UNIVERSITY OF EDUCATION, WINNEBA

EFFECT OF USING IMPROVISED INSTRUCTIONAL MATERIALS TO ENHANCE ACADEMIC ACHIEVEMENT OF FORM THREE BIOLOGY STUDENTS IN THE TEACHING OF RESPIRATORY SYSTEM AT TEPA SENIOR HIGH SCHOOL

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DECLARATION

Student's Declaration

I, **ROCKSON OFORI-AMANFO** declare that this thesis, with the exception of quotation and references contained in published works which have all been duly identified and acknowledged, is entirely my own original work, and that, it has not been submitted, either in part or whole, for another degree elsewhere.

SIGNATURE……

DATE……

Supervisor's Declaration

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

NAME: PROF. YAW AMEYAW

SIGNATURE:……

DATE:……

DEDICATION

I dedicate this work to my lovely wife, Beatrice Aning, Father, Mr. Osei Asibey, Mother, Agnes Achaia, Brothers and Sisters, Friends especially Mr. Adu Stephen (Student Loan Trust Internal Auditor, Accra), Children: Agnes Achiaa Ofori and Esther Pomaa Ofori.

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ABSTRACT

The purpose of the study was to find out the effect of using improvisation instructional materials to enhance academic achievement of form three Biology students in respiratory system at Tepa Senior High School. Research approach adopted for the study was quasi-experiment design. The instrument used to collect data for the study were questionnaire, document analysis, pre and post treatment test. The target population consisted of 300 students and 15 teachers, and the accessible population included 120 students and 10 teachers, the sampling technique used was simple random sampling. Study findings, though, the school has a biology laboratory, the school have inadequate standard practical materials for practical lessons, lack of skills for improvisation among most teachers of Tepa Senior High School, inadequate biology laboratories, used of laboratories for classroom because of large school population and inadequate classrooms, when the improvised materials was used in place of standard one due to inadequacy, the students' achievement was excellent as experimental group scored the above average mark of 23.3% as against 3.3% in control group showing an improvement in their academic achievement when the treatment was used for experimental group . Summary and recommendations of findings, based on the research findings, the study recommends the following: Teachers of Tepa Senior High should be trained on how to at least construct basic improvisation materials, enough equipment and facilities should be secured for Tepa Senior High to ensure individualised practical activities, Management of Tepa Senior High School should ensure that teachers teach with improvised materials in absence of standard ones to enhance students understanding especially in respiratory system.

CHAPTER ONE

INTRODUCTION

1.0 Overview

This chapter contains information on the background to the study, statement of the problem, the purpose of the study, educational significance of the study and research questions that addressed the study. Also, presented are the limitations and delimitations of the study. It finally presents the organization of the various chapters in the study.

1.1 Background to the Study

Iloeje (2007) viewed biology as the science in which we study living things and non-living things. Traditionally, biology is divided into two branches: botany, the study of plants and zoology; the study of animals. Understanding of human respiratory system is possibly necessary for children to relate issues in the world around them to their own health, that is the hazards of smoking, pollution, and diseases of other body systems such as heart disease, lung cancer and others (Tweney, 1987). The self creates a new and different world - a cognitive construction- and the representations created become models and theories in science; as images are pictures of reality, the act of imagining is the manipulation of mental pictures as opposed to the manipulation of concrete objects (Abugu, 2007). Teachers and students find it difficult in teaching and learning of biology especially respiratory system, as results of inadequate standard materials, therefore there is the need of improvisation as substitutes (Balogun, 2006). Improvised instructional material is a meaningful attempt towards finding suitable substitute or alternative to conventional science materials (Balogun, 2006).

Carin and Bass cited in Eminah (2009) opined that science is a subject that is best learned through practicals. Literary approaches to the teaching of the subject cause the learners to be deficient in the processes of science. According to them, teaching the subject without allowing the children to manipulate the resources available and to learn science by doing and observing may cripple their interest and chances of learning science to the highest level.

