The aim of this part was to find out whether teachers were trained as part of the implementation of the SRC project. From Table 4.9, eight teachers (66.7%) out of the 12 teachers said they participated in the training component and 4 teachers out of the 12 (33.3%) said they did not participate in the training component of the SRC project.

Table 4.10: Mode of the SRC Training for Teachers

Form Trained	Frequency	Percent
Trainers of trainer	8	66.7
School based in-service training	3	25.0
Not at all	1	8.3
Total	**12**	**100.0**

Item 6 (iii) sought to identify the number of teachers in each study school who were trained by the ITEC team, and to further find out whether these trainer of trainers did organize any in-service training for their colleague teachers in their respective schools. From Table 4.10, 8 out the 12 teachers (66.7%) were involved in the trainer of trainers program while 3 teachers 25% received some form of SRC in-service training from their colleagues and just 8.3% never got

any form of training in connection with the SRC project. Subsequently, 11 teachers (91.7%) were trained, thus, laying the foundation for the project.

Table 4.11: Use of Equipment and Materials at the Science Resource Centre s for teaching Biology

Use of Equipment	Frequency	Percentage (%)
Yes	12	100.0

The importance of this Part is to ascertain the use of equipment and materials at the SRCs by teachers in the selected schools. From Table 4.11, all 12 teachers (representing 100% of the respondents) said "Yes," implying that they use the materials.

Table 4.12: Use of Some Equipment/Materials and the Extend of Usage by Teachers

	Usage		Extent		
Equipment	**Yes**	**No**	**Greater extent**	**Lesser extent**	**Not used at all**
1. Projector and screen	10	2	4	6	2
2. Microscope	12	0	9	3	0
3.DigitalMicroscope	3	9	1	2	9
4. Digital clinical 5. Thermometer	6	6	0	6	5
6. Stethoscope	7	5	2	5	5
7. Potometer	6	6	0	4	8
8. Sensors	2	10	0	2	10
9. Lung volume bag/ kit	2	10	1	1	10

This item sought to find out the extent of usage of some Science Resource Centre equipment and materials. From Table 4.12, 100% of the respondents (all 12 teachers) used microscopes in their teaching to a greater extent (75% of the respondents) while 25% (3 teachers) used the same equipment to "lesser

Extend" with nobody not using it at all. Again 83.3% of the respondents 9 teachers used Projector and Screen and 16.7% (2 teachers) said No. Out of this 33.3%, 50%, and 16.7% of the respondents 4, 6 and 2 teachers reportedly used the items to a "greater extend", lesser extend" and "Not all" respectively. At the same time, 7 teachers (58.3% of the respondents) used stethoscopes and 5 teachers did not use it and out of this, 1 and 5 respondent(s) use it to a Greater extend and lesser extend respectively and 6 teachers did not use it all. 6 teachers (50% of the respondents) each use digital clinical thermometer and photometer and the other 50% did not use the items at all. 7 teachers used the digital clinical thermometer to lesser extend while 5 teachers did not use it at all. No teacher used it to a greater extend. In the case of Potometre, 50% of the respondents said they used the item to less extend and the other 50% did not use the item at all. On the other hand, digital microscope, sensors and lung volume bag/kit each scores 75% (9 teachers), 83.3% (10 teachers) and 83.3% (10 teachers) of the respondents respectively who said they did not use each item while 3 (25%), 2 (16.7%), and 2 (16.7%) teachers used the items respectively. The extent of usage on the digital microscope was 1(8.3%), 2 (16.7%) and 9 (83.3%) teachers saying they used it to a; "greater extent", "lesser extent" and "Not used at all" respectively. Also 2 teachers (16.7%) said they used the sensors to lesser extent and a hooping 10 teachers (83.3%) did not use the item at all. Again, 83.3% of the respondents (10 teachers) did not use the lung volume bag/ kid in any way while 8.3% of the respondents each (1 teacher) use the item to a greater extent and lesser extent.

Table 4.13: Biology Teachers' Perception of the equipment/materials at the Science Resource Centres (SRCs)

Perception	Frequency	Percentage
User Friendliness	12	100.0

This part sought to find out how user-friendly the equipment and materials at the SRCs have been. From Table 4.13, 100% (12 teachers) of the respondent said "Yes', implying that the equipment and materials at the SRC have been user-friendly. This further implied that according to the teachers' responses, the students use the materials and equipment with ease and limited challenges.

Table 4.14: Impact of SRC Project III on Students Performance in Biology.

Impact on performance	Frequency	Percentage (%)
Impact on performance	12	100.0

All 12 teachers representing 100% said the project has improved students' performance by responding yes to the item. However a comparison of the 2013 and 2015 biology WASSCE results as shown in Table 4.1 and Table 4.3 indicates otherwise.

