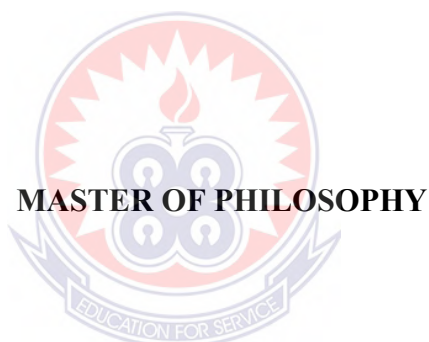


**UNIVERSITY OF EDUCATION, WINNEBA**

**THE IMPACT OF IMPROVISED INSTRUCTIONAL MATERIALS ON  
STUDENTS' ACADEMIC ACHIEVEMENT IN BIOLOGY IN THE CAPE  
COAST METROPOLITAN AREA**

**FAMOUS AMENU**



**2023**

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**FAMOUS AMENU**

**(202142385)**



A Dissertation in the Department of Science Education,  
Faculty of Science Education,  
Submitted to the School of

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

**APRIL, 2023**

## DECLARATION

### STUDENT'S DECLARATION

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

**SIGNATURE:** \_\_\_\_\_

**DATE:** \_\_\_\_\_



### SUPERVISOR'S DECLARATION

I, Dr. Yeboah Kwaku Opoku hereby declare that, the preparation and presentation of this M. Phil Thesis was supervised in accordance with the guidelines on supervision of dissertation as laid down by the School of Graduate Studies, University of Education, Winneba.

**SIGNATURE:** \_\_\_\_\_

**DATE:** \_\_\_\_\_

## DEDICATIONS

This thesis is dedicated to my beloved children, Perez Delase Amenu, Elikem Elolo Amenu and Seyram Ami Amenu.



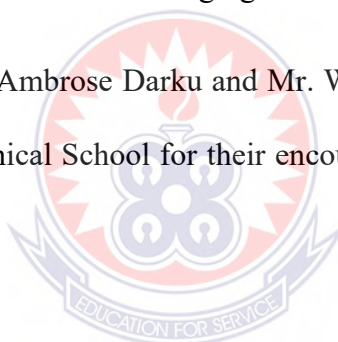
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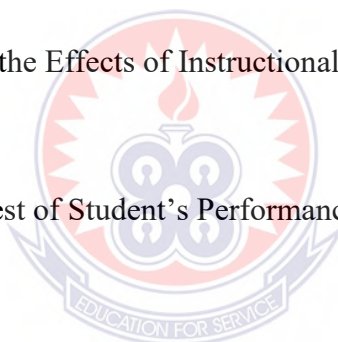
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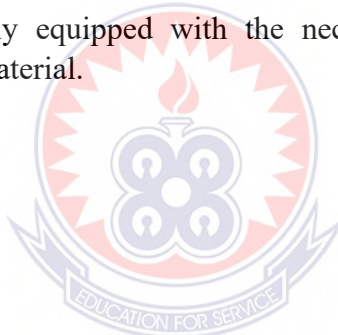
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## ABSTRACT

This study aimed to investigate the impact of improvised instructional materials on the performance of senior high school students in biology. A sequential-exploratory mixed-method research design was employed, and data from four senior high schools were conveniently selected from the Cape Coast Metropolitan Area. The sample consisted of 136 students and 16 biology teachers. Tests, questionnaires, and focused group interviews were used to collect data for analysis. The study sought to answer three research questions: (1) What are the views of teachers and students about the extent to which improvised instructional materials affect students' achievement in biology? (2) what challenges do biology teachers face in improvising instructional materials? and (3) what is the impact of improvised instructional materials on student achievement in biology? SPSS software was used to organize the data into frequencies, means and charts. The findings showed that improvised instructional materials are a key factor that promotes academic achievement in biology. However, biology teachers face several challenges, including monetary problems, lack of motivation, and lack of knowledge and skills in improvisation. The study also revealed that improvised instructional materials had a significant positive impact on students' learning outcomes ( $p$ -value = 0.00). Overall, the study highlights the importance of improvised instructional materials in enhancing students' academic achievement in biology, and the need for biology teachers to be adequately equipped with the necessary knowledge and skills to improvise instructional material.



## CHAPTER ONE

### INTRODUCTION

#### 1.0 Overview

This introductory chapter presents information on the background to the study, the statement of the problem and the purpose of the study. Also, in this chapter are the objectives that this study sought to achieve and the research questions that guided the conduct of this study. Finally, the chapter discussed the scope, limitations and the significance of this study.

#### 1.1 Background to the Study

Biology is one of the science subjects that senior high school students offer at the senior high level in the Ghanaian schools. Ahmed (2011) reported that Biology is a very important science subject and a requirement for further learning of several science-related professional courses like medicine, agriculture, botany, etc. In contemporary Ghana, great emphasis is placed on science and technological development. Today, Biology pervades literally every field of human endeavour and plays a fundamental role in educational advancement. However, the issue remains that in most secondary schools in Ghana, there is high rate of failure in the subject (Eminah, 2009).

The National Policy on Education (GES, 2007) emphasizes the need for teaching and learning of science processes and principles. The policy recommends practical, exploratory and experimental methods of teaching Biology. In this regard, Opoku-Asare (2014) stated that the basic tools that science uses in the learning of science processes are the instructional materials. Studies have shown that the use of instructional materials have improved students' achievement in biology significantly

(Tamakloe, Amedahe & Atta, 2015; Fianu, 2013). Instructional materials are wide varieties of equipment and materials used for teaching and learning by teachers to stimulate self-activity on the part of the students. The teaching of Biology without instructional materials may invariably result in poor academic achievement (Nwagbo, 2009). This suggests that the mastery of Biology concepts might not be fully achieved without the use of instructional resources.

Azure (2014) observed that there is lack of adequate and appropriate instructional resources for effective teaching of Biology in Ghanaian schools. In a study conducted by Ibitoye and Fape (2007), the poor achievement in Biology was traced to unavailability of instructional resources for Biology teaching and learning, poor state of infrastructure facilities, large class size, poor teaching, use of faulty assessment practice, and inadequacy of quality teachers. According to Okebukola (2014), the poor state of laboratory facilities and the inadequacy of instructional materials has constituted a cog in the wheel of students' achievement in Biology in the senior high school examination. The verbal exposition does not promote skill acquisition, objectivity, and critical thinking abilities that will enable the child to function effectively in the society (Eminah, 2009). The teaching of Biology cannot be done effectively without interaction between the teacher, students and the teaching resources. The biology curriculum is planned to enable the teacher use activity oriented and child-centred approach (guided inquiry) to teach (Nzewi & Nwosu, 2009). However, evidence from research has shown that instructional materials, resources and equipment for science, especially Biology, are either in short supply or are completely lacking in schools to the extent that teachers end up with verbal exposition of scientific principles, facts and concepts (Wasagu, 2011). This has been a major source of concern to school administrators, parents and the government at large. Hence, there is the need for further

research to explore other means to teach Biology in a practical manner amidst the lack or absence of instructional materials. It is therefore considered worthwhile to investigate the impact of improvised instructional materials on senior high school students' achievements in Biology; hence this study.

## **1.2 Statement of the Problem**

Despite the significant advances in technology and pedagogy, many students still struggle to comprehend and retain biology concepts. The utilization of improvised instructional materials affected the academic achievement of students at this educational level, Salawu and Ibrahim (2021). There are potential benefits or drawbacks of using improvised instructional materials in the context of biology education for senior high school students

Educational institutions frequently encounter resource shortages, forcing teachers to use improvisation as a backup method of supplying teaching resources, Onubogu and Obaji (2020). Traditional teaching methods, such as lectures and textbooks, may not be sufficient to engage and motivate students and enhance their understanding of complex biology topics. Teaching learning materials (TLMs) are very important in teaching and learning. However due to challenges, most schools do not have the necessary TLMs. It is therefore important to improvise in resource scarce schools. Therefore, there is a need to explore alternative teaching methods, such as improvised instructional materials, that can enhance student achievement in biology. While some researches have been conducted on the use of improvised instructional materials in other subject areas, there is a gap in the literature on their impact on students' achievement in biology. This thesis aims to investigate the impact of improvised instructional materials on student achievement in biology by examining their effect on comprehension, engagement, retention, critical thinking, and differentiation. By addressing this research

gap, this thesis can contribute to the development of effective teaching strategies in biology education and improve student achievement in this critical subject area.

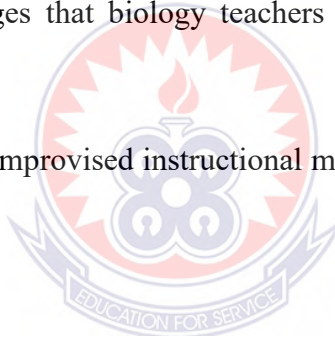
### **1.3 Purpose of the Study**

The purpose of this study was to investigate the impact of improvised instructional materials on students' academic achievement in biology in the Cape Coast Metropolis.

### **1.4 Objectives of the Study**

The objectives of this study were to:

1. Explore the views of teachers and students about the extent to which improvised instructional material affect student performance in biology.
2. Examine the challenges that biology teachers face in improvising instructional materials.
3. Assess the impact of improvised instructional materials on student achievement in biology.



### **1.5 Research Questions**

The under listed research questions guided the conduct of this study.

1. What are the views of teachers and students about the extent to which improvised instructional materials affect students' performance in biology?
2. What challenges do biology teachers face in improvising instructional materials?
3. What is the impact of improvised instructional materials on student achievement in biology?

## 1.6 Significance of the Study

This study is significant for the following reasons:

1. Findings from this study will contribute to the existing body of knowledge by providing evidence-based insights into the impact of improvised instructional materials on student achievement therefore will inform future research and educational practice
2. The findings will also have a practical implication for teachers, schools, and educational policymakers.
3. The study can explore the creative and innovative use of improvised instructional materials, which can be beneficial for teachers looking for new ways to engage students and improve their learning outcomes.
4. The study can provide insights into the effectiveness of such materials, which can help schools and teachers to make informed decisions about resource allocation.

## 1.7 Operational Definitions

**Instructional Material:** Instruction materials are those materials used by a teacher to simplify their teaching. They include both visual and audio-visual aids and could either be concrete or non-concrete. These instructional materials bring life to learning by stimulating students to learn.

**Improvised Instruction:** Improvised instructional materials are teaching materials designed and produced from available local materials in order to promote effective teaching and learning in schools.



**Instructional strategy:** Instructional strategies are techniques teachers use to help students become independent, strategic learners. These strategies become learning strategies when students independently select the appropriate ones and use them effectively to accomplish tasks or meet goals.

**Achievement:** Achievement represents performance outcomes that indicate the extent to which a person has accomplished specific goals that were the focus of activities in instructional environments, specifically in a test.

### **1.8 Delimitations of the Study**

This study focused only on deprived public senior high schools in the Cape Coast Metropolis.

### **1.9 Limitations of the Study**

The following factors limited this study:

Test anxiety on the part of the students could affect their scores on the tests.

Random sampling was not used. This may limit the generalisability of this study.

### **1.10 Organisation of the Study**

The study is organised into five (5) chapters. The first chapter outlined the background to the study, the statement of the problem, the research objectives, and questions. The chapter also presented the significance of the study, operational definition of terms as well as the delimitations and limitation encountered in the study. The second chapter presents the review of literature related to the study.

Chapter three discusses the research methodology that was used in the study. The fourth chapter includes findings and discussions. Chapter five encompasses the summary, the conclusions that were drawn and the recommendations made thereof.

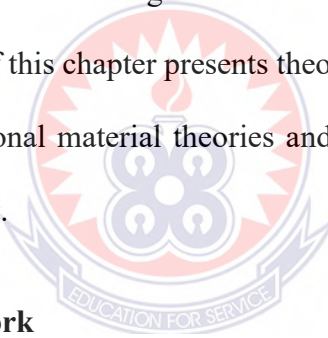


## CHAPTER TWO

### LITERATURE REVIEW

#### 2.0 Overview

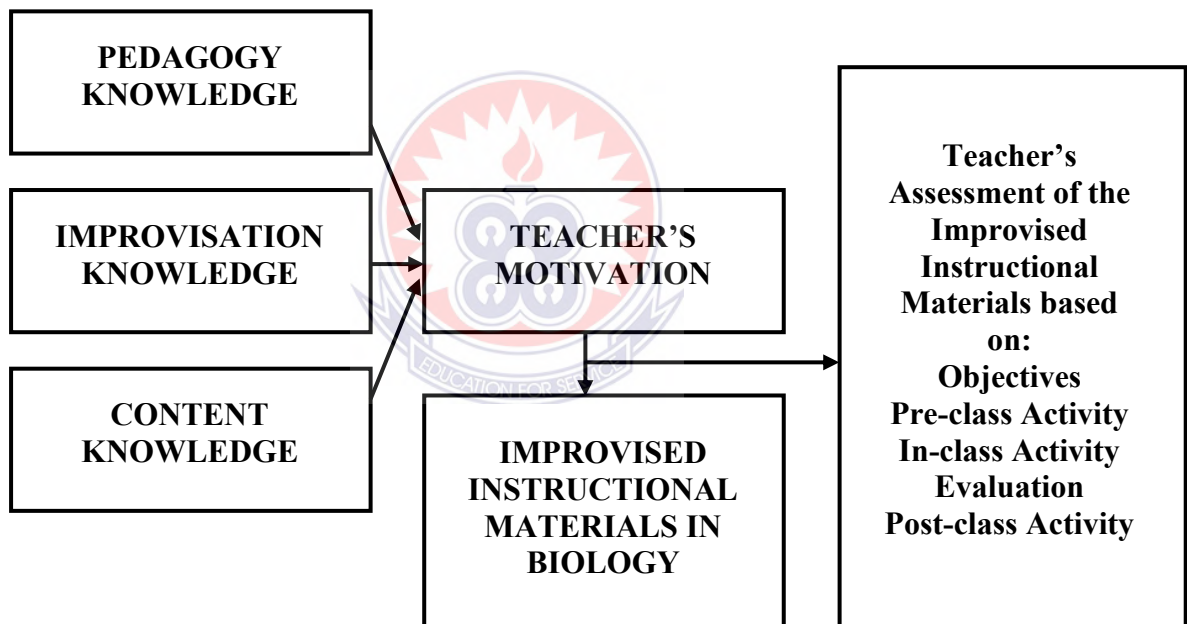
This chapter presents the related literature for this study. Section one of this chapter dwells on the conceptual framework, developed to support this study. The subsequent portion presents the related and empirical literature that orbits-around the objectives framed in chapter one of this study. These include: the extent to which instructional facilities affect student performance; the challenges that teachers in community secondary schools face in accessing instructional materials; and the strategies that teachers use to minimize the challenges of attaining and using quality instructional materials. The final part of this chapter presents theoretical framework. This is focused on two theories: Instructional material theories and sociocultural theory of teaching, learning, and development.