Some of the importance of biology education cited by Sarojini (2001) in scientific research and development of new tools and techniques which invariably improves the quality of our lives, it also helps in finding applications in medicine, dentistry, veterinary science, agriculture and horticulture; additionally, it helps in dealing with ecological problems such as over population, food shortage, erosion, pollution, disease etc. Biology has remained the most popular subject in the senior high school System in Ghana (Anamuah-Mensah, 1995). It has a high enrolment figure annually compared to chemistry, physics and the other science subjects. However, this number does not reflect the students' achievement in the subject. Since the introduction of biology into the senior high school (SHS) programme particularly teaching of respiratory system as one of the sciences topic, students' performance in biology examinations conducted by the West African Examination Council (WAEC, 2009) has been dwindling despite the numerous educational reforms, policies and programs (Science Resource Center Project, USAID Science Project and SEEP Project) initiated by the Ghana Education Service (GES, 2012) and the Ministry of Education (MoE, 2009) to improve the teaching and learning of the subject in the country (Anamuah-Mensah, 1995). According to Nnamonu (2003) and Akinmade (1992), in spite of these policies by educational authorities to improve teaching and learning, students' performance has consistently been below expectation and unimpressive. Similarly, the Chief Examiners'

Reports from the West African Examination Council (WAEC, 2010) have consistently indicated poor performance of SHS students in biology. The Chief Examiners' Reports showed that more students fail in biology because they do not perform creditably in biology practicals (WAEC, 2022).

The Ghanaian science education system, like those in most developing countries, and just like all of its West African neighbors, has many hallmark issues to be solved. A pervasive teacher-centered pedagogy, lack or absence of laboratory materials, poor quality teacher training, and minimal support systems for teachers at their schools are all problems that must be resolved for a healthier education system. The issue acknowledges the wide-spread teaching practice of a teacher-dominated, lecture driven and rote-learning pedagogy (UNESCO, 2015). Practical Education Network (PEN, 2018), is an organization that addresses some of the challenges face by teachers in the classroom. PEN provides a teacher training program infused with a learning-by-doing approach to promote hands-on science regardless of a school's resource constraints (Practical Education Network, 2018). For example, when the students are learning about the respiratory system they are often traditionally taught to memorize the function and location of the different organs within the system. The PEN approach is different, giving the teachers ideas for hands on activities especially improvisation that allow students to gain a deeper understanding of concepts like volume and pressure change within a system, in addition to learning the structures and functions normally taught in the traditional classroom setting. The national science curriculum encourages hands-on learning and critical thinking skills, yet most teachers find themselves without the necessary teaching materials and continued training in teacher-centered learning pedagogy to implement such a curriculum (PEN, 2018). There is also a mismatch between teacher training and the support mechanisms available in the classroom.

Teachers receive some instruction on student-centered learning pedagogy during their teacher training and are provided with periodic workshops to support this practice. Extensive research in international science education shows that students who engage in inquiry-based learning that mirrors the practices actually followed by scientists and engineers are able to build a more cohesive understanding of science over time (NGSS Lead States, 2013). Unfortunately, students in Ghana are not commonly engaged in inquiry-based learning, but rather, are taught in a teacher-centered lecture style nearly all of the time. Potential proof of the dilemma may be seen in the West African Senior High School Certification Examination (WAEC, 2015), where Biology had the lowest pass rate of all the science subjects in this terminal standardized test for Senior High School graduates (MoE, 2016). In the twenty-first century, critical skills remain essential for the four pillars of life: learning to know, learning to do, learning to be, and learning to live together (Zubaidah, 2016). Each of the four principles has particular abilities that must be developed throughout learning activities, including critical thinking, problem solving, communication, teamwork, creativity and invention, and literacy. These 21st century skills can be acquired by improving the quality of learning, assisting students in developing participation, adjusting learning personalization, emphasizing problem or project-based learning, encouraging collaboration and communication, increasing student engagement and motivation, cultivating a culture of creativity and innovation in learning, utilizing the appropriate learning facilities, and desiring (Zubaidah, 2016). Learning is a process of absorption of information from teachers by engaging certain activities and actions or treatments to achieve the goal of better learning outcomes. The respiratory system is an abstract and quite difficult biology subject because there are things that concern concepts, processes, symptoms or anything that occur in the body in daily life. Students can't see these things directly.