Table 4.15: Influence of the SRC project III on Students' Attitude towards Biology Practical

Students' Attitude	Frequency	Percent
Develop interest towards biology Practical	12	100.0

This item sought to find out the influence of the project on students' attitude towards practical in biology. From Table 4.15, all 12 teachers, representing 100% of respondents said the project has influenced the students' attitude positively towards biology practical.

Table 4.16: Impact of SRC Training on Teachers' Mode of Teaching

Training and Teaching Mode	Frequency	Percentage (%)
Influenced my teaching mode	8	66.7
No influenced on my Teaching mode	4	33.3
Total	**12**	**100.0**

Item 14 on the questionnaire instrument sought information on whether the SRC training teachers had received improved their mode of teaching biology. From Table 4.16, 8 teachers, representing 66.7% think the training they had received as part of the SRC project III had improved their teaching mode and 4 teacher representing 33.3% of the respondents said, "No", the training had not improved their teaching mode.

Table 4.17: Impact of SRC Project III Training on Students' Approach to Learning

		Response			
S/N	**ITEM**	**SA**	**A**	**D**	**SD**
1	Moved students on and away fr to rote learning	7	3	1	1
2	Moved students from following instructions into questioning	2	8	1	1
3	Moved students into designing, planning and carrying out experiments	2	10	0	0
4	Moved students into recording and analyzing data	3	9	0	0
5	Moved students to evaluate results	2	10	0	0

Item 15a (a sub-item under item 15) was used to evaluate the objectives stated in the training manual. From Table 4.17, 7 teachers (58.3%) strongly agreed that the training had helped them to move students "on and away from rote learning" while 3 teachers (25% of the respondents) agreed and 1 teacher each (8.3% of the respondents) disagreed and strongly disagreed that the training had helped them to move students "on and away from rote learning". This finding goes a long way to develop scientific culture in students and facilitate meaningful learn of the subject (biology).

Item 15b is aimed at evaluating the goal of the training component of the programme in Table 4.9 pg 53. Referring to Table 4.17, 66.6% of the respondents (8 teachers) agreed that the training had helped them to move students "from following instructions into questioning" while 16.7%, 8.3% and 8.3% of the respondents strongly agreed, disagreed and strongly disagreed respectively. This means a scientific culture is being built in the students.

Item 15c is intended to also evaluate the objective of the training. From Table 4.17, 75% of the respondents (9 teachers) agreed that the training had helped them to move students "into recording and analyzing data" and 3 teachers (representing 25%) strongly agreed to that. This would help students to develop high level scientific thinking skill thus, leading to the ability to synthesize information. This has the potential of improving students' performance in biology.

In Table 4.18, 83.3% of the respondents (10 teachers) agreed that the training had as part of the SRC Project III helped them to move students "into evaluating results" and 2 teachers (16.7%) strongly agreed to the same

statement. Evaluating results is a high level scientific skill and thus students' ability to evaluate results will enhance their scientific culture and further enhance their performance in biology.

4.2 Discussion of the Results

The discussion of the results is based on the research questions:

4.2.1 To what extent has the SRCP III equipment and materials impacted on students' performance in biology in the selected SHS in the upper West Region?

One of the objectives of the study was to find out whether there would be any difference between students' performance in biology before the SRC project III and three years after its implementation. In order to find out the students' performance in biology, students' WASSCE results in biology before SRC package in 2013 and that of the first beneficiary of the SRC Project III package who wrote in 2015, were compared. Findings from the study show that the students' performance in biology has not improved even with arrival and use of the SRC project III equipment and materials and this is supported by the findings of Neji, Amba, Ukwetang, Nja and Cecilia (2014), Woods and Jeffrey (1997) which revealed that adequacy of laboratory facilities does not significantly contribute to the variance in students' academic performance in Chemistry. It is also consistent with the findings of Mangan, Hurd and Adnett (2007) in which they intimated that the total level of school resources is not closely related to students' performance.

The drop in performances of students in biology in SRC beneficiary schools after receiving and using the project equipment and materials has not reflected much of what is suggested by the literature on use of the science resources and students' performance though it agreed with some few literature.

Results in this study showed that, none of the 6 beneficiary schools investigated had their results in biology improved, implying that the before intervention results in 2013 was better than the after intervention results in 2015 in all the beneficiary schools where the study was conducted. This is supported by Neji, Amba, Ukwetang, Nja and Cecilia (2014) and Woods and Jeffrey (1997) who reported from their studies that adequacy of laboratory facilities does not necessarily contribute to the variance in students' academic performance in Chemistry. This gives the evidence that the SRC equipment and materials would not necessarily improve students' performance in biology. The drop in performance after the provision of SRC materials and equipment could be as a result of lack of laboratories, teachers' competencies in the use of these new equipment and materials, large class size and lack of laboratory technicians to manage the SRCs as established in this study as some challenges in these schools.