#### 2.1 Conceptual Framework

The importance of resources to effective teaching and learning of biology cannot be over emphasized. Resources when appropriately utilized in teaching and learning of biology makes learning more concrete, real, immediate and permanent (Shamija, 2015). The teaching and learning of biology involving students' interaction with resources will no doubt enhance student acquisition of much desired process skills of self-reliance which most nations of the world including Ghana are yearning for. In spite of the immense importance of biology resources to effective teaching and learning of the subject, many researchers (Adejoh & Ityokyaa, 2019; Johnson & Obeng, 2018; Taiwo, 2018;) found that essential resources for teaching and learning of science (biology inclusive) are inadequately provided in schools. Resources are indispensable in the

teaching and learning of biology. The biology teacher is the central figure in the use of resources for curriculum implementation. This being the case, biology teachers are expected to have a wide knowledge of the usage of resources available for teaching and learning of biology and the improvisation of those that are scarce. The biology teacher needs to cultivate the culture of improvisation to enhance effective teaching of biology. The biology teacher's ability to improvise unavailable instructional materials is influenced by their content and pedagogical knowledge as well as their motivation to engage in improvisation of instructional materials. Figure 1 summarises this concept.



**Figure 1: A Model for Assessing the Role of Improved Instructional Materials in Biology in Students' Academic Performance**

## 2.2 Biology Education

Biology education imparts a method of inquiry and a methodical way of processing knowledge about the physical world to learners. For this reason, biology education provides part of the groundwork for any knowledge-based effort to advance health, nutrition, family planning, environment, agriculture, and industry. Biology education has two broad purposes (CRDD, 2010). The first drive is to encourage scientific literacy among citizens on matters directly affecting their lives and the society so that they can make decisions based on information and understanding. This is essential for the sustainable development of a modern, technological society. The second purpose is to build up technological competence by equipping the future workforce with essential science-based knowledge and skills, and by preparing students for scientific disciplines in higher education and science-related careers. Given the potential benefits, the provision of quality biology education to all children will have far reaching significance on a country's development prospect.

Practical activities in biology education are regarded as one of the necessary elements to promote understanding of scientific principles. To accomplish this goal, the equipment and experiment have to be carefully selected to give students the relevant experiences that they may need. Provision of relevant equipment is necessary, but not a sufficient condition for successful biology teaching (Osei-Himah et al., 2018).

Other factors such as pre-service and in-service teacher training, technical and educational suitability of equipment, distribution, maintenance and supply of consumable instructional materials influence the quality of practical activities (Osei-Himah et al., 2018). The utilization of resources in teaching brings about fruitful learning because it stimulates students' sense as well as motivating them. Denyer (2018) in his study on instructional materials in national curriculum in the United

Kingdom reported that instructional materials, when used as a resource enable less able children to stay on task and remain motivated for longer periods.

One of the problems confronting science teachers in developing countries, like Ghana, is lack of materials for teaching and lack of money to acquire desirable materials (Osei-Himah et al., 2018). There is a general genuine problem in teaching science in developing countries and that resourceful teachers need to look for alternatives that can help them carry on with their work (Bajah, 2019; Loko, 2018). Many candidates entering the teaching field cite their love for children and their desire to make a difference as their primary motivation. As soon as they are confronted with the reality of the teaching experience and the challenge of little or no support from the primary stakeholders from whom they should expect support, they quickly forget that investing in the children is their primary motivation. A clear focus on the primary motivation for entering teaching should undoubtedly compel committed teachers to become resourceful in the midst of little or no support. Such teachers should explore all possible resources, materials and equipment that would enable them to carry on with their primary task of teaching and to create conducive learning environment for their beloved students. Students often tend to see biology as difficult to understand and its main ideas as abstract and remote from everyday life experiences (Braud, 2019). This means that more should be done to make biology friendlier and more real to them.

Despite the role of biology as a discipline in people's life in our societies, students still do not have interest in the study of biology. Probably lack of pupils' interest in biology may be as a result of biology teachers' inability and lack of interest in the improvisation of instructional materials. Research has shown that effective use of instructional materials arouses students' interest (Agwagah, 2019; Uzoegwu, 2017). It is therefore expected that in the absence of the commercially made instructional materials for the

teaching and learning of biology, teachers should improvise. Ezegbe (2019) emphasized the importance of the use of objects or materials in our environment in achieving set objectives. The importance of instructional materials in the teaching and learning process cannot be over-emphasized; hence they make teaching and learning more lively, meaningful and understandable. In support of the above fact, Uzoegwu (2017) maintained that teachers should employ instructional materials in their teaching in order to make sure that teaching is more permanent in the minds of the learners. Agwagah (2019) rightly noted that instructional materials, if used effectively can arouse interest, foster stimulation, self-activities, increase retention ability, make the subject matter relevant to life and lessen the burden of teaching.

### **2.3 Methods of Teaching Biology**

There are different pedagogical approaches to teaching biology. Each type has its pros and cons. Instructional approach, according to Ndirangu (2017) is the technique used to impart knowledge to students; it is the means by which the teacher attempts to impart the desired experience. To Kimweri (2014), instructional approach refers to the variety of ways in which a learning task is managed to facilitate the learning process.

Instructional approach was also defined by Osokoye (2014) as the strategy or plan that outlines the strategy that teachers intend to use to achieve the desirable objectives; this involves the way teachers organize and use teaching tools and material to meet teaching objectives.

The choice of a preferable instructional approach by the instructor is dependent on several factors (Ndirangu, 2017). Among these factors may be the content to be taught, the objectives which the teacher plans to achieve, the availability of teaching and learning resources and the ability and willingness of the teacher to improvise if

conventional teaching aids are not available. Evaluation and follow-up activities as well as individual learner differences are also factors to consider. Several pieces of research have been conducted to investigate the effectiveness of different instructional approaches. For instance, Asikhia (2010) found that qualification of teachers and students' environment do not influence students' performance but rather, teachers' approach to teaching influence academic performance. Findings of this research are supported by the study conducted in the USA by Haas (2012) about the impact of instructional approach on students' performance. This study examined various instructional approaches used in science subjects at A-level. The study found that instructional approach influenced students' learning to a great extent. Another study on instructional approach was carried out by Gulobia et al (2010) in Uganda. This study analyses the link between educational inputs; instructional approach and pupils' performance among grade 5 students. The findings showed that teaching and learning strategies contribute to better school performance.

Although several studies (Haas, 2012; Asikhia, 2010; Gulobia et al., 2010) supported the idea that instructional approaches influenced students' academic achievement, it is highly likely that some instructional approaches can better enhance learners' academic achievement than others. Gulobia et al. (2010) argued that instructional approaches espoused to teach biology lessons could be broadly categorised in to two; teacher-centred, which are viewed to be somewhat ineffective in the impartation of knowledge and student-centred, which are viewed as more effective in the impartation of knowledge. Below is a discussion of the two major groups and some teaching methods that can be classified under them.

A research conducted by Alice et al. (2018) examined the pedagogical skills and content knowledge of pre-service biology teachers in Ghana. The researchers found that the



pre-service teachers had good content knowledge, but lacked the necessary pedagogical skills to effectively teach biology.

“Assessment of Biology Teachers’ Classroom Practice in Ghana” by Wilhelmina et al., (2017): this study assessed the classroom practices of biology teachers in Ghana. The researchers found that most teachers used traditional methods of teaching, such as lectures and note-taking, and lacked the skills to effectively engage students in the learning process.

## **2.4 Learner Centred Instructional Approaches**

This method of teaching is student oriented. Here, the learner is vigorously engaged in the process of teaching and learning. They are allowed to do, manipulate, ask and experience. Bruner (1960) asserted that students need a rich supply of meaningful examples and manipulatives to help make ideas and relationships come to life. Some instructional approaches that are categorised under this group are discussed below.

### ***2.4.1 Question and answer***

Question and answer is defined as a method both for teaching and oral testing based on the type and use of questions. Questioning techniques are one of the basic and successful ways of stimulating students thinking and learning (Ndirangu, 2017). It is applicable to all teaching approaches and methods. This approach in learning is a highly effective way to enhance learning and retention. This approach involves asking question and providing answers, either alone or in groups, to reinforce key concepts and principles. The approach provides immediate feedback to students about their knowledge and understanding, allowing them to identify areas that need further study, encourages student engagement and participation, making learning a more enjoyable and interactive experience and also promotes critical thinking by requiring students to analyse and evaluate information and concepts.

Warren, Ogonowski & Salinger (2014) conducted a comprehensive review of the literature on questioning in education, which was published in the Harvard Educational Review in 2014. The authors analysed research on questioning from variety of disciplines, including education, psychology, linguistics, and communication studies, and identified several key themes and findings. The authors Warren et al. (2014) argued that well-designed questions can promote the kind of thinking that leads to deeper understanding, critical thinking, and knowledge transfer and can help engage with material more effectively. They also noted that effective questioning requires careful planning and preparation on the part of the teacher, as well as sensitivity to the needs and abilities of individual students.

#### ***2.4.2 Discussion***

Discussion approach to instruction is an important component of any teaching or learning situation which allows students to share their ideas (Ndirangu, 2017). It can be used at the beginning of a topic to ascertain students' preconceived notion of the subject matter. Or toward the end of a subtopic by presenting the student with a new situation and asking them to explain it in terms of what they have just learned. Discussion method is a teaching and learning strategy that entails sharing and exchange of ideas, experience and opinion (Kimweri, 2014). Strengths of discussion method are; increases the depth of learners' understanding, enhances motivation and generates greater involvement of the learners, promotes leadership role skills, develops skills of organizing and presenting ideas to others in a logical form and develops a spirit of cooperation among learners. In spite of the strengths, there are also limitations of discussion method which includes; time-consuming, can be used effectively with a limited number of learners, if not well handled some extrovert learners may dominate the discussion.

### **2.4.3 Brainstorming**

Brainstorming is a popular teaching strategy used to encourage students to generate ideas, solve problems, and enhance critical thinking skills (MIE, 2014). It is a collaborative and creative process that encourages participants to come up with as many ideas as possible, without worrying about their quality or feasibility. Brainstorming can be used in a wide range of educational contexts, including classroom discussions, group projects, and research assignments.

The main objective of brainstorming is to generate a large number of ideas quickly, without being constrained by traditional thinking patterns or limitations. By encouraging students to think creatively and freely, brainstorming helps them develop their problem-solving skills and enhances their ability to work collaboratively. Brainstorming can also help students to develop their communication skills by promoting active listening and constructive feedback.

The following are some of the benefits of using brainstorming as a teaching strategy:

1. **Encourages Creative Thinking:** Brainstorming allows students to think outside the box and come up with innovative solutions to problems. This can help them develop their creativity and critical thinking skills, which are essential for success in many fields.
2. **Promotes Collaboration:** Brainstorming encourages students to work together to generate ideas and solve problems. This collaborative approach fosters a sense of teamwork and helps students develop their communication and interpersonal skills.
3. **Enhances Engagement:** Brainstorming can be an engaging and fun way to teach. By encouraging students to be active participants in the learning process, it can help to increase their motivation and interest in the subject matter.

4. **Increases Diversity of Ideas:** Brainstorming encourages students to come up with a wide range of ideas, which can help to ensure that all perspectives are considered. This can lead to more comprehensive solutions and a deeper understanding of the subject matter.

There are several different techniques that can be used to facilitate brainstorming sessions in the classroom. Some of these techniques include:

1. **Free-Form Brainstorming:** This involves asking students to write down as many ideas as they can think of on a given topic, without any restrictions or guidelines.
2. **Round-Robin Brainstorming:** This involves going around the group and allowing each person to contribute one idea at a time. This can help to ensure that everyone has an opportunity to share their ideas.
3. **Mind Mapping:** This involves creating a visual map of ideas, with the central idea in the middle and related ideas branching out from it. This can be a useful technique for organizing and categorizing ideas.
4. **Reverse Brainstorming:** This involves asking students to come up with as many bad ideas as possible, and then working to turn those bad ideas into good ones. This can help to stimulate creative thinking and encourage students to consider alternative perspectives.

In conclusion, brainstorming is an effective teaching strategy that can be used to promote creative thinking, collaboration, and engagement in the classroom. By using various brainstorming techniques, educators can encourage students to think creatively and develop their problem-solving skills. Brainstorming is a powerful tool for teaching that can help students to learn and grow in exciting new ways.