According to Allen (2003), science attempt to make the chaotic diversity of our sense experience to conform to a logical uniform system of the thought. Science comprises the three basic disciplines which are biology, physics, and chemistry. Biology is the study of life and its processes. It is an essential subject that provides a foundation for most careers in the medical and life sciences. There is a growing need for continuous improvement in biology instruction, particularly in the materials used to teach the respiratory system. Researchers such as Ogunleye (2002) and Obioha (2006), reported that there are inadequate resources for the teaching of science subjects in developing countries. They further stated that where there are little resources at all, they are not usually in good conditions, while the few that were in good conditions are not enough to go round those who need them. Instructional materials used in teaching respiratory system helps to enrich learning; while the lack of these materials in the classroom makes teaching and learning less interactive and more difficult to understand. Most schools in the rural areas lack many of these instructional materials for teaching and learning of respiratory system, common example is Tepa Senior High School in the Ahafo Ano-North District where this research is carried out.

The inadequacy of these materials has been of serious concern to science teachers in rural areas (Aina, 2013). In developing countries, there is a high expectation from teachers even though there are scarce and limited resources to achieve these goals (Lingam & Lingam, 2013). However, these instructional materials can be improvised in place of the standardized ones to bring about the same learning result as the standardized instructional materials. Respiratory system is difficult biology subject because there are things that concern concepts, processes, symptoms or anything that occur in the body in daily life. Students can't see these things directly. It also makes them understand science and its connection to natural phenomena. Improvised

instructional materials are those devices developed or acquired by the teacher in place of standard equipment to facilitate the transmission of knowledge and skills to the learners within an instructional situation (Obioha, 2006). In the case of limited government resources, biology teachers' ingenuity to improvise becomes tasking for learning to be effective and productive.

Local materials become imperative in situations where there are scarce resources and facilities. The Ghanaian school system today is experiencing a boost in population, giving way to greater demand for classroom facilities and equipment (MoE, 2015). The application of improvised instructional materials as alternative materials in the teaching – learning process to supplement insufficient standard materials and verbal explanation of concepts has gained grounds in modern educational practices. The selection and procurement of instructional materials are strictly guided by the content of the curriculum and the teacher's method of instructional delivery. According to Iwuozor (2000), local materials stimulate the students desire to learn, assist learning process by making assimilation and memorization of materials easy. It helps to hold attention, bring about greater acquisition, as well as objective which may be accessible to many students. Again, the use of local materials makes learning available to a wider audience, control the pace of learning, promote better understanding and helps to overcome physical difficulties in presenting the subject contents. Teachers often make use of textbooks, charts, models, graphics and locally sourced materials to facilitate learning. Instructional materials are of several kinds. They are classified on the basis of the type of sense they appeal to. Printed materials such as text books, laboratory manuals, work books, cartons, photographs, maps charts, microfilm, Journals, model specimens etc are visual materials. Those that stimulate the sense of hearing such as radio, tape recorder, compact discs, record player etc. are classified as audio materials. Instructional

materials which appeal to both the sense of hearing and sight are called audiovisual materials such as television, video tapes and players, compact disc, still or motion pictures etc.

Learning is facilitated when the learners make use of at least three of the sense organs namely; seeing, hearing and touching. This agrees with the popular Chinese proverbs that states: I hear- I forgot, I see- I remember, I do- I understand (Vaillancourt, 2009). The need for improvisation in the absence of standard instructional materials cannot be over-emphasized. Improvisation occurs when the teacher on the ground of inadequacy or lack of standard instructional materials, makes a step or move to develop, construct, design and utilize alternative instructional materials to aid his/her instructional delivery and facilitate students' understanding of concept taught. It is an essential innovation in educational technology. However, students at the senior high school level have invariably had their imaginations Stretched too far due to the teachers' excessive use of words to convey meaning when instructional materials are not put to use. There are time teachers teach but no learning takes place. This is because something was missing that makes the students not to understand the lesson and therefore learning did not take place. That constituted wasted time and energy. This will go a long way to improve students' academic achievement in the subject.