The study found additionally, that whiles schools obtained very good percentage passes in biology in WASSCE, only a few of those candidates (less than half of them) who qualified to enter tertiary institution for biology related programmes even with the intervention of the SRC Project III. This suggests that, the SRC project III has not been up to expectation after three years of its implementation in the region. The unusual drop in performance of students in

biology after implementation of the project does not support the response of teachers in this study (Table 4.14 and Table 4.15). The data indicated that teachers in the beneficiary schools admitted that SRC Project III has really improved on students' performance in biology in all the schools where the study was conducted.

4.2.2 What problems are encountered by biology teachers in the use of Science Resource Centre Project III equipment and materials in the teaching of biology in the selected SHSs?

Researches question two;

To what extent do biology teachers use Science Resource Centre (SRC) Project III equipment/materials in the teaching of biology in beneficiary schools?

This question focused on the extent to which biology teachers in schools with SRC project use science resource materials. From the data, the teachers used some equipment and materials more than others. This selective use of equipment and materials by teachers is consistent with the findings of Chinwe and Chilee (2014) which revealed that less expensive materials were utilized to a greater extend while some expensive biology laboratory material resources were utilized to a lesser extent. It implies that the modern equipment and materials such as the digital microscope and sensors which are IT based and may generate interest and facilitate understanding of science concepts are not adequately and effectively utilized. Teachers' inability to use some equipment/materials depends on factors such as inadequate knowledge in their use, teaching style adopted by teachers, teacher's unwillingness to accept change, teacher's quality and professional experience. The use of these

equipment/materials facilitates critical thinking and understanding in learners. Nwike and Onyejegbu (2015) and Olagunju and Abiona (2008) found that there was a remarkable difference in the achievement scores of students taught with various instructional materials and those not exposed to the use of instructional materials.

4.2.3 What problems are encountered by biology teachers in the use of Science Resource Centre Project III equipment and materials in teaching biology in the selected SHSs?

Research question three,

What problems are encountered by biology teachers in the use of Science Resource Centre Project III equipment and materials in teaching biology?

The teachers' responses to items 7 and 11 on the questionnaire were used to answer this question. Also observations by the researcher on his visit to the schools and interactions with some teachers in the schools were equally used to answer the question.

Responses to item 7; "How are you handling the project materials/equipment in your school?" With exception of one school where 2 teachers said the school had well-structured laboratory and equipment/materials kept and managed by laboratory technicians, the remaining 10 teachers from 5 of the selected schools gave responses such as:

"They are kept in boxes and carefully used"

"No laboratory for biology so managing equipment is a problem"

"No proper storage facilities", and

"No place to keep equipment and materials hence they were still in their boxes."

From the above responses, most of the schools had no laboratories to store and use SRC Project III equipment and materials though the basic requirement for a school to benefit from the project was to have laboratory for all the elective science subjects (biology, chemistry and physics). The absence of laboratory in these schools impeded the effective utilization of the equipment and materials.

To item 11 respondents were required to list the challenges in using these equipment and materials. These challenges were;

1. Teacher factors
    i. Many of the teachers in these schools lacked laboratory technician who would assist in the use and maintenance of the laboratory
    ii. Competition in the use of projector/screen among teachers.
    iii. Teachers' inadequate knowledge in information and communication technology (ICT) to use software and materials.
2. Physical facilities/ infrastructural deficiencies.
    i. Limited space for chemistry and physics hence equipment and items are still kept intact in their boxes.
    ii. Inadequate space to keep the equipment and materials in schools with the laboratories.
3. Lack of support from school authorities
    i. Headmasters or Headmistresses were to replace or buy consumables that were exhausted. This was a major challenge that affected the running of the SRC Project III.

The finding of lack of well-structured laboratories is supported by Kriek and Grayson (2009) who reported that learners in South Africa are performing poorly in science due to the nonexistence of science laboratories. This problem affects the implementation of SRC projects III in some and subsequently negatively affects the performance of students in any of the science subjects including biology.

Challenges in the use of software and models in the SRC Project III package was also identified due to teachers' inadequate knowledge in (ICT), This is also supported by Umeh (2006) who is of the view that audio-visual aids such as television, computers and projectors are not utilized in schools due to lack of knowledge on the proper use of such resources for teaching.