#### **2.4.4 Peer instruction**

Peer Instruction (PI) is a research-based pedagogy for teaching large introductory science courses (Fagen & Mazur, 2013). It is a method created to help make lectures more interactive and to get students intellectually engaged with what is going on. PI provides a structured environment for students to voice their idea and resolve individual misunderstandings by talking with their peer (Gok, 2012). Peer instruction is a cooperative learning technique that promotes critical thinking, problem-solving, and decision-making skills (Rao & Dicarolo, 2017). This method has the advantage of engaging the student and making the lesson more interesting to the student. It also has the tremendous importance of giving the teacher significant feedback about where the class is and what it knows.

Despite these arrays of teaching methods being advocated in literature, there is no one universally accepted method. Both learners centred and teacher centred methods of teaching are important in teaching and learning (Haas, 2012; Gulobia, Wakadala & Bategeka, 2010), and each is appropriate depending on the environment within which they are used. For teaching to be more effectively done, a combination of these methods should be employed since education has many different types of approach and context.

#### **2.5 Teacher-Centred Instructional Approach**

Teacher-centred approaches to instruction, also referred to as the traditional method of teaching, usually involves instructor-centred instruction, dominated by “chalk and talk” teaching, lecturing, note copying by learners, factual knowledge, abstract concepts, and demonstrations (Onwu & Stoffels, 2015). In a typical teacher centred science class, the educator provides a few examples or solves a few problems on the board. In some cases, the teacher performs experimental demonstrations. Learners in such classes listen to the educator and write notes, but hardly ever ask questions or make remarks (Briscoe &

Prayaga, 2014; Kang & Wallace, 2015). This mode of handling science courses may cause students not to appreciate the nature of science. For example, a report by the Organization for Economic Cooperation and Development (OECD) states that most learners at high-school level are of the view that science teaching lacks a sense of community, does not reflect their experience of the world or contemporary research, involves too much repetition, does not provide a good overview of the subject, and offers little room for discussion. Other researchers, (Freeman et al, 2014; McCarthy & Anderson, 2010) have indicated that the traditional ways of teaching science usually involve little active learning, and frequently cause learners to become disengaged and unmotivated.

The subsequent sections examine the literature on some of the traditional teaching approaches used in the teaching of biology.

### **2.5.1 Lecture**

A lecture is a traditional teaching strategy that involves a teacher or lecturer delivering information to a group of students. Lecturing is commonly used in a variety of educational settings, including higher education, secondary schools, and professional training programs. Lectures can be presented in a variety of formats, including live presentations, recorded videos, or online modules.

The lecture format typically involves the teacher or lecturer standing at the front of the classroom and presenting information to the students in a structured and organized manner. The lecture may be accompanied by visual aids such as slides or handouts, and may involve interactive elements such as questions and answers or group discussions.

Lectures are often used as a way to present complex or technical information in a clear and concise manner. They are also used to provide an overview of a particular topic, to introduce new concepts, or to provide context for further learning. Lectures can be an

effective way to deliver information to large groups of students in a relatively short amount of time.

However, lectures are not without their limitations. One of the main criticisms of lectures is that they can be passive and one-sided, with students simply sitting and listening to the teacher or lecturer. This can lead to disengagement and boredom, particularly if the lecture is lengthy or delivered in a monotone voice. Lectures can also be overwhelming, particularly for students who may struggle to process and retain large amounts of information.

Despite these limitations, there are several benefits to using lectures as a teaching strategy. These include:

1. **Efficient use of time:** Lectures can be an efficient way to deliver information to large groups of students in a relatively short amount of time. This can be particularly useful in courses where there is a large amount of material to cover.
2. **Clear and concise delivery:** Lectures are often structured and organized, with the teacher or lecturer presenting information in a clear and concise manner. This can be helpful for students who may struggle to understand complex or technical material.
3. **Provides context:** Lectures can be a useful way to provide context for further learning. By providing an overview of a particular topic, lectures can help students to understand how different concepts and ideas fit together.
4. **Accommodates different learning styles:** Lectures can be accompanied by visual aids, such as slides or handouts, which can help to accommodate different learning styles. Visual aids can be particularly helpful for students who are visual learners.

In order to make lectures more effective, there are several strategies that teachers and lecturers can use. These include:

1. Use of visual aids: Visual aids, such as slides or handouts, can help to make lectures more engaging and accessible to students. They can also help to accommodate different learning styles.
2. Interactive elements: Including interactive elements, such as questions and answers or group discussions, can help to make lectures more engaging and interactive for students.
3. Varied delivery: Varying the delivery of the lecture, such as by changing the pace or tone of voice, can help to keep students engaged and prevent boredom.
4. Accommodate different learning levels: Lecturers should take into consideration that students have different learning levels and understanding, and they should use examples, analogies, and real-life scenarios to facilitate comprehension and retention.

In conclusion, lectures are a traditional teaching strategy that can be an efficient way to deliver information to large groups of students in a relatively short amount of time. While lectures have some limitations, there are several strategies that can be used to make them more effective, including the use of visual aids, interactive elements, and varied delivery. Lectures can be an effective way to introduce new concepts, provide context, and deliver complex or technical material to students.

### **2.5.2 Presentation**

Presentation is a teaching strategy that involves delivering information or content to a group of learners through various media such as slideshows, videos, audio recordings, or live speeches. Presentations are an effective way to communicate complex ideas or



concepts to a large audience in a concise and engaging manner. They can be used in a variety of educational settings, from elementary school classrooms to professional development seminars.

Some benefits of using presentation as a teaching strategy are:

1. **Captures Attention:** A well-designed presentation can capture the attention of learners and make the content more engaging. By using visuals, videos, and other multimedia elements, presenters can create a dynamic and interactive learning experience.
2. **Simplifies Complex Information:** Presentations can help simplify complex information by breaking it down into smaller, more manageable pieces. By presenting information in an organized and easy-to-follow manner, learners can better understand and retain the information.
3. **Provides Visual Aids:** Presentations often include visual aids such as graphs, charts, and diagrams that can help learners understand the material more effectively. Visual aids can also help learners remember the information more easily.
4. **Enhances Retention:** Studies have shown that learners retain information better when it is presented in multiple formats. By incorporating visual aids, audio recordings, and live speeches, presenters can provide learners with a multi-sensory learning experience that enhances retention.
5. **Encourages Interaction:** Presentations can encourage interaction between the presenter and the audience as well as between the learners themselves. By asking questions, using polling tools, or allowing for discussion, presenters can create a more engaging and participatory learning experience.

When designing a presentation as a teaching strategy, MIE (2014) recommended the following tips:

1. **Know Your Audience:** Understanding the needs and learning styles of your audience is essential to designing an effective presentation. Consider the age, background, and level of knowledge of your audience when creating your presentation.
2. **Keep it Simple:** Avoid overwhelming your audience with too much information. Stick to the most important points and break down complex information into smaller, more digestible pieces.
3. **Use Visual Aids:** Incorporate visual aids such as images, videos, and diagrams to help illustrate your points and make the content more engaging.
4. **Practice:** Practice your presentation beforehand to ensure that you are comfortable with the content and the timing. This will help you deliver a more confident and effective presentation.
5. **Engage Your Audience:** Encourage interaction and participation from your audience by asking questions, using polling tools, or allowing for discussion. This will create a more engaging and memorable learning experience.

In conclusion, presentation is a powerful teaching strategy that can simplify complex information, provide visual aids, enhance retention, and encourage interaction. When designing a presentation, it is important to keep your audience in mind, keep it simple, use visual aids, practice, and engage your audience. By following these tips, you can create an effective and engaging presentation that will help your learners retain and apply the information you are teaching.

### **2.5.3 Seminar**

The seminar method is a teaching strategy that involves small groups of learners engaging in a discussion about a specific topic under the guidance of an expert or facilitator. The seminar method is an effective way to encourage critical thinking, active participation, and collaboration among learners. It can be used in a variety of educational settings, from high school classrooms to professional development workshops.

Some benefits of using the seminar method as a teaching strategy include:

1. **Encourages Critical Thinking:** The seminar method encourages learners to engage in critical thinking by asking questions, analyzing information, and evaluating arguments. Through this process, learners can develop their own perspectives and opinions on the topic being discussed.
2. **Promotes Active Participation:** The seminar method promotes active participation by encouraging learners to share their ideas and perspectives with the group. This can create a more engaging and interactive learning experience.
3. **Fosters Collaboration:** The seminar method fosters collaboration by encouraging learners to work together to explore and analyze a topic. This can help learners develop teamwork skills and learn from each other's perspectives and experiences.
4. **Provides Opportunities for Feedback:** The seminar method provides opportunities for learners to receive feedback from their peers and the facilitator. This can help learners refine their ideas and arguments and improve their critical thinking skills.
5. **Enhances Learning:** The seminar method can enhance learning by providing learners with a deeper understanding of the topic being discussed. Through group

discussion and analysis, learners can gain a more nuanced understanding of the topic and its relevance to their lives and work.

According to Kimweri (2014), When designing a seminar as a teaching strategy, some tips to keep in mind include:

1. **Choose an Appropriate Topic:** Choose a topic that is relevant to the learners and can be explored in depth. Make sure the topic is broad enough to allow for diverse perspectives and opinions.
2. **Provide Pre-Reading Materials:** Provide learners with pre-reading materials such as articles, case studies, or videos to prepare them for the discussion. This will ensure that all learners are on the same page and can participate fully in the seminar.
3. **Establish Ground Rules:** Establish ground rules for the seminar to ensure that all learners feel comfortable sharing their ideas and perspectives. This can include guidelines for respectful communication and active listening.
4. **Facilitate the Discussion:** Facilitate the discussion by asking open-ended questions, encouraging learners to share their ideas, and guiding the discussion to ensure that all relevant topics are covered.
5. **Provide Feedback:** Provide feedback to learners throughout the seminar to help them refine their ideas and arguments. This can include asking follow-up questions, providing additional information, or challenging learners to consider alternative perspectives.

By following these tips, you can create an engaging and effective seminar that will enhance learning and promote critical thinking among your learners.

#### **2.5.4 Demonstration**

The demonstration method is a teaching strategy that involves showing learners how to perform a task or use a tool or piece of equipment. This teaching method is particularly effective when teaching skills or procedures that require hands-on practice or observation.

The demonstration method is used in a variety of educational settings, from vocational training programs to science laboratories. Here are some benefits of using the demonstration method as a teaching strategy:

1. **Enhances Understanding:** The demonstration method can enhance understanding by providing learners with a visual and hands-on demonstration of a task or concept. This can help learners see the steps involved in a task or understand the mechanics of a tool or piece of equipment.
2. **Encourages Active Learning:** The demonstration method encourages active learning by providing learners with a hands-on experience or opportunity to observe the task being performed. This can help learners develop a deeper understanding of the task or concept being taught.
3. **Improves Retention:** The demonstration method can improve retention by providing learners with a visual and experiential memory of the task or concept being taught. This can help learners remember the steps involved in a task or the mechanics of a tool or piece of equipment.
4. **Builds Confidence:** The demonstration method can build confidence by providing learners with a clear understanding of how to perform a task or use a tool or piece of equipment. This can help learners feel more confident in their abilities and more willing to take on new challenges.

5. **Facilitates Feedback:** The demonstration method facilitates feedback by providing learners with an opportunity to ask questions and receive feedback on their performance. This can help learners refine their skills and improve their understanding of the task or concept being taught.

When designing a demonstration as a teaching strategy, here are some tips to keep in mind:

1. **Plan Ahead:** Plan the demonstration ahead of time to ensure that all necessary materials and equipment are available and that the demonstration runs smoothly.
2. **Break the Task Down:** Break the task down into steps and explain each step clearly to the learners. This can help learners understand the mechanics of the task and the order in which the steps should be performed.
3. **Use Visual Aids:** Use visual aids such as diagrams or videos to enhance the learners' understanding of the task or concept being taught.
4. **Encourage Active Participation:** Encourage learners to participate actively in the demonstration by asking questions and performing the task themselves under the guidance of the facilitator.
5. **Provide Feedback:** Provide feedback to learners throughout the demonstration to help them refine their skills and improve their understanding of the task or concept being taught.

In summary, the demonstration method is an effective teaching strategy that can enhance understanding, encourage active learning, improve retention, build confidence, and facilitate feedback among learners. When designing a demonstration, it is important to plan ahead, break the task down, use visual aids, encourage active participation, and

provide feedback. By following these tips, you can create an engaging and effective demonstration that will enhance learning and promote skill development among your learners.

## **2.6 Factors that Influence the Choice of Instructional Approach**

As a biology teacher, there are several factors that can influence the choice of an instructional method to use in teaching students. These factors can be categorized into student factors, teacher factors, and contextual factors.

### **2.6.1 Student factors:**

1. **Learning Styles:** Students have different learning styles, and as a biology teacher, it is important to consider the learning style of your students when choosing an instructional method. For example, if you have students who are visual learners, you may choose to use diagrams or videos as a teaching strategy.
2. **Prior Knowledge:** The prior knowledge of students is another important factor to consider when choosing an instructional method. If your students have little prior knowledge of the topic being taught, you may choose to use a more teacher-centered approach such as a lecture to introduce the topic.
3. **Cognitive Development:** The cognitive development level of students also plays a role in the choice of instructional method. For younger students, hands-on activities and interactive learning activities may be more appropriate, while for older students, more complex tasks and problem-based learning activities may be suitable.

### **2.6.2 Teacher Factors:**

1. **Pedagogical Content Knowledge:** The teacher's knowledge and understanding of the subject matter and the ability to select appropriate instructional methods that align with the learning objectives are crucial in effective teaching.
2. **Teaching Style:** Teachers have different teaching styles, and this can influence the choice of instructional methods. Some teachers may prefer lecture-style teaching, while others may prefer to use a more student-centered approach such as group work or project-based learning.
3. **Classroom Management:** Effective classroom management skills are essential in creating an environment that is conducive to learning. As such, the teacher's ability to manage the classroom can influence the choice of instructional methods.