1.3 Statement of the Problem

Biology instruction materials is essential for students to understand respiratory system concepts and phenomena. However, the process of teaching respiratory system requires the use of materials that can facilitate learning and engagement among students. The current standard materials used in teaching respiratory system is not sufficient to promote active learning, critical thinking, and academic performance in Tepa Senior

High. Additionally, the existing standard materials is not suitable for teaching respiratory system as they are too old, considering the 21st century teaching methods. Teachers of Tepa Senior High, fail to improvise so they resort to teaching without teaching materials in Biology classes especially teaching of respiratory system. The use of lecture method (teaching without teaching materials) at Tepa Senior High School is ongoing because some teachers at this lack basic knowledge of improvisation in place of standard materials for teaching respiratory system. Therefore, there is a need to use improvised materials for biology instruction materials that are diverse, inclusive, and adaptive to different learning styles to enhance academic achievement among students. One of the challenges to effective teaching and learning of respiratory system in schools is the inadequacy or lack of relevant instructional materials to aid students' understanding of instruction and teachers' ignorance of improvisation. Respiratory system cannot be taught effectively without relevant instructional materials to facilitate understanding among students. Apparently, it has been observed with dismay that most Biology teachers especially in Tepa senior high school are still teaching respiratory system verbally without relevant instructional materials and have made no effort to use local materials as improvised where standard materials are not readily available. This development has serious consequences on the effective teaching and learning of the respiratory system. The need for the use of easily accessible local materials as improvised has become a matter of utmost necessity for effective teaching of Biology in schools. There is no doubt that effective teaching of Biology will be a mirage without relevant instructional materials.

It is against this background, therefore, that this study, using improvised instructional materials to enhance academic achievement of form three Biology students in respiratory system at Tepa Senior High School is necessary.

1.4 Purpose of the Study

The purpose of this study was to assess the effect of using improvised instructional materials to enhance academic achievement of form three Biology students in respiratory system at Tepa Senior High School in the Ahafo Ano-North Municipality of Ghana.

1.5 Objectives of the Study

The study objectives were to:

1. examine the availability of improvised materials for teaching respiratory system?
2. assess the improvised materials teachers use to teach respiratory system?
3. assess the effect of improvised materials on students' achievement in respiratory system?
4. identify the students' attitude towards the use of improvised materials in teaching respiratory system?

1.6 Research Questions

1. What are the improvised materials available for teaching respiratory system?
2. What improvised materials are used by teachers to teach respiratory system?
3. What are the effect of improvised materials on students' performance in respiratory system?
4. What are students' attitude towards the use of improvised materials in teaching respiratory system?

1.7 Significance of the Study

As a biology teacher in a rural area, teaching Biology especially respiratory system in these areas becomes very difficult, since it is taught from a more theoretical stand point and lacks the practicality of a concept. This is attributed to the lack of resources in these areas. This study was intended to make appropriate use of improvised materials in place of the standardized materials for teaching respiratory system concepts in Biology in order to enhance students' interest and performance in the study of the concepts, especially in Tepa Senior High, where there is insufficient standardized instructional materials. Also, the study will help to reveal the attitudes of teachers and students on the use of improvised materials. Furthermore, it will help to know the effectiveness of using improvised materials in teaching respiratory system concept.

1.8 Limitation of the Study

The limitations of the study were:

1. Improvised materials are non- standard and may vary in terms of design, quality and functionality.
2. Assessing the effectiveness of improvised materials can be challenging due to the absence of established benchmarks.
3. The study may have only examined the short-term impact of using improvised materials, leaving long term effect on learning outcomes.

1.9 Delimitation of the Study

The study was conducted among some selected final year biology students. The major focus was on to find out how improvisation material would improve the students' achievement in the teaching and learning of respiratory system.