Large class size also challenged the use of SRC Project III equipment and materials. Imogie (2010) attributed the problem of poor resource utilization by science teachers to increase in students' enrolment into the science subjects (especially biology) which makes the available resources to be grossly insufficient for any meaningful activity-based learning in the science. In this study almost all the selected schools had a class size been more than 30 students which is the nationally for SHSs in Ghana.

Other findings in this study were that biology teachers' lack of skills/competencies to use the resources, hindered practical work. Also heavy teaching loads, lack of laboratories and technicians to man the laboratories, unwillingness of headmasters or headmistresses to replace exhausted consumables and large class size were the main factors hindering the use of equipment and materials in science resource centres, in biology teaching. This

has been supported by Bajah (1986) who reported a significant relationship between teachers, facilities and schools' academic performance in secondary schools in Nigeria. Hofstein and Lunetta (2008) stated that school laboratory has been given a central and distinctive role in science education, and science educators have suggested that rich benefits in learning accrue from using laboratory activities. This is further supported by Kriek and Grayson (2009) who reported that South African learners are performing poorly in science due to the nonexistence of science laboratories. This implies that laboratories with qualified technicians are crucial for a successful science programme.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS, RECOMMENDATIONS AND SUGGESTIONS FOR FURTHER RESEARCH

5.0 Overview

The chapter covers the summary of major findings and conclusions of the study. Also, the chapter presents some recommendations and suggestions for further studies;

5.1 Summary of key findings

The study sought to assess the impact of science resource centre project III on the performance of students in biology in some selected beneficiary schools in the Upper West Region. Science resource centres are an important component in the teaching and learning of biology for both academic success and practical application of concepts in life. The study used the descriptive survey design which sought to evaluate the impact of SRC Project III on students' performance in Biology. It further employed the mixed methods where both quantitative and qualitative instruments were used to collect data on both students and teachers.

- The study found that the Science Resource Centre Project III has not improved students' performance in biology in spite of the claim by biology teachers that they have used the equipment/materials and that the SRC project III had influenced the attitude of students towards biology practicals.

- Also the study revealed that, the quality of grades obtained by students in (2015) was poorer than those obtained by the students in 2013. The pass rates of students in biology, was better in 2013 as well as qualifications into the tertiary institutions.
- The study further showed that biology teachers used more of Science Resource Centre Project III equipment and materials that were more familiar to them.
- Additionally the study identified challenges of biology teachers in implementing the project as follows:
  i) lack of or insufficient skills and competencies required for using the resources for practical work,
  ii) lack of laboratories in most schools
  iii) absence of laboratory technicians in schools with SRCs
  iv) heavy teaching loads on the teachers
  v) unwillingness of headmasters/headmistresses in replacing exhausted consumables and
  vi) Large class sizes in most schools.

5.2 Conclusions

Generally, it can be concluded that the mere provision of Science Resource Centre Project III does not necessarily improve on students' performance in biology. The availability of SRCs does not mean they are effectively utilized to improve students' performance in biology. Other factors act in concert with the availability of SRCs. For science resource project equipment and materials to be effectively used to improve students' performance in biology and any other

science subjects, all other factors that influence academic performance in students have to be considered.

The findings of the study suggest that the mere provision of the SRC project and its components does not necessarily improve on students' performance in biology and the other science subjects. Other factors such as teachers' response to innovation, teachers' competencies in the use of the equipment and materials, teachers' experience, school environment, availability of well-structured laboratories with a qualified technician, and class sizes all influence the students' performance in the subject.

5.3 Recommendations

Based on the findings and conclusions drawn from the study, the researcher recommended the following:

1. Laboratories should be provided and with qualified laboratory technicians to man these laboratories to augment and improve implementation of the SRC Project III
2. Heads of schools should replenish exhausted stocks, especially consumables to prevent a complete breakdown of the SRCs
3. The authorities of SRC beneficiary schools should organize workshops on the use of ICT component of the SRC project for all science teachers to enable them use effectively the equipment and materials for the benefits of their students.

5.4 Suggestions for Further Studies

The following suggestions were made for further research with respect to the impact of science resource centre project III on students' performance.

1. More studies be conducted to find out the influence of teachers academic qualification and area of specialization on the performance of students in biology.
2. Again, a study be conducted to determine any differences between students' performances in schools with SRC Project III and those schools without the SRC project.
3. A study be conducted in all parts of the country in order to ascertain the actual impact of Science Resource Centre Project III on students' performance in all the other science subjects.

REFERENCES

Abrahams, I., & Millar, R., (2008). Does practical work actually work? A study of the effectiveness of practical work as a teaching method in science schools. *International Journal of Science Education, 3* (2), 9-12.

Adedji, S. O., & Owoeye, J. S. (2000). *The effect of interaction of location, facilities and class-size on academic achievement of secondary school students in Ekiti State.* Nigeria: An unpublished Ph.D thesis, University of Ibadan.