### **2.6.3 Contextual Factors:**

1. **Time Constraints:** Time constraints can influence the choice of instructional methods, especially when there is a limited time to cover a topic. For example, a teacher may choose to use a lecture or demonstration method to save time.
2. **Available Resources:** The availability of resources such as equipment, technology, and teaching aids can influence the choice of instructional methods. If resources are limited, a teacher may choose to use a more traditional teaching method such as a lecture.
3. **Classroom Size:** The size of the classroom can also influence the choice of instructional methods. In a large classroom, a teacher may choose to use a lecture-style teaching method, while in a smaller classroom, more interactive methods such as group work or discussions may be more suitable.



In general, several factors can influence the choice of instructional methods used by biology teachers. These factors include student factors such as learning styles, prior knowledge, and cognitive development; teacher factors such as pedagogical content knowledge, teaching style, and classroom management; and contextual factors such as time constraints, available resources, and classroom size. Biology teachers should consider these factors when choosing instructional methods to ensure that the learning objectives are met and the students' needs are addressed.

### **2.7 Current Research into the Teaching of Biology in Ghana**

In recent years, Ghana has spent much time, money, and effort to improve the materials and curriculum for its students. These changes have come across all subject areas, and include the study of biology. Suliman (2017) described the goal of teaching biology in Ghana as a move from simply memorizing and recalling information, to applying it in different situations and contexts. The new method of teaching biology is different because it takes into account the role of the students as active participants in their learning. The role of the teacher has also changed. The teacher acts as a guide for the students, by helping them take parts of the lesson, such as individual facts and observations, and apply them to broader contexts. This process helps the teacher to connect the concepts that are difficult to understand for students, and contribute to the student' acquisition of abstract concepts that are difficult to learn through traditional teaching methods. This process promotes the learning of science through research and encourages the student to think critically. Through this process, the students can investigate, survey, explore, compare and research topics, all with the goal of both promoting area content knowledge and critical thinking skills. These higher order thinking skills lay the groundwork for students to arrive at their own understandings, through observation and reasoning skill.

In the traditional lecture style of teaching, the answers and ways to understand a concept is through the teacher as the provider of knowledge in the class. The expectations of the students in the curriculum have also changed in terms of how student knowledge is assessed. The focus for assessment and exams used to be on recalling small details and facts. Now, students are expected to be able to explain and understand the way things work, as this creates a more complete, longer-lasting knowledge of the topic. Experts in the development of new biology curriculum in Ghana have suggested that educators teaching this subject apply a learning quintet cycle (Yeboah, 2010). This cycle consists of five elements, namely: engagement, exploration, explanation, expansion, and evaluation. When a teacher teaches this process, he/she must organize the lesson into five steps. First, engagement is created through the presentation of the problem, which makes the students want to try to solve it.

Second, exploration is where the teacher gives students the materials and guidance to collect data. This step is centred on the learner, and the teacher in charge gives students sufficient guidance and suitable materials related the concept to be explored.

In the third element, explanation, the teacher directs students' thinking, so that students are asked to provide her/him with the information they have gathered and processed. This helps them to organize their understanding and develop the appropriate language necessary to describe the concept.

The expansion is the fourth approach in which the teacher promotes discussion and development of the topic among the students to broaden their understanding and apply what they have learned. The teacher also answers questions from the students.

The fifth and final stage is the evaluation stage where the teacher asks questions to students and waits for answers. Also, a student and her colleagues discuss the solutions

reached and compare and evaluate their findings with the findings of their classmates. This process of lesson creation can be applied to all subjects, but is especially relevant to the sciences, including biology, as experimentation has the benefit of allowing students to apply what they have learned to hands-on, collaborative tasks.

## **2.8 Availability of Instructional Materials and Students' Academic Performance**

One important factor that affects students' academic performance in biology, according to the literature, is the availability of learning facilities such as a biology laboratory. Laboratory is essential to the teaching of biology and the success of any science course is much dependent on the laboratory provision made for it. On the need for practical work, Osman (2017) stated that practical work is a matter of maximum importance in the learning of biology or any other natural science. In his opinion, a common error observed in biology teaching in schools is that teachers do not include enough practical works in their teaching scheme. According to him, schools do not teach biology practical until second or third term of their schooling. The reason could be the lack of laboratory facilities (Osman, 2017).

Mosha (2015), pointed out that utilisation of laboratory equipment enables learners to focus their attention on important issues and acquire practical skills in biology. In effect, acquisition of such skills is capable of helping students combat unemployment and poverty. Hence, the need for maximum use of such learning resources cannot be overemphasised.

Omari (2011) found in her study that schools with highest frequency of utilisation of these learning resources had highest mean score followed by schools with average and low frequency of utilization respectively. Nambuya (2016) also found that students who are taught with instructional materials in Nigeria perform better than students taught

without instructional materials. Similarly, Oghuvbu (2017) found that in Nigeria, instructional materials have a significant impact on academic performance in biology. He asserted that the use of instructional materials facilitates the smooth delivery of a lesson and it enhances teaching and learning. The use of instructional materials assists students to understand the concept of biology better. As a result of this students who are taught with instructional materials perform better than students taught without instructional materials (Molokomphale & Mhlauli, 2014).

## **2.9 Improvisation of Biology Resources in Senior High Schools**

It has been observed in recent times that both the rural and urban senior high schools are increasing in population and the challenge is that of acquiring adequate human and materials or facilities for effective teaching and learning of biology, which is the only science subject offered by both science and arts-based students. For teaching and learning of biology to be effective, it requires resourcing schools adequately with teaching and learning resources. These resources include microscope, meter rule, stop watch, hand lens, preserved specimen, Dissecting kits, petri dish, gas cylinder, Aquarium, school building (Laboratory), test tube, biological charts, beakers, school garden, models, measuring cylinders, filter funnel, hygrometer, wind vane, wash bottle, quadrat, reagent, weigh balance, rain gauge, thermometer, computer, photographs, anemometer, Bunsen burner and barometer, etc. The complete provision and utilization of these material resources will help make the teaching and learning of biology by the teachers and the students interesting and effective. However, researchers (Bajah, 2019; Loko, 2018) observed that there is a canker of the lack of teaching resources in senior high schools in most developing countries, Ghana inclusive. One possible solution to this problem of inadequate material resources according to Eguabor (2016) and Akinrotun (2017) is improvisation. Improvisation is the act of construction of

instructional materials from locally available materials that can adequately replace or function in place of the original material or prototype which otherwise may be very expensive or in short supply or unavailable (Eriba, 2017). Improvisation, therefore, is not just a pre-conceived on the spot activity, improvisation is a state of mind and it is a skill that lies at the heart of good biology teaching. Eriba (2017) sees improvisation as the art of using alternative materials and resource to facilitate instruction whenever there is a lack or shortage of some specific first-hand teaching aids. He says it is the art of designing a replica of something to make it function or play the role of real thing using available materials.

Improvisation is an art of identifying, developing and using suitable materials in the absence of the real one for effective teaching and learning of process, morphology and anatomy of various organs. Improvisation could mean making of instructional material or teaching aid by biology teachers where the original materials are not available or where they are available but not functional. However, it has been observed that most science teachers are not creative enough to carry out the process of improvisation (Eriba, 2017). Nwagbo (2018) asserted that most science teachers (biology inclusive) cannot improvise biology equipment and materials because they lack creativity and resourcefulness. Given the indispensability of material resources to students' acquisition of the much-desired practical skills of self-reliance which Ghana is in dreadful need of to ease unemployment and poverty level in the country, it becomes very important to look at the production and utilization of resources. The decline in performance in STME may not be unconnected with the poor learning environment created by this state of infrastructural facilities (Jerry, 2018). Mapaderum (2012) and Oni (2015) also observed that the availability of resources and adequacy of these facilities promote effective teaching and learning activities in schools while inadequacy

affect the academic performance negatively. Several attempts have been extended by teacher training institutions such as the University of Education, Winneba to train senior high school teachers on improvisation techniques in various science subjects including biology, hence there is the need to evaluate how teachers have been able to improvise materials for effective teaching and learning of biology. the use of fine graded stick as a meter rule, use of glass cup as a beaker, moulding shapes using clay, drawing of plants and animal cells using cardboard papers, the use of watch in place of stop watch, the use of stove in place of bunsen burner, the use of transparent glass container in place of aquarium, etc.

### **2.10 Need for Improvisation of Biology Resources**

In a perfect case, biology would be taught in small classes with well-equipped laboratories. In the absence of well-equipped laboratories, alternatives must be provided to facilitate practical activity in biology. The significance of practical activity in biology cannot be over emphasized, yet those materials required for the teaching and learning of biology are very much in short supply. Adebipe (2017) lamented that there is a total or partial absence or inadequacy of the science teaching resources and gross inadequate finances most especially for the purchase of science equipment, poor maintenance culture, etc. With all these challenges, it seems that the best option is the improvisation of science teaching materials in the classroom by teachers and even students, improvisation becomes imperative in a situation where there are scarce resources and facilities. The Ghanaian senior high school system today is experiencing a sharp proliferation in the population of students due to the implementation of the free senior high school policy, giving rise to greater demand for classroom and laboratory facilities and equipment with limited government resources, the teacher ingenuity to improvise becomes tasking for learning to be more effective and productive.

## **2.11 Factors Affecting Improvisation of Biology Teaching and Learning Resources**

Improvisation is an essential skill that enables biology teachers to create and adapt teaching and learning materials to meet the needs of their students. However, several factors can affect the ability of biology teachers to improvise teaching and learning materials effectively. These factors can be classified into three main categories: teacher factors, student factors, and contextual factors.

Teacher Factors:

1. **Pedagogical Content Knowledge:** Teachers' level of knowledge and understanding of the subject matter can affect their ability to improvise teaching and learning materials. Teachers with a solid understanding of the subject matter can easily improvise materials that align with the learning objectives.
2. **Creativity:** The ability to be creative and think outside the box is essential in improvising teaching and learning materials. Teachers who are creative can develop innovative and engaging materials that resonate with their students.
3. **Experience:** The level of experience of a teacher can also affect their ability to improvise teaching and learning materials. Experienced teachers have a better understanding of their students' needs and can quickly develop materials that address their needs.

Student Factors:

1. **Learning Styles:** The learning styles of students can affect the type of teaching and learning materials that a biology teacher can improvise. Teachers must consider the learning styles of their students when improvising materials to ensure that they are effective.

2. **Prior Knowledge:** The prior knowledge of students can also affect the type of materials that a biology teacher can improvise. Teachers must ensure that they develop materials that build on their students' prior knowledge.
3. **Motivation:** The level of motivation of students can also affect the type of materials that a biology teacher can improvise. Teachers must develop materials that are engaging and motivating to keep their students interested in the subject matter.

Contextual Factors:

1. **Available Resources:** The availability of resources can affect the ability of a biology teacher to improvise teaching and learning materials. Teachers who have access to a wide range of resources can develop materials that are more engaging and effective.
2. **Time Constraints:** Time constraints can also affect the ability of a biology teacher to improvise teaching and learning materials. Teachers who have limited time may need to rely on existing materials and may not have the time to develop new materials.
3. **Curriculum Requirements:** The curriculum requirements can also affect the ability of a biology teacher to improvise teaching and learning materials. Teachers must ensure that the materials they develop align with the curriculum requirements.

### **2.12 Basic Consideration in the Improvisation of Science Resource Materials**

To embark on any improvisation in the teaching and learning of biology, certain pedagogical considerations are necessary. Some of these considerations, according to Madubum (2016) includes:

- What is to be taught.



- Objectives of the lesson.
- The background knowledge of the learner.
- The durability of the improvised materials.
- The cost advantage of improvised materials.
- Individual difference of learners.
- Learning Environment.

The degree of sophistication of the improvised materials will be determined by what is to be taught and the objective of the lesson. Knowledge of the learner's academic background would provide the teacher with insight into whether the improvised materials would be appropriate to learn the task at hand or not. It is also necessary to give consideration to the durability of the improvised materials. A durable material on a long-term basis reduces cost as well as saves time and labour. Concerning the cost benefit, it may be more beneficial to acquire an already existing cheaper factory-made material than to spend time and labour to embark on the improvisation of such materials.

### ***2.12.1 Influence of improvisation on the teaching and learning of biology***

Improvisation becomes imperative in situations where there are scarce resources and facilities. According to research (Ogunleye, 2017), some influences that improvised materials would have on biology teaching and learning include but not limited to the following:

- Improvised materials provide a cognitive bridge between abstraction and reality to students.
- Improvisation saves cost.

- Improvisation undertaken by teacher enable him to think and research for cheaper, better and faster methods of making the teaching and learning process easier for students.

### **2.13 Guidelines on the Improvisation of Science Resource Materials**

It is necessary to have a guideline for biology teachers embarking on the improvisation or production of biology resources. In other words, improvised materials should possess certain qualities and these are as follows:

- Appropriateness of teaching aids to the age of the learners.
- Its clarity in illustrations and simplification of concepts.
- Its adequacy in size.
- Its relevance to the lesson they are meant for.
- It should be interesting to the learners, durable and improvisable among others.

Boulind (2017) stated that when the desirable is not available then the available becomes the alternative if it can perform the same or similar functions as the desirable.

It should be borne in mind that resource materials do not achieve any of the attributed values on their own. Their usefulness depends on what the teacher makes out of them i.e., the influence made on the students by the teacher with the materials.

### **2.14 Empirical Literature**

This section of the report provides empirical literature relevant to the study.