Definitions of Terms and Abbreviations

1. **MoE** - Ministry of Education
2. **PEN** - Practical Education Network
3. **IM** - Improvisation Materials
4. **SDG** - Sustainable Development Goal
5. **WAEC** - West African Examination Council
6. **GES** - Ghana Education Service
7. **C.R.D.D** - Curriculum Research Development Division
8. **SHS** - Senior High School
9. **IAEP** - International Assessment of Educational Progress
10. **UNESCO** - United Nations Educational Scientific Cultural Organization
11. **Researcher** - Is the person conducting research
12. **Simple random sampling-** it is the probability sampling technique where every member of the population has an equal chance of being selected for the sample.
13. **Lecture Method** – Teaching without teaching materials
14. **Improvised instructional material** is a meaningful attempt towards finding suitable substitute or alternative to standard practical equipment for science practicals or teaching materials.
15. **Biology** is the study of living and non-living things and its environment
16. **Living things** are organisms that have life and carry out life activities. eg. Plant and Animals
17. **Science** is the systematic process of obtaining verifiable and testable knowledge about nature through theoretical and also knowledge obtained through observation and experimentation.

1.10 Organisation of the Chapters

This study is presented in five chapters. The first chapter deals with background to the study, statement of problem, purpose of the study, objectives of the study, research questions, significance of the study, Limitations and delimitations.

The review of relevant literature is dealt with in chapter two while chapter three deals with the methodology, which consists of the research design, population, sampling and sampling technique and instrumentation, data collection procedure, as well as, the procedure for analysing the data. The chapter four was on results and discussion. Finally, chapter five also focused on the summary of main findings, conclusions, recommendations and suggestions for further studies.

CHAPTER TWO

LITERATURE REVIEW

2.0 Overview

This chapter contains review and other related works and literature. The literature review is organized under the following headings:

- Theoretical framework
- Conceptual Framework
- Conceptions of Respiratory System
- Theories of Conceptual Change
- Instructional Materials
- Improvised Instructional Materials
- Technical Factors for improvisation materials of respiratory system
- Teachers Training Level and Use of Improvised Instructional Materials
- Improvisation in science teaching and learning
- Utilization of Science Resources in Teaching Respiratory System
- Importance of Effective Utilization of Science Resources in Teaching Respiratory System
- Influence of Improvisation of Resource Materials in the Teaching and Learning of Respiratory System
- Need for Improvisation of Science Resources
- Use of Improvised Instructional Materials in Teaching Biology
- Role of Students in Improvisation
- Role of School Authorities in Improvisation
- Evaluation of the Improvised Materials

- Instructional Materials from Local Resources
- Criteria for Selection of Improvised Materials for Teaching Respiratory System
- Importance of using Improvised Instructional Materials for Teaching Respiratory System
- Contribution of indigenous practices in respiratory system
- History of practical work
- Benefits of Practical Activities
- The Role of Practical Work in the Teaching and Learning of Biology
- Hands-On Practical Activities
- Mediation of Learning

2.1 Theoretical framework underpinning the study

Theoretical framework that can be used for improvisation of materials in biology instructions especially teaching respiratory system is the contextual learning theory. This theory asserts that learners acquire knowledge better when they are taught using real-world applications and examples (Brown, Collins, & Duguid, 2002). In improvisation of biology instructions, the contextual learning theory can be used to incorporate practical applications of biological concepts and principles. In this case, instructors can use examples from the environment or diseases in the society to teach various biological concepts. Moreover, the experiential learning theory can be used to facilitate the improvisation of materials in biology instructions. Experiential learning theory suggests that learners learn best through hands-on learning and reflection (Kolb, 2000). In improvisation of biology instructions, the experiential learning theory can be used to incorporate various activities, such as fieldtrips, observations, and experiments,

which allow students to apply their knowledge practically. This approach enhances their understanding and retention of biological concepts.