Adeogun, A. & Osifila G. I. (2008). *Relationship between educational resources and students' academic performance in Lagos state, Nigeria*. Department of Educational Administration, Faculty of Education, University of Lagos Akoka.

Agboala, J. A. (1984). *Activities for developing Critical thinking skills.* Published paper, Department of Education, Ahmadu Bello University, Zaire.

Akinsolu. A, O. (2011). Resource Utilization and Internal Efficiency in Nigerian Secondary Schools. A case Study of South West Nigeria Secondary Schools; implications for Social Problems of Education. *International Journal of Sociology and Anthropology, 4* (1), 23-30.

Akinwumigu, J. A., & Orimoloye, P. S. (1986). *Accountability in public examinations. In A. Dada (Ed.), Mass failure in public examination: Causes and problems*. Ibadan: Heinemann Educational Books (Nig) Ltd.

Anderson, R. D. (2007). Inquiry as an organizing theme for science education. In S. K. Abell and N. G. Lederman (Eds), *Handbook of Research on Science Education* (pp. 807–830). Mahwah, NJ: Erlbaum.

Bajah, S. T. (1986). *Implementation of the new SSC Chemistry Curriculum*. Keynote Address presented at the STAN, National Chemistry Workshop, Enugu, April 27, May 2nd.

Balogun, T. A. (1982). Improvisation of Science Teaching Equipment. *Journal of Science Teachers Association, 20* (2) 72-76.

Barrett, A., Clegg, J., Ali, S., Hinostroza, J., Lowe, J., Nikel, J., Novell, M., Oduro, G., Pillay, & Beare, K. (2012). *Computer use in the ESL Class*. Retrieved June, 20, 2016, from www.about.com/snf.htm

Beatty, J.W. & Woolnough, B.E. (1982). Practical Work in 11–13 Science: the context, type and aims of current practice, British *Educational Research Journal, 8,* 23–30.

Berg, S. (2010). *Low quality education as a poverty trap.* Retrieved August, 5, 2016, from https://www.andover.edu//low-Quality

Chenwe, N., & Chilee, G. (2014). Biology Laboratory Material Resources Utilisation in Colleges of Education: Implications for Curriculun Delivery in Nigerian Secondary Schools. *Global Journal for Reasearch Analysis, 3* (4). Retrieved July, 14, 2016, from http://stemstates.org/assets/files/217_Bioliogy%20lab%20resources.pdf

Creswell, J. W., & Tashakkori, A. (2007). Developing publishable mixed methods manuscripts. *Journal of Mixed Methods. Research, 1,* 107-111.

Darkwa, O. & Owerri, W. (2000). *Role of multipurpose community telecentres in accelerating national development in Ghana*. Retrieved September, 3, 2015, from www.peer.accc.uic.edu/ojs/index.php/fm/article/view/722/631/

Doucette, W. (1999). *School library programme: a handbook for school administrator*. Retrieved June, 22, 2016, from http://www.upei.ca/~fac_ed/projects/handbook/program.htm Retrieved on 22/6/16

Eminah, J. K. (2007). The evolution of science education in Ghana. *Maiduguri Journal for Historical Studies, 5* (2), 55-73.

Eshiet, I. (1987). Remedy for students poor performance .In science involvement of local scientific experience in curriculum Implementation to motivate learning. *Journal of the STAN 125* (2),19-23.

Friedman, T. (2005). *ICT in Education in developing countries: challenges and solutions*. Retrieved December, 29, 2015 from http://koreafundman.wordpress.com/2010/08/18/ict-in-education-in-developing

Gall, M. D. (2009). *Educational research: an introduction*. 2nd ed. New York: Long man.

Gamoran, A. (1992). The variable effects of high school tracking. *American Sociological Review*. 57: 812-824.

Gemma, M., Carey, J., Levaãiç, R., Armstrong, V., Alejandra, C., & Castle, F. (2007). *The interactive whiteboards, pedagogy and pupil performance evaluation: an evaluation of the schools whiteboard expansion (SWE) project: London challenge*. Retrieved June, 11, 2016, from http://eprints.ioe.ac.uk/22066/1/Moss2007whiteboardsRR816.pdf

Ghana News Agency (GNA) (2012). *Cape Coast metropolis gets a science resource center for basic school*. Retrieved July 14. 2015, from www.ghananewsagency.org/politics

Ghana Statistical Service (GSS) (2010), 2010 *Population and housing census National Analytical Report*. Accra: Ghana.

Gott, R., & Duggan, S. (1995). *Investigative work in the science curriculum*. Buckingham: Open University Press.