#### ***2.14.1 The extent to which instructional materials affect student performance***

In his study Adeogun (2020) revealed a strong positive link between instructional resources and academic performance. According to Adeogun (2020), schools that possess more instructional resources performed better than schools that have less instructional resources. This finding supported the study by Babayomi (2019) that

private schools performed better than public schools because of the availability and adequacy of teaching and learning resources. Adeogun (2020) noted that there was a low level of instructional resources available in public schools and hence commented that public schools had acute shortages of both teaching and learning resources. He further commented that effective teaching and learning cannot occur in the classroom environment if essential instructional resources are not available.

Fuller and Clark (2014) suggested that the quality of instructional processes experienced by a learner determines quality of education. In their view they suggest that quality instructional materials create in the learner quality learning experiences. Mwiria (2015) also supports that student's performance is affected by the quality and quantity of teaching and learning resources. This implies that the schools that possess adequate teaching and learning materials such as textbooks, charts, pictures, real objects for students to see, hear and experiment with, stand a better chance of performing well in examination than poorly equipped ones. A study by Chonjo (2014) on the physical facilities and teaching learning materials in Primary schools in Tanzania supports the above views. Chonjo interviewed teachers and students on the role of instructional materials on effective learning. From his study he learned that performance could be attributed to adequate teaching and learning materials and equipment that are in a school. He recommended that in order to provide quality education the availability of sufficient quality facilities is very important. Chonjo's (2014) study was one of its kinds in Tanzania which directly linked the role of physical facilities with students' academic performance in primary schools. However, Chonjo focused only on physical facilities, leaving out instructional materials. Physical facilities such as buildings including classrooms, chairs and desks are not enough to provide quality teaching and learning. Instructional materials are also necessary. The study done by Maundu (2017) agrees

with previous findings that in order for a school to have a good performance it must be well equipped with relevant and adequate text books and other teaching and learning resources.

### **2.15 Challenges that Teachers Face in Accessing Instructional Materials**

Teachers in deprived senior high schools most especially in rural community schools face several difficulties in accessing instructional materials. One of the major challenges that teachers in deprived senior high schools face in accessing instructional materials is skimpy funds provided by the government to these schools for procuring instructional materials. Rural secondary schools depend to the great extent on the government for subsidy. Very little support is received from local government and communities around the schools most especially in rural areas due to poverty. The funds are provided in form of capitation grants. The capitation grant is aimed at improving the quality of education by making sure that sufficient teaching and learning materials are provided at school level. In particular, the capitation grant is meant to finance the acquisition of textbooks and other teaching and learning materials as well as to fund repairs, administration materials, and examination expenses (Opoku, 2018). However, while the number of students who are enrolled in schools has been increasing each year, education capitation grant has been dropping. Even without adjusting for inflation, the actual amount of money reaching schools for capitation grants is clearly much less today compared to what it was in years past (Opoku, Annan & Agbesi, 2019). Opoku *et al.* (2019) asserted that the money reaching senior high schools as capitation grant is unacceptably inadequate to purchase a minimum set of textbooks apart from other instructional materials which are extremely needed by the teachers. According to Opoku (2018), government's Policy towards effectual provision of these facets of educational resources has not been reassuring and has continually not been well

planned, scrutinised, supervised and appraised with rural schools as the back bench of implication of these policies.

Another challenge that teachers face is the lack of experience and restricted accessibility to contemporary instructional facilities. Most deprived senior high schools especially in pastoral areas do not have access to information communication technology (ICT) which could ease scarcity of instructional materials. The current millennium comes with a heightened awareness of the need to use up-to-date scientific approach in teaching and learning processes in our schools. At present, there is a universal recognition of information and communication technology as a foremost driving force in the dissemination of knowledge (Aina, 2013). Many teachers who were trained in the 1990's may not have skills in the field of Information and Communication Technology. Where there are skilled teachers, other problems naturally include problem of installation, maintenance, operation, network administration and local technicians to service or repair this equipment and the other facilities. In most of the rural senior high schools, most of the facilities are non-existent, hence the traditional chalk and duster approach still dominates in senior high school pedagogy (Obasi, 2018).

Poor salary is also another challenge that teachers face. Teachers like most civil servants in Ghana are poorly paid. This becomes a hindrance for them to purchase their own teaching materials or acquisition of new ideas, skills and knowledge by failure in enrolling for further educational programmes including Information and Communication Technology (ICT). With this, the academic and intellectual capacities of teachers and learners are bound to be affected substantially during classroom interaction (Opoku, 2018). Lack of sufficient skills and creativity may hamper teachers to improvise their own instructional materials. Local governments and communities around rural senior high schools are supposed to provide resources most especially

funds to these schools so that teachers can use them to access instructional materials. But very often this is not the case due to a number of reasons. Some local communities have very narrow tax base. Also, the performance of local councils in the collection of their own revenue have been recorded very poor. Many local authorities however have found themselves unable to deal with such a rapid increase in expenditure and their budget deficit increase. Education is one of the sectors, which is mostly affected by this situation. Poverty is another reason, which may hinder members of the community in supporting teachers and schools financially so that they can access instructional materials. According to Kimego (2011), Parent and community participation differ from rural to urban communities and from one mode of economy to another. Another challenge that teachers face in accessing instructional materials is lack of clear policy and monitoring mechanisms to ensure that enough funds are provided to rural senior high schools for purchasing instructional materials and also these funds are used for the intended purpose. As Opoku (2018) comments, government's Policy towards efficient provision of these aspects of educational resources has not been encouraging and has always not been well planned, monitored, supervised and evaluated with rural schools as the back bench of implication of these policies.

### **2.16 Strategies to Minimize the Challenges of Attaining Instructional Materials**

Many strategies exist, that can be utilised to curtail the challenges of attaining and using standard instructional materials in senior high schools. According to research conducted in different parts of the world including Africa, one of the strategies is improvisation of instructional materials (Opoku, Annan & Agbesi, 2019). Eshiet (2016) stated that improvisation involves sourcing, selection and deployment of relevant instructional materials into the teaching-learning focus in the absence or shortage of standard materials for a meaningful realization of specified educational goals and

objectives. Based on studies done by Abodelraheem and Al-Rabane (2015), Ibe-Bassey (2012) and Udosen (2011) any course of study's restricted knowledge base can be expanded through the use of improvised media using low- technological materials and resource – centered learning, which can also improve instruction to a level of quality that is assured. It can also promote strategies that ensure the integration of technology in the teaching and learning of biology. The findings correlate with the findings of Dodge (2017) who observed that using technologies like simulation devices open new prospects for distinct learning tools, environmental resources and services. The use of ICT can also minimize some of the challenges in accessing instructional materials. According to UNESCO (2014), the use and swift spread of electronic communications has the capacity to affect the quality and efficiency of biology education throughout the world. The effortlessness with which teachers and students can gather information over the internet on nearly any topic has the latency to transform instructional content and pedagogical practice. Moreover, courses advanced by the best teachers in one country can be made available to students across many countries. Newer technology-based instructional strategies, incorporating the internet and the World Wide Web (WWW), can therefore be used more to expand communication and increase access to resources. Tinio (2012), points out that ICT has the potentials in increasing access and improving relevance and quality of education in developing countries. Tinio further stated the potentials of ICT as follows: ICTs greatly facilitate the acquisition and absorption of knowledge, offering developing countries unprecedented opportunities to enhance educational systems.

## 2.17 Theoretical Framework

This research was premised on two educational theories; the instructional material theory, as propounded by Gagné *et al.* (2015), and the sociocultural theory of teaching, learning and development (Vygotsky, 1978).

### 2.17.1 Instructional material theory

Instructional material theory assumes that there is a direct link between the materials that the teachers use, and students' learning outcomes. These outcomes include higher abilities to learn, quality strategies to learn and perform classroom activities and positive attitude towards learning. Further, this theory accept that instructional materials have the capacity to develop in students the highest order of intellectual skills as they illustrate clearly, step by step how to follow the rules/principles and elaborate on the concepts, all of which have positive impact on solving new problems by analysing the situation and formulating a plan (Gagné *et al.*, 2015). According to Gagne *et al.* (2015) instructional material can be used to develop higher learning abilities of the learners through self-teaching or guided learning. This suggests that the instructional materials primarily encompass “provoking performance” and “providing response on performance correctness,” in addition to “providing learning guidance” for guided discovery learning. Many of Gagné’s *et al.*’s (2015) ideas have broad implications for senior high school teachers. Many of these ideas have capacity building undertones with themes of students’ acquisition of critical thinking and problem-solving skills. However, the theory does not relate to whether or not students can think critically in what aspects or how they can solve a particular problem by themselves. Nonetheless, authorities like Vygotsky (1978), held a view that tools and signs, which are in a form of instructional materials, have the capacity to develop in students’ higher level of thinking, which is important in problem-solving activities. However, since they



are considered to be domain-specific, the ways instructional materials can start cognitive development is yet to be studied with respect to classroom teaching. Thus, this study stretches these views.

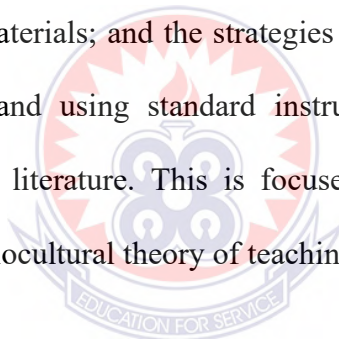
### ***2.17.2 Sociocultural theory of teaching, learning, and development***

Sociocultural theory of teaching, learning and development is the second theory that underpin this research. Largely inspired by the seminal works of Lev Vygotsky, this theory assumes that human minds do not develop by virtue of some predetermined cognitive structures that unfold as one matures. Rather, this theory posits that human's minds develop as a result of constant interactions with the social material world (Alderman, 2019; Butler, 2018). According to Vygotsky (1978), human mind develops through interaction with materials in the learning process where people learn from each other and use their experiences to successfully make sense of the materials they interact with. These experiences are preserved in 'cultural tools', and the learners have to master such tools in order to develop specific knowledge and skills in solving specific problems and, in the process, become competent in specific profession. In the classroom, these tools can be a picture, a model, or pattern of solving a problem (Butler, 2018). Learning by using such tools is not something that simply helps the mind to develop; rather, this kind of learning leads to new, more elaborated forms of mental functioning (Alderman, 2019). For example, when children master such a complex cultural tool as human language, this results not only in their ability to talk but leads to completely new levels of thinking, self-regulation and mentality in general. It is the specific organization of this tool (e.g., the semantic, pragmatic and syntactic structures of language) that calls into being and in effect shapes and forms new facets of the child's mind (Alderman, 2019). The sociocultural approach, unlike that of instructional materials by Gagne discussed above, not only allows for a synthesis of teaching,

learning, and cognitive development; it actively calls for it. This theory implies that instructional materials lead to cognitive development because they mediate learners' thinking through the tools, and such mediation constitutes the very cornerstone of mental development.

### **2.18 Summary**

This chapter presented the relevant literature for this study. The first part looked at the conceptual framework that was developed to support the study. The second part presented empirical literature that revolved around the objectives developed in chapter one. These included: the extent to which instructional facilities affect student performance; the challenges that teachers in community secondary schools face in accessing instructional materials; and the strategies that teachers use to minimize the challenges of attaining and using standard instructional materials. The last part presented the theoretical literature. This is focused on two theories: Instructional material theories and Sociocultural theory of teaching, learning, and development.



## CHAPTER THREE

### RESEARCH METHODOLOGY

#### 3.1 Overview

This chapter presents the methodology used in the study. This includes area of study, research design, selection of respondents, data collection methods, data quality control and ethical issues, and data analysis. This chapter presents the procedures and the methods the researcher employed to carry out the study. The chapter comprises the research design, study population, sampling procedures, data collecting instruments, validity and reliability of the instruments, methods of data collection and analysis.

#### 3.2 Study Area

The research was conducted in four senior high schools in the Cape Coast Metropolitan Assembly, Central Region in the Republic of Ghana (Fig. 2). The traditional name of Cape Coast 'Oguaa' originates from the Fante word 'gua' meaning market. It was named Cabo Corso by the Portuguese meaning Short Cape and later on changed to Cape Coast by the British. The Cape Coast Metropolitan Area is one of the oldest districts in Ghana. It was raised to the status of municipality in 1987 by LI 1373 and upgraded to metropolitan status in 2007 by LI 1927. Cape Coast is endowed with many schools across the length and breadth of the Metropolis, ranging from basic to tertiary institutions. This study was conducted in four senior high schools namely: Oguaa Senior High Technical School [OSTECH], Efutu Senior High Technical School [Efutu SHTS], Ghana National College [GNC], and Academy of Christ the King Senior High School [ACK SHS]. All schools had boarding facilities. These schools were chosen

because materials for the teaching and learning of biology were in acute shortage (Amoako & Boateng, 2020) and there was the need to explore alternative means.

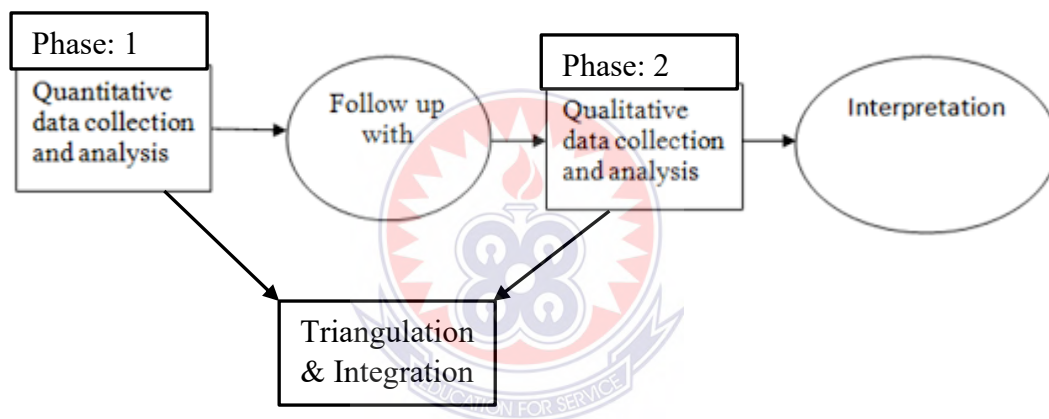


**Figure 2: Map of Cape Coast Metropolitan**

### 3.3 Research Design

Creswell (2014) holds that the research design refers to the overall strategy that the researcher chooses to integrate the different components of the study in a coherent and logical way, thereby, ensuring she/he effectively addresses the research problem. It constitutes the blueprint for the collection, and analysis of data.

This study sought to examine the effects of improvised instructional materials on the academic performance of senior high school students in biology. In effect, the study used mixed-method sequential exploratory design (Fig. 3).



**Figure 3: Mixed-Method Sequential Exploratory Design**

A mixed-method sequential exploratory design is characterised by two phases of data collection, involving an initial quantitative phase of data collection and analysis, followed by a phase of qualitative data collection and analysis (Creswell, 2014).

### 3.4 Population

A population refers to a group of individuals from which samples are taken for measurement (Creswell, 2014). For any study, the target population is all the members of a group defined by the researcher's specific interest; for him/her to answer research questions and to whom the findings of a study may be generalized. The target

population of this study comprised all the biology students and teachers in public senior high schools in the Cape Coast Metropolis. The accessible population, however, consisted of biology students and teachers in four schools, Oguaa Senior High Technical School [OSTECH], Efutu Senior High Technical School [Efutu SHTS], Ghana National College [GNC], and Academy of Christ the King Senior High School [ACK SHS]. The accessible population of the study was about 750. This includes 20 biology teachers and 730 biology students.

### **3.5 Sample and Sampling Techniques**

A sample is a subset of people, items, or events from a larger population from whom the researcher collects and analyses data to make inferences (Creswell, 2014). Sampling technique is the method used to select the sample for the study. Four public senior high schools, OSTECH, Efutu SHTS, GNC, and ACK SHS were conveniently selected to take part in the study. Purposive sampling was used to select 16 biology teachers out of 20. Four biology teachers were selected from each school. One hundred and thirty-six biology students from general science classes were conveniently selected from the four schools to form the sample of the study. Thirty-four students were selected from OSTECH; thirty-three students were selected from Efutu SHTS; thirty-two students were selected from GNC and thirty-seven students were selected from ACK SHS. Thus, in total, 152 participants formed the sample for the study (Table 1).

**Table 1: Distribution of Participants by Schools**

Participants	Frequency			
	OSTECH	Efutu SHTS	GNC	ACK SHS
<b>Students</b>	34	33	32	37
<b>Teachers</b>	4	4	4	4
<b>Total</b>	<b>38</b>	<b>37</b>	<b>36</b>	<b>41</b>

Out of the 136 biology students selected for this study, sixty-nine were females while eighty-three were males. The students were also aged between sixteen and twenty. The students were selected from general science classrooms only. For the biology teachers, ten were males while six were females. The purposive sampling was used to select teachers who had some experience in improvisation in biology and hence are knowledgeable about the subject. For the students, intact classes were selected in order not to disrupt normal lessons.

### 3.6 Research Instruments

In this study, tests, questionnaire and interview were used as the main tools for collecting data. The selections of these tools were guided by the nature of data to be collected; the time available as well as the objectives of the study.

#### 3.6.1 Tests

In this study, one of the instruments used for data collection included pre-intervention and post-intervention tests. The pre-intervention test was administered to the students before the intervention, while the post-intervention test was administered after the

intervention. The purpose of using both tests was to assess the impact of the improvised instructional materials on students' performance in Biology.

The pre-intervention test served as a baseline measure of students' understanding of Biology concepts before the intervention. It provided a means to assess the impact of the intervention by comparing the performance of the students before and after the intervention. The pre-intervention test consisted of questions that covered the key concepts and topics that the intervention aimed to improve.

The post-intervention test was administered after the intervention to evaluate the effectiveness of the improvised instructional materials. The test consisted of questions that covered the same concepts and topics as the pre-intervention test to ensure that the comparison between the pre-intervention and post-intervention scores was valid.

The use of pre-intervention and post-intervention tests as instruments for data collection in this study is a common approach in education research. It allows researchers to evaluate the effectiveness of interventions and teaching strategies in enhancing student learning outcomes. Additionally, the use of tests with similar content ensures that the comparison of the pre-intervention and post-intervention scores is valid and reliable.

### ***3.6.2 Questionnaire***

Questionnaires are thought to be appropriate in enabling a researcher gather a large amount of data from many subjects economically. Questionnaires were used since the study was concerned with variables that could not be directly observed such as views, opinions, perceptions and feelings of the respondents. Such information was best collected through questionnaires (Cohen, Manion & Morrison, 2018). According to Cohen et al. (2018), a questionnaire is a collection of written questions which are usually answered in order to obtain information from the participants. The purpose of using the questionnaire was to enable the respondents to answer questions freely as they



respond to the questionnaire forms. This instrument was necessary for this study as the respondents would have time to provide well thought answers. The questionnaire consisted of open-ended and closed items (Appendix A). These aimed at collecting information about effects of improvised instructional materials on performance of senior high school students in biology and challenges faced by biology teachers in accessing standard instructional materials. The questionnaire consisted of three sections. The first section collected demographic data relating to sex, level of academic qualification, professional qualifications, and years of teaching experience. The second section collected data on the views of teachers and students about the effect of instructional materials on students' performance in biology and the difficulties in accessing standard instructional materials. The final section collected data on the status and availability of teaching and learning materials (TLMs). The items in the questionnaire were Likert-type items. Each item contained a statement followed by five suggested options; strongly disagree (= 1), disagree (= 2), neutral (= 3), agreed (= 4) and strongly agree (= 5). The participants were required to place tick against the option that best expressed their opinion about the item.

### ***3.6.3 Interview***

This study employed the focused group discussion (FGD) (Appendix C). The focused group discussion is another type of the interview that is used in collecting data for investigations by involving around eight people who come to discuss a topic under the guidance of the interviewer. The interview questions were formulated by using the research objective as guide. The advantage of this method is that it allows those who cannot initiate discussion to contribute after observing the contribution of their fellows in the group. The method again can generate a lot of data in a shorter time than other method like the questionnaire. FGD if not well controlled, can result in chaos and lose

direction in the discussion, thus, the researcher used an assistant to help record the discussion when the discussion was on going. The researcher, thence, played a role of the mediator to control the discussion as recommended by Patton (2019).

### **3.7 Validity of the Instruments**

According to Cohen, Manion and Morrison (2018), validity can be determined by using a panel of persons who shall judge how well the instruments meet the standard. The content validity of the data collecting instruments was done by the experts in the field of biology education who proof read and provided necessary suggestions. Colleague biology teachers were further requested to rate the ability of each item in the instruments to measure and elicit anticipated data. They were also requested to indicate if the required data was meaningfully related to the stated research questions and objectives.

The validity of the instruments was further verified during a pilot study. Suggestions offered by assessors were used by the researcher to modify the instruments to make them more adaptable to the study.

### **3.8. Reliability of the Instruments**

To ensure reliability of the data collecting instruments, the first draft of the instrument was presented to a few colleagues for their opinion and suggestions on the format, content and other related issues. Their opinions and suggestions were incorporated on the final draft of the instrument. The Cronbach's alpha method of determining reliability was used to compute the reliability coefficient of the questionnaire items. A reliability coefficient ( $r$ ) of 0.92 was obtained which indicated reliable data. Creswell (2014) asserted that in research, a reliability coefficient of 0.8 or more would imply that there was a high reliable data. For the interview, it was ensured that the data collected

using the interview items were trustworthy. The trustworthiness of the interview data was ensured through credibility (where the respondents were given time after the process of data collection to review both the data collected and the researcher's interpretation of the data).

Transferability: adequate details were provided on the site, participants, and methods or procedures used to collect data during the study. This will help other researchers evaluate whether the results are applicable for other situations.

Dependability: the tools used for data collection were justified

Confirmability: the research was neutral and not influenced by the assumptions or biases of the researcher.

### **3.9 Data Collection**

Kombo and Thromp (2016) defined data collection as the process of gathering of specific information to prove or refute some facts.

Permission from the School of Graduate Studies [SGS], University of Education, Winneba was obtained. Permission from school administrative leadership for each of the four schools that participated in this study was sought to visit schools and contact teachers and students. The four schools were visited, teachers and students were informed about the study and made more arrangements for another visit. The schools under the study were re-visited and questionnaires were administered to biology teachers and general science students. Students were guided to respond to their questionnaires immediately after administration. Teachers were allowed two weeks to respond to the questionnaires administered to them. After the two weeks, another visit was made to the schools to collect the teachers' questionnaires and to organize the

focused group interview for the students to collect data to augment those provided by the students in the questionnaire.

### **3.10 Data Analysis**

Creswell (2014) explained that data analysis involves organizing what we have observed, heard and read, to make sense of the acquired knowledge. He maintained that as one does so he/she categorizes, synthesizes, searches for patterns and interprets the data collected. Cohen, Manion and Morrison (2018) defined data analysis as a systematic process involved in working with data, organizing and breaking them into manageable units. It is also concerned with synthesizing data, searching patterns, discovering what is important, what is to be learned and deciding what to tell others.

Upon successful collection of data, the quantitative data was organized systematically in frequency tables. Thereafter the data code sheet was prepared and coded in the statistical package for social sciences [SPSS] software. Data was presented in frequency tables and charts.

For the qualitative phase, the data from the recorded focused group interviews were analysed thematically. A micro interlocutor analysis was used to analyse the interview data after transcription. In this approach, responses to a common question from all interviewees were analysed together in themes (Patton, 2019).

### **3.11 Ethical Considerations**

Gray (2019) insists on the need of the researcher to observe the principle of ethics when conducting educational research. While this research intended to contribute to knowledge on the effects of improvised instructional materials on academic performance among selected senior high school students, it maintained utmost confidentiality about respondents. The researcher explained to the respondents the

importance of data to be collected. They were informed that all data in the questionnaires would be treated with confidentiality. Where necessary, clarification was made on the items of the questionnaire. The respondents were not required to indicate their names on the questionnaire and the researcher ensured that all respondents were given free will to participate and contribute voluntarily to the study. Besides, the researcher ensured that relevant authorities were consulted and permission granted. The consent of the respondents was sought before commencement of data collection.



## CHAPTER FOUR

### FINDINGS AND DISCUSSIONS

#### 4.0 Overview

This chapter presents and discusses the findings from the study. The first part discusses the demographic information of the respondents, the second part discusses findings on the views of teachers and students on the extent to which instructional facilities affect students' performance, the third part discusses findings on the challenges facing teachers in community secondary schools in accessing instructional materials, the fourth part of this chapter discusses findings on the strategies that teachers use to minimize the challenges of attaining and using quality instructional materials and finally, the effects of improvised instructional materials on students' performance was discussed.

#### 4.1 Demographic Characteristics

This section describes the general background information about the categories of respondents, students and teachers.

Out of the 136 biology students selected for this study, sixty-nine were females whiles eighty-three were males. The students were aged between sixteen and twenty years (Table 2)

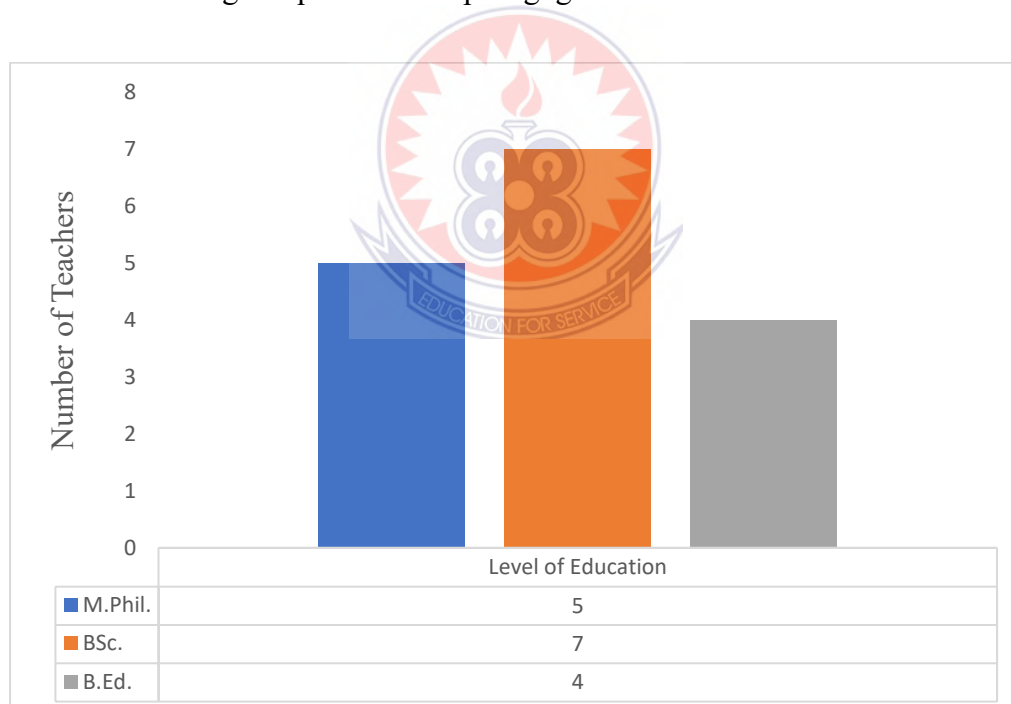
**Table 2: Distribution of Students by Age**

Age Range	Male	Female
<b>16-18</b>	53	57
<b>18-20</b>	30	12
<b>Total</b>	<b>83</b>	<b>69</b>

For the biology teachers, ten were males while six were females.