Greene, J. C., Caracelli, V. J., & Graham, W. F. (1989) "Toward a conceptual framework for mixed-method evaluation designs". *Educational Evaluation and Policy Analysis,* 11 (3), 255-274.

Gyamera, E. K. (2006). *An update on the science resource centres in Ghana.* Accra: Ghana.

Hofstein, A., & Lunetta , P. (2008). *Learning in and from science laboratories: Enhancing students' meta-cognition and argumentation skills*. Retrieved July, 17, 2016, from http://ro.ecu.edu.au/cgi/viewcontent.cgi?article=1494&context=theses

Imogie, A. I. (2010). *A new paradigm for teacher preparation in the 21st century Nigeria. .a paper presentation at the annual national conference organized by the Institute of Education*, University of Nigeria, Nsukka.

Jatau, A. A. & Jatau, S. Y. (2008). *Identification of level of utilization of STEM curriculum instructional resources among science teachers in Pankshin: proceedings of the 49th. Annual STAN Conference*.46-51.

Joppe, M. (2000). The Research Process. Retrieved July 16, 2016, from http://www.ryerson.ca/~mjoppe/rp.htm.

Kibirige, I., & Hodi, T. (2013). Learners' performance in physical sciences using laboratory investigation. *International Journal of Education Science, 5* (4):425-432.

Kriek, J., & Grayson, D. (2009). *A holistic professional development model for South African physical science teachers*, vol 29: 185- 203.

Krueger, R. A. (1988). *Focus Groups: A practical guide for applied research*. Newbury Park, CA: Sage.

Leedy, P. D., & Ormond, J. E. (2005). *Practical Research: planning and designing. 8th ed*. N. J. Prentice Hall, Upper Saddle River.

Loertscher, D. (2000). *Taxonomies of the school library media program*. *2nd ed*. Salt Lake City: Hi Willow Research & Publishing.

Mangan, J., Hurd, S., & Adnett N. (2005). Are secondary schools spending enough on books? *British Educational Research Journal, 31* (2) 239-255.

Manqele, C. M. (2012). *An investigation of the role of learners and teachers resource materials in determining a school performance and quality education: a case study of Isiphosemvelo Secondary School*. Retrieved July, 16, 2016 from http://uir.unisa.ac.za/handle/10500/9909

Millar, R. (2004, June 34). The role of practical work in the teaching and learning of science. Retrieved July 3, 2016, from: http://www7.nationalacademies.org/bose/Millar_draftpaper_Jun_04.pdf.

Millar, R. (2008). *The role of practical work in the teaching and learning of science. paper prepared for the committee: High School science laboratories*. *role and vision*, National Academy of Sciences, Washington DC. York: University of York.

Miller, B. (2016). *Official conversation concerning the operations of science resource centres.*

Ministry of Education (M. O. E) (2010). *Teaching syllabus for elective biology (Senior High Schools)*. Accra, Ghana: CRDD.

Ministry.of.Education (M.O.E) (2010). *Education sector performance Report 2010.* Retrieved September, 5, 2015, from www.idpfoundation.org/Ghana MOD performance Report 2010.pdfon

MOE, S. S. S. Division (2002). *Chapter two: second cycle education-Ministry of Education*. Retrieved June, 5, 2015, from www.moe.gov.gh/assets/media/docs/Education sector review-3 and 6.

Mokgehle, M. & Guardian, M. (2012). *Annual national teachers'awards.*

Mudulia, A. (2012). The telationship between availability of teaching/learning resources and performance in Secondary School science subjects in Eldoret Municipality, Kenya. *Journal of Emerging Trends in Educational Research and Policy Studies (JETERAPs), 3* (4):530-536.

National Academy of Sciences (1997). *Science for all Americans*. New York, USA: Oxford University Press.

Neji, R., Amba, H., Ukwetang, Nja, J. O. & Cecilia, O. (2014). Evaluating adequacy of laboratory facilities and its impact on students' performance. *International Organization of Scientific Research, 4* (3) 45-78.

Ngman-wara, E.D.N (2005). *Introduction to integrated science teaching*. Winneba: University of Education.

Nweki, S. & Onyegyegbu R., (2013). *Classroom management in contest orchestrating positive learning environment".* Boston, Toronto: Houghton Mifflin Company.

Obemeata, J. O. (1995). *Education: an unprofitable industry in Nigeria.* a postgraduate school Interdisciplinary research discourse, at the faculty of Education, University of Ibadan.

Office for Standards in Education (Ofsted) (2010). *Science in secondary schools*. London: HMI/Ofsted. Retrieved June, 14, 2016 from http://live.ofsted.gov.uk/publications/annualreport

Olagunju, A. M., & Abiona, O. F. (2008): Production and utilization of resources in biology education. a case study of south west Nigerian school. *International Journal of African and African American Studies, 2* (2) 23-40.