Data on the gender of teachers indicated that 10 (62.5%) were males while 6 (37.5%) were females. This showed that majority of the biology teachers included in this study were males.

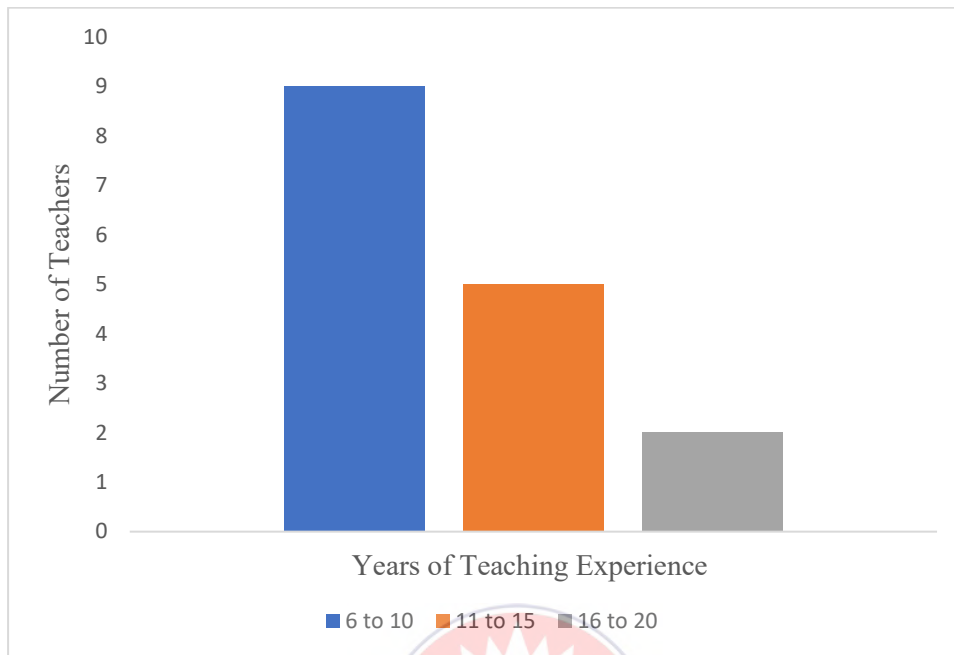
Data on the level of education of the teachers indicated that 5 (31.3%) had a Master of philosophy degree in biology education, 7 (43.8%) of them had a Bachelor's degree in biology while the rest (4; 24.9%) had Bachelor of education degrees. The data showed that all the teachers were adequately prepared as teachers by virtue of being trained in content knowledge acquisition and pedagogical skills.



**Figure 4: Distribution of Teachers by Level of Academic Qualification**

The data indicated that more than half of the teachers, (9, 56.3%) had been teaching biology for 6 to 10 years, 5 of them (31.3%) had been teaching biology for 11 to 15

years while the rest, (2, 12.4%) had 16 to 20 years of teaching experience as biology teachers (figure 5)



*Figure 5: Distribution of Teachers by Years of Teaching Experience*

#### 4.2 Research Question One

**What are the views of teachers and students about the extent to which improvised instructional materials affect students' performance in biology?**

##### *4.2.1 Common Instructional Materials Used in the Study Area*

The common instructional materials used by teachers as accounted by students in the study area are summarized in Table 3.

Table 3 shows that 34% of students reported that textbooks were used by the teachers, 23% pointed out that charts and diagrams were used, 7% indicated that teachers used computer hardware and software, 15% affirmed that models and realia were used by the teachers and 8% noted that worksheets were used as instructional materials. From the responses, it is clear that textbooks, charts, diagrams, models, and realia were the



most common instructional materials used in senior high schools in the study area. When one looks critically at these materials, they are ready made and the teachers are not required to develop them, nor buy them individually. Normally these materials are purchased by the schools. This may lead us into believing that teachers in community secondary schools do not bother to develop or create their own instructional materials, nor do they bother to ask their students to make them.

**Table 3: Common Instructional Materials Used in the Study Area**

<b>Instructional resource</b>	<b>Frequency</b>	<b>Percentage</b>
<b>Textbooks</b>	46	34
<b>Worksheets</b>	11	8
<b>Charts and Diagrams</b>	31	23
<b>Laboratory apparatuses</b>	17	13
<b>Computer hardware and software</b>	10	7
<b>Models and Realia</b>	21	15
<b>Total</b>	<b>136</b>	<b>100</b>

The findings show that 62% of the teachers in the study area affirm textbooks were very important, 75% of teachers agreed that the use of models and realia in teaching were very important for students' learning and 67% of the teacher respondents noted that the use of charts and diagrams for teaching is very important. It was interesting to find that, all the teachers agreed that instructional materials were very important or important,

except two teachers who indicated that worksheets were not important, and one teacher who noted that computer hardware and software were not important. Although this was a minor issue, it is worth mentioning.

**Table 4: Types of the Instructional Materials and Levels of Importance**

<b>Instructional resource</b>	<b>Very important</b>	<b>Important</b>	<b>Not important</b>	<b>Never important</b>
Textbooks	10(63%)	6(37%)	0	0
Worksheets	7(44%)	7(44%)	2(12%)	0
Charts and Diagrams	11(67%)	5(33%)	0	0
Laboratory apparatuses	9(56%)	7(44%)	0	0
Computer hardware and software	8(50%)	7(44%)	1(6%)	0
Models and Realia	12(75%)	4(25%)	0	0

When the teachers were asked whether the materials used in class are commercial or improvised locally; 76% pointed out that most of the materials are commercially based and 24% are locally made by the teachers (Table 5).

**Table 5: Nature of Instructional Materials Used in the Study Area**

<b>Nature of Instructional Materials</b>	<b>Frequency</b>	<b>Percentage</b>
Commercial	12	75
Improvised	4	25
<b>Total</b>	<b>16</b>	<b>100</b>

The findings from Table 5 indicated that there was very minimal use of improvised materials by the teachers which suggests creativity on improvisation of locally made materials by the teachers was low.

#### ***4.2.2 Opinions on the effectiveness of improvised instructional materials for students' performance***

The researcher wanted to explore the views of teachers and students on the extent to which instructional materials affect student performance. This question was intended to determine the reasons why the teachers used instructional materials in teaching. The findings are summarized in Tables 7 and 8 for teachers and students respectively.

On whether the instructional materials used by teachers help students in the teaching and learning process; majority of the respondents, 63% of the teachers (Table 6) and 79% (Table 7) of the students pointed out that the materials help them to improving knowledge and skills and the minority, 21% of student respondents (Table 6) and 37% (Table 7) of the teachers pointed out that the materials help them to pass examinations. These responses are in line with the literature where scholars (Osei-Himah et al., 2018; Opoku et al., 2019) asserted that there is a very strong positive significant relationship between instructional resources and academic performance. As Osei-Himah *et al.* (2018) suggested, schools endowed with more resources performed better than schools that are less endowed. The respondents in this study are in agreement with the literature. This is corroborated by the study by Nyarko and Amevi (2019) that private schools performed better than public schools because of the availability and adequacy of teaching and learning resources.

**Table 6: Teachers' Views about the Effects of Instructional Materials on Students' Performance**

Effects of Instructional Materials	Frequency	Percentage (%)
To Pass Examinations	6	37
To Improve Knowledge and Skills	10	63
<b>Total</b>	<b>16</b>	<b>100</b>

**Table 7: Students' Views about the Effects of Instructional Materials on their Performance**

Effects of Instructional Materials	Frequency	Percentage (%)
To Pass Examinations	28	21
To Improve Knowledge and Skills	108	79
<b>Total</b>	<b>136</b>	<b>100</b>

#### 4.3 Research Question Two

##### **What challenges do biology teachers face in improvising instructional materials?**

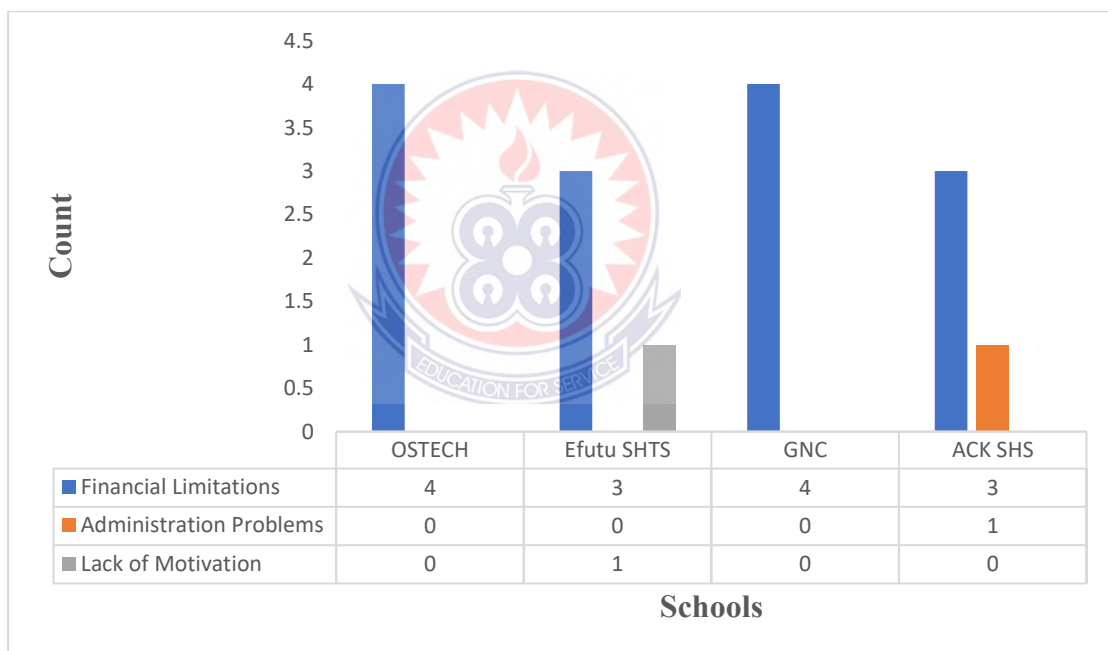
The goal of this research question was to determine challenges biology teachers face in improvising instructional materials.

##### ***4.3.1 Challenges facing teachers in improvising instructional materials***

The researcher investigated the challenges that teachers face in improvising instructional materials. This illustrates challenges faced by biology teachers in the four schools under study.

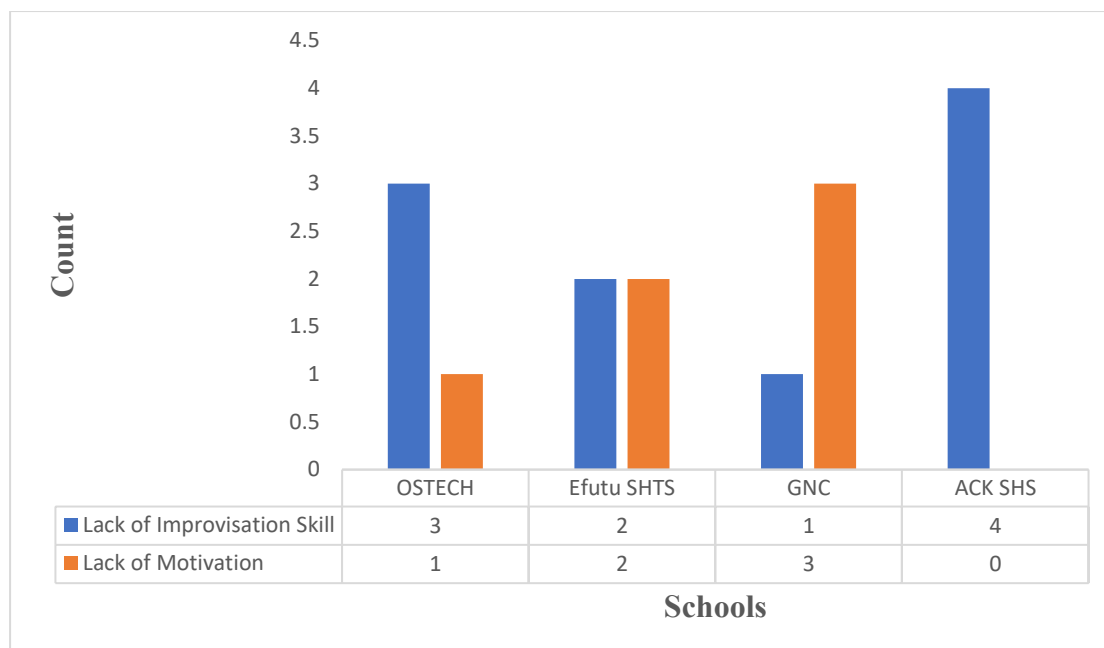
Figure 6 shows that 88% of the teachers are faced with financial problem in accessing improvised instructional materials, 6% faced with the challenge that school administrators are unwilling to readily release money for the purpose of improvising

instructional materials even though the money is available and 6% are not motivated to improvise instructional materials from locally available materials. Figure 7 shows that 38% of the teachers do not want to improvise local materials for teaching while 62% of the teachers affirmed that the access to locally made materials is hindered by their lack of improvisation skills. The results concur with the findings by Opoku (2018). Opoku found that, lack of using improvised instructional materials in senior high schools was very much related to insufficient skills and creativity among the teachers. These, Opoku opined, may hinder teachers from improvising their instructional materials.