Onyeji, J. N. (2013). Status of instructional readiness for integrated science teaching in the universal basic education era. *Journal of Science and Technical Education for Sustainable Universal Basic Education in Nigeria*, *1* (1) 170-172.

Owoeye, J. S. & Yara, O. P. (2010). *Factors impacting science achievement.* Retrieved June, 14, 2016, From http://www.uky.edu/~kdbrad2/Letao.pdf

Owolabi, T., & Oginni, I. (2012). Improvisation of science equipment. *Universal Journal of Education and General Studies, 1* (3):44-48.

Perry, E. (2015). *Developing practical work in Ghana: the Ghana science resource centres.* Retrieved , June, 13, 2016, from https://www4.shu.ac.uk/research/cse/news

Science Resource Centre Project III Traning Manuals (2012). *Biology: science resource training manual developed by ITEC*.

Seymour, E., & Hewitt, N. M. (1994). *Talking about leaving. factors contributing to high attrition rates among science, mathematics, and engineering undergraduate majors: final report to the Alfred P. Sloan Foundation on an ethnographic inquiry at seven institutions*. Boulder, Colo.: University of Colorado. Retrieved June, 16, 2016, from *http://unesdoc.unesco.org/images/0014/001448/144858eb.pdf*

Sofeme, R. J., & Andy N. M. (2012). *Relationship between learning resources and student's academic achievement in science subjects in Taraba State Senior Secondary Schools*. Retrieved June 14, 2016, from http://libraries.sta.uwi.edu/journals/ojs

Swain, B. S., Monk, R., & Johnson H. (1998). *Practical work in science: a report and proposal for a strategic framework*. Retrieved June, 7, 2016 from http://www.score-education.org/media/3668/report.pdf

Umeh, M. O. (2006). *Availability and use of human and material resources in the teaching of ecology and genetics in biology education in Senior Secondary Schools in Anambra State. Proceedings of Annual STAN Conference*. 128-13. .

Wellington, J. (1998). *Practical work in school science. which way now?* London: Routledge.

Williams, D., Wavell, C. and Coles L., (2001) The *impact of the school library resource centre on learning. Aberdeen: the Robert Gordon University for resource the council for museums, archives and libraries*. Retrieved August, 4, 2015 from http://www.resources.gov.uk

Wise, K. C., & Okey, J. R. (1983). A mata-analysis of the effects of various science teaching strategies on achievement. *Journal of Research in Science Teaching Vol. 20* (5) 419-435.

Woods, P., & Jeffrey, B. (1997). The relevance of creative teaching: pupils' views in: Pollard, A., Thiessen, D. and Fiker, a. (eds) *Children and their curriculum: the perspectives of primary and elementary children*. Pp. 24-44. London Falmer.

Woolnough, B. E., & Allsop, D. N. (2005). *Effective Science Teaching.* Buckingham*:* Open University Press.

APPENDICES

UNIVERSITY OF EDUCATION, WINNEBA

DEPARTMENT OF SCIENCE EDUCATION

QUESTIONAIRE FOR TEACHERS

Dear Respondent,

I am undertaking a study on: **"Assessing the Impact of Science Resource Centre Project III on Students' Performance in Biology in some Selected Senior High Schools in the Upper West Region"**. The study is for academic purposes only. You will be contributing to its success if you answer the items as frankly and honestly as possible. Your responses will be kept confidential. Kindly read through each of the items carefully and indicate your opinion on the issue raised.

Thank you for your cooperation and assistance.

NAME OF SCHOOL……

General Instruction

Please indicate your response by ticking [√] the appropriate bracket or column and fill in the blank spaces where applicable.

SECTION A: BIODATA OF RESPONDENT

1. Gender Male [ ] Female [ ]

2. Which subject do you teach in this school? Biology [ ] Chemistry [ ] Physics [ ] Integrated Science [ ]

3. How long have you taught the subject in the school 1-3yrs [ ] 4-6yrs [ ] 7-10yrs 11 and above

4. What is the entry behavior of your science students? Most of them are admitted with grades between; 6-10 [ ] 11-20 [ ] 21-30 [ ] 31-40 [ ]

5. What is the average size of the class(es) you teach 20-30 [ ] 31-40 [ ] 41-50 [ ] 51 and above [ ]

SECTION B: TRAINING AND MANAGEMENT INFORMATION

1. I) Are you familiar with the Science Resource Centre (SRC) Project in your school? Yes [ ] No [ ]
   II) Did you participate in any training component of the Science Resource Centre (SRC) Project? Yes [ ] No [ ]
   III) If yes in which way did you participate in the training? Through;
   Trainers of trainer [ ] School based in-service training [ ]

7. How are you handling the project materials and equipment in your school?
……
……
……
……

SECTION C: UTILISATION AND CHALLENGES IN THE USE OF SRC PROJECT III EQUIPMENT/MATERIALS

8) I) Do you **use** the materials/equipment in the Science Resource Centre for teaching your lessons? Yes [ ] No [ ]

II) If **YES** in **8(I)** above, which of the following materials/equipment have you used? Indicate by ticking **(√)**

EQUIPMENT	**RESPONSE**
a. Projector and screen	
b. Microscope	
c. Digital microscope	
d. Digital clinical thermometer	
e. Stethoscope	
f. Potometer	
g. Sensors	
h. Lung volume bag/kit	

9) To what extend do you use the materials/equipment indicated in **6(ii)** above? To a:

EQUIPMENT	Great Extend (GE)	Lesser Extend (LM)	Not Used at all (NUA)
a. Projector and screen			
b. Microscope			
c. Digital microscope			
d. Digital clinical thermometer			
e. Stethoscope			
f. Potometer			
g. Sensors			
h. Lung volume bag kit			
g. Lung volume bag kit			

10. Are these equipment and materials at the Science Resource Centre (SRC) user friendly? Yes [ ] No [ ]

11. What challenges do you encounter in the use of materials/equipment in the Science Resource Centre (SRC)? Indicate by listing them.

……
……
……
……
……

SECTION D: EVALUATION

12 Do you think the Science Resource Centre (SRC) Project III has really improved students' performance in biology in your school? Yes [ ] No [ ].

Explain your answer

……
……

13. Do you think the training you received has improved on your mode of teaching? Yes [ ] No [ ]. Explain your answer

……

……

……

14. Has the SRC Project III influenced your students' attitude positively towards practical? Yes [ ] No [ ]. Explain your answer

……

……

15. In the table below, respond by ticking the appropriate response column

KEY: **SA-Strongly Agree A-Agree D-Disagree SD-Strongly Disagree**

SRC Project III has helped me to move students;

STATEMENT	SA	A	D	SD
a. On and away from rote learning				
b. From following instructions into questioning				
c. Into designing, planning and carrying out experiments				
d. Into recording and analyzing data				
e. Evaluating results				

UNIVERSITY OF EDUCATION, WINNEBA
DEPARTMENT OF INTEGRATED SCIENCE EDUCATION
P. O. BOX 25, WINNEBA - TEL. NO. 0432 - 20108

August 4, 2016.

Dear Sir/Madam,

LETTER OF INTRODUCTION
MR. KPEMUONYE ALBAN KAMINGEN NUBAZUNG

Mr. Kpemuonye Alban Kamingen Nubazung is a post graduate student of the University of Education, Winneba in the Department of Science Education. He is currently working on "ASSESSING THE IMPACT OF SCIENCE RESOURCE CENTRE PROJECT III ON STUDENTS PERFORMANCE IN BIOLOGY IN SOME SELECTED SENIOR HIGH SCHOOLS.

I am a supervisor to Mr. Kpemuonye and I should be grateful if you could assist him with information relevant to his topic. The essence of the study is to provide us with information that sometimes characterise the success or otherwise of such intervention in science education which may help the authorities to address possible weaknesses of such interventions.

The information you will provide will be treated with outmost confidentiality. The name of your institution will not feature in the final report of the research. The student will also furnish you with a summary of his findings.

Yours faithfully,

Ernest Immaare D Ngman-Wara (PhD)

E-mail address: immaare@yahoo.com;
Cell phone: +233244150836

UNIVERSITY OF EDUCATION, WINNEBA
DEPARTMENT OF SCIENCE EDUCATION
P. O. BOX 25, WINNEBA TEL. NO. 0202041079
Website: www.uew.edu.gh Email: science@uew.edu.gh

Our Ref:

Your Ref:

Date: July 20, 2016

TO WHOM IT MAY CONCERN

Dear Sir/Madam,

LETTER OF INTRODUCTION
KPEMUONYE, ALBAN KANINGEN N. (STUDENT INDEX NO. 7140130030)

We write to introduce the above student who is an M.Ed student of the Department of Science Education at the University of Education, Winneba. Please, he has requested for an introductory letter to enable him conduct a research on *"Assessing the Impact of Science Resource Centre (SRC) Project on the Performance of Students in Biology in some Selected Senior High Schools"* at your outfit.

We should be grateful if you could grant him the required assistance.

Thank you for your cooperation.

Yours faithfully,

VICTOR ANTWI (Ph.D)
AG. Head of Department