**Figure 6: Challenges of Improvising Instructional Materials**

Figure 7 shows challenges biology teachers face in terms of improvisation skills and lack of motivation.



**Figure 7: Challenges for Accessing Locally Made Instructional Materials**

#### 4.4 Research Question Three

**What is the impact of improvised instructional materials on student achievement in biology?**

**Table 8: Dependent Sample t-Test of Student's Performance on Pre- and Post-Intervention Tests**

Statistic	Pre-intervention	Post-intervention	Effect Size
	test	test	
Observation	136	136	
df	135		
Mean	10.57	24.76	0.9
SD	4.4	21.76	
P value	0.00		

The mean score and standard deviation obtained by the students on the pre-intervention test were 10.57 and 4.4, respectively, while that for the post-intervention test was 24.76 and 21.76, respectively. The Cohen's *d* was estimated at 0.9 (Table 8).

The mean score of the students in the pre-intervention test suggests that they had a poor understanding of the biology concepts being tested. However, the post-intervention test's mean score indicates a significant improvement in their performance, suggesting that the improvised instructional materials had a positive impact on their learning outcomes. Additionally, the large standard deviation obtained in the post-intervention test could suggest that the intervention had different effects on individual students.

The Cohen's *d* value of 0.9 indicates a large effect size, which means that the intervention had a significant impact on the students' learning outcomes. It is important to note that a Cohen's *d* value of 0.9 is considered a very strong effect, and it is generally accepted that effect sizes of 0.2, 0.5, and 0.8 represent small, medium, and large effect sizes, respectively.

Furthermore, the t-test results suggest a statistically significant difference between the students' performance on the pre- and post-intervention tests in favour of the post-intervention test ( $p < 0.05$ ).

Based on these results, it can be inferred that the improvised instructional materials had a significant positive impact on the students' learning outcomes. The findings of this study could have significant implications for the teaching and learning of biology in schools. The use of improvised instructional materials could be an effective strategy for enhancing students' understanding of complex concepts, particularly in science-based subjects. Furthermore, the study's findings highlight the importance of using evidence-based teaching strategies to improve students' learning outcomes.

The use of improvised instructional materials to enhance student learning outcomes in Biology has been a topic of interest in education research. Several studies have been conducted to investigate the effectiveness of this approach. In general, the findings of this study are consistent with previous research on the topic.

For instance, a study conducted by Olowe and Adedeji (2018) in Nigeria investigated the impact of improvised instructional materials on students' academic performance in Biology. The study found that the use of improvised instructional materials significantly improved students' academic performance in Biology. Similarly, another study by Mamiro et al. (2018) in Tanzania found that the use of improvised instructional materials improved students' understanding of Biology concepts.

Moreover, a study by Dabipi et al. (2018) in Nigeria found that the use of improvised instructional materials improved students' understanding of Biology concepts and enhanced their motivation to learn. This finding is consistent with the current study, which also found a significant improvement in students' performance in Biology following the use of improvised instructional materials.

Generally, the findings of this study are consistent with previous research on the effectiveness of improvised instructional materials in enhancing student learning outcomes in Biology. The use of improvised instructional materials has been shown to be an effective teaching strategy that can significantly improve students' understanding of complex concepts in science-based subjects such as Biology. These findings suggest that teachers should consider incorporating improvised instructional materials into their teaching practices to enhance student learning outcomes.



#### 4.5 Summary

This chapter presented the data on the views of teachers and students on the extent to which improvised instructional materials affect students' performance; the challenges that biology teachers face in improvising instructional materials; and the general impact of improvised instructional materials on student achievement in biology. On the first objective, teachers and students perceived that improvised instructional materials foster good academic performance in biology. Schools which do not have access to standard instructional materials can use improvisation as an alternative. On the second objective, the data show that some of the challenges biology teachers face in improvising instructional materials include monetary problems, lack of improvisation skills, lack of motivation and administration issues. Lastly, for objective three, the use of improvised instructional materials has been shown to be an effective teaching strategy that can significantly improve students' understanding of complex concepts in science-based subjects such as Biology. These findings suggest that teachers should consider incorporating improvised instructional materials into their teaching practices to enhance student learning outcomes.

## CHAPTER FIVE

### SUMMARY, CONCLUSION AND RECOMMENDATIONS

#### 5.0 Overview

This section presents the summary of the study, conclusion and the recommendations made based on the findings of the study.

#### 5.1 Summary

The purpose of this study was to investigate the impact of improvised instructional materials on the performance of senior high school students in Biology. The independent variable in this study was the improvised instructional materials whereas the dependent variable was students' academic achievement. The researcher reviewed related literatures on the role of instructional materials for academic performance and established that there was limited research on the topic in the Cape Coast Metropolitan area. The limited research on this motivated the researcher to carry out this study. The study used mixed-method sequential exploratory design since the area under the study has been extended and the entire population could not be covered on individual basis. The research design employed enabled the researcher to be able to generalize the characteristics of the entire population because of its sample.

The target population comprised all the biology students and teachers in public senior high schools in the Cape Coast Metropolis. The accessible population, however, consisted of biology students and teachers in four schools, Oguaa SHTS, Efutu SHTS, GNC, and ACK SHS. The accessible population of the study was about 750. This included about 20 biology teachers and 730 biology students. The study used non-

probability sampling methods to select students and teachers in selected schools for the study.

The instruments which were used to collect data in this study included tests, questionnaires and interview. Questionnaires were used to collect data from students and teachers while interview and tests were used to collect data from the students only. The collected data were coded and analysed and the results were presented in condensed form in terms of tables and figures.

The findings for the research questions of this study are as follows:

The first objective of this study was to explore the views of teachers and students about the use of improvised instructional materials and the effects on students' performance. The findings revealed that teachers consider improvised instructional materials as a key factor that promote academic performance in biology. This implies that the schools with inadequate standard instructional materials can resort to improvisation to enhance performance in biology.

The second objective was to examine the challenges that biology teachers face in improvising instructional materials. The findings show biology teachers are faced with different problems, including among others; monetary problems, lack of motivation and lack of knowledge and skills in improvisation.

The third objective was to assess the impact of improvised instructional materials on student achievement in biology. The findings showed that the improvised instructional materials had a significant positive impact on the students' learning outcomes. This finding could have significant implications for the teaching and learning of biology in schools. The use of improvised instructional materials could be an effective strategy for

enhancing students' understanding of complex concepts, particularly in science-based subjects.

## 5.2 Conclusion

Based on the findings of this study, it can be concluded that improvised instructional materials have a significant positive impact on the performance of students in biology. The study has revealed that the use of improvised instructional materials promotes academic performance in biology, and this is supported by the teachers' and students' views. Furthermore, the study has highlighted the challenges that biology teachers face in improvising instructional materials, which provides valuable insights into how to improve the implementation of improvised instructional materials in the classroom.

The results of this study also demonstrate that the improvised instructional materials have a considerable impact on student achievement in biology, as evidenced by the significant increase in mean scores and standard deviation obtained by the students on the post-intervention test. The Cohen's  $d$  value of 0.9 suggests a large effect size, further confirming the significant positive impact of improvised instructional materials on student learning outcomes in biology.

In light of these findings, it can be concluded that improvised instructional materials are a crucial factor that can be leveraged to improve student performance in biology. The study's findings have important implications for biology teachers, curriculum developers, and policymakers, who can utilize this information to design and implement effective strategies to enhance the use of improvised instructional materials in the classroom. Overall, this study provides compelling evidence that justifies the importance of further exploration and implementation of improvised instructional materials in the biology classroom.

### 5.3 Recommendations for Practice

Basing on the findings from this study the following are recommended;

1. Schools in the Cape Coast Metropolitan Area should organise workshops and seminars for teachers teaching Biology to update their knowledge and skills in improvised instructional materials. This will encouraged Biology teachers improvise instructional materials to enhance student performance in biology
2. Biology teachers in the Cape Coast Metropolitan Area should be given incentives to motivate them to improvise instructional materials. Such incentives can include recognition, awards, or financial incentives to encourage them to develop and use improvised instructional materials.
3. Teachers in the Cape Coast Metropolitan Area should be supported with adequate funding to acquire the necessary materials to create improvised instructional materials, and schools should have well-equipped laboratories and classrooms to facilitate effective improvisation.
4. Curriculum developers should include improvisation as part of the biology curriculum to help students develop the necessary skills to improvise instructional materials. This will not only enhance their performance in biology but also equip them with valuable life skills that can be applied in other areas of their lives.

In summary, the findings of this study suggest that improvisation is an effective strategy for enhancing student performance in biology. Therefore, it is recommended that teachers, schools, and education authorities prioritize the development and use of improvised instructional materials in biology education.

#### **5.4 Suggestions for Further Studies**

This study investigated the role of instructional materials in improving student's performance in biology. Further research should be conducted to explore the effectiveness of different types of improvised instructional materials and their impact on student learning outcomes in biology. This will help to identify the most effective types of improvised instructional materials and provide guidance for teachers on how best to use them in the classroom.



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## APPENDICES

### APPENDIX A

#### QUESTIONNAIRE FOR BIOLOGY TEACHERS

The purpose of this questionnaire is to collect data on the effects of improvised instructional materials on the academic performance of students in biology. Be assured that the information gathered from this study will be treated with utmost confidentiality and used for academic purposes only. Do not write your name anywhere in this questionnaire. Please tick (✓) where appropriate or fill in the required information as guided.

#### Section I: Background Information

1. School name .....
2. Please indicate your sex.  
Male [ ]  
Female [ ]
3. Age  
19 – 30 [ ]  
Between 30 and 45 years [ ]  
45 years and above [ ]
4. Level of academic qualification  
Masters [ ]  
Bachelors Degree [ ]  
B.Ed. [ ]  
Diploma [ ]  
Others (Specify).....
5. Years of teaching experience  
1 – 5 [ ]  
6 – 10 [ ]  
11 – 15 [ ]  
16 – 20 [ ]  
20 and Over [ ]
6. Did you attend a professional teacher training institution?  
Yes [ ]  
No [ ]
7. How many years have you taught in your current school?



Please indicate .....

## Section II: Importance of Instructional Resources in Students' Learning

Indicate by ticking (√) how important the following instructional resources are in students' learning of biology.

Instructional resource	Very important	Important	Not important	Never important
Textbooks				
Worksheets				
Charts and Diagrams				
Laboratory apparatuses				
Computer hardware and software				
Models and Realia				

## Section III: Accessibility of Instructional Materials

- Indicate how equipped your school is in terms of resources for teaching biology.  
 Highly equipped [ ]  
 Adequately equipped [ ]  
 Fairly equipped [ ]  
 Poorly equipped [ ]
- What type of instructional materials you often use?  
 Commercial based [ ]  
 Locally made [ ]
- What is your view about the effects of instructional materials on students' performance  
 To pass examinations [ ]  
 To improve knowledge and skills [ ]

4. How equipped is your school in terms of the following resources

Resource	Excellent	Very Good	Good	Average	Poor
Textbooks					
Worksheets					
Laboratory apparatuses					
Charts and Diagrams					
Models and Realia					
Computer software and hardware					

5. What Challenges do you face in accessing;

(a) Commercial based material

.....  
 .....  
 .....  
 .....

(b) Locally made material

.....  
 .....  
 .....  
 .....

6. What strategies do you use to minimise the challenges of obtaining standard instructional resources for teaching biology?

.....  
 .....  
 .....  
 .....  
 .....  
 .....  
 .....  
 .....  
 .....



**Section IV: Views of Teachers on the Effects of Improvised Materials**

Indicate by ticking (✓) the extent to which you agree with the following statements.

Statement	Agree	Undecided	Disagree
Improvised materials sustain pupils' interest			
Improvised materials engage pupils in the learning process			
Improvised materials bring the same learning outcome as prototype			
Improvised materials motivate pupils			



**APPENDIX B****QUESTIONNAIRE FOR STUDENTS**

The purpose of this questionnaire is to collect data on the effects of improvised instructional materials on the academic performance of students in biology. Be assured that the information gathered from this study will be treated with utmost confidentiality and used for academic purposes only. Do not write your name anywhere in this questionnaire. Please tick (✓) where appropriate or fill in the required information as guided.

**Section I: Background Data**

1. Please indicate your sex

Male [ ]

Female [ ]

2. Indicate your age group

11 – 15 [ ]

16 – 20 [ ]

20 and Over [ ]

3. Your level

Form one [ ]

Form two [ ]

Form three [ ]

**Section II: Importance of Instructional Resources in Students' Learning**

Indicate by ticking (✓) how important the following instructional resources are to you in learning biology.

Instructional resource	Very important	Important	Not important	Never important
Textbooks				
Worksheets				
Charts and Diagrams				
Laboratory apparatuses				
Computer hardware and software				
Models and Realia				

1. In your opinion, how do the resources listed above influence your academic performance in biology?

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**Section III: Views of Students on the Effects of Improvised Materials**

Indicate by ticking (✓) the extent to which you agree with the following statements.

Statement	Agree	Undecided	Disagree
Improvised materials sustain my interest in biology lessons.			
Improvised materials engage me in the learning process.			
I understood what was taught with the use of improvised materials.			
Improvised materials motivate me to learn biology.			

## APPENDIX C

### INTERVIEW GUIDE FOR STUDENTS

This interview guide is designed to collect data on the effect of improvised instructional materials on students' performance in biology.

1. Is your performance in biology good?
2. What materials do teachers use in the class aside from textbooks?
3. Do you think those materials help you in the learning process?
4. Are you given chance to prepare materials for learning? e.g., Posters?
5. What challenges do you face in understanding teachers' materials?
6. How do you overcome the challenges?