2.2 Conceptual Framework

Conceptions refer to beliefs, thoughts or ideas teachers have about teaching and learning (Koç & Köybasi, 2016). This is pivotal to this study because in order to understand how teachers mediate learning of respiratory system using easily accessible resources, it is important first to explore their conceptions and experiences. Koç and Köybasi (2016) believed that teachers' beliefs or thoughts influence the way the subject content is presented to the learners in the classroom. Moreover, the teachers' pedagogical approach and content knowledge, as well as other personal characteristics determine the type of behaviours in the class, instructional practices and the learning environment. This concludes that there is a relationship between conception and the method of teaching in the classroom. Eley (2006) argued that although teachers differ on their teaching and learning practices, their conceptions should be based on their reflection on the teaching, and not directly in the teaching episodes. This also applies to the practical knowledge the teachers have, which may differ from teacher to teacher. Van Driel, Beijaard, and Verloop (2001) stressed that more experienced teachers possess positive conceptions and tend to attend better to practical activities during lesson planning and teaching comparing to the novice teachers.

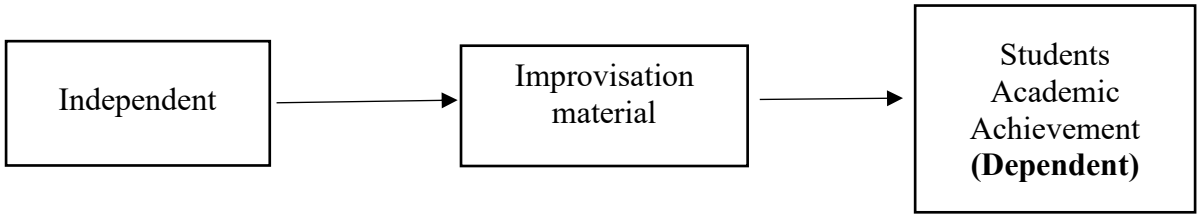
Furthermore, Ferreira, and Morais (2010) indicated that some teachers' conceptions are due to insufficient subject knowledge and skills which may result in scientific inaccuracies. The components related to teachers' conceptions or beliefs discussed in Atallah, Bryant, and Dada (2010). It can also apply to teaching Biology as a subject; which includes: belief about the subject, belief about oneself as a subject user, and the

learners, and beliefs about teaching the subject. This is similarly related to this study on what teachers' conceptions are in relation to practical activities, use of easily accessible resources and indigenous knowledge (IK) to mediate the learning of respiratory system. For instance, how teachers identify IK in relation to the teaching of respiratory system in Biology and how beneficial it is to the learning of respiratory system. Thus, Dziva, Mpofu and Kasure (2011) recognised that preconceptions inhibit teaching and learning of science because it makes more sense than the concepts found in that subject. The study by Lederman (1999) conducted in Corvallis revealed that teachers have a positive understanding that teaching science is partially based on human creativity, imagination, subjective and yet empirical evidence. This means that teachers have a strong commitment that science concepts are constructed based on the observation of phenomena. Lederman (1999) indicates that it is best to make use of the environment when teaching science subjects. With reference to indigenous knowledge (IK), the study by HSileshi, (2012), conducted in South Africa, indicates that before the intervention, about 67% of the participants perceived IK negatively and believed that it holds the African continent back, and that its integration should not be entertained. He continues that teacher perceived IK as backward to science and merely for uncivilised people, and thought that western science was special.

After the intervention and working as a community of practice, most of the participants' dispositions changed from the incorrect assumption to positive thinking over IK inclusion in science teaching Thus, Eley (2006) emphasised that goal-directed activities lead to development within individuals after an intervention. Therefore, to apply such to a study, it is important to explore teachers' dispositions (Taylor & Wasicsko, 2016) towards the use of easily accessible resources to enable to design appropriate model lessons during the intervention. This means the participation in such an intervention is

part of professional development that might provide teachers with new knowledge and skills to overcome their own problems during teaching and learning (Eley, 2006).

CONCEPTUAL FRAMEWORK FOR THE STUDY



2.3 Conceptions of Respiratory System

Research into students' understandings about the human body has taken two paths, one dealing primarily with naming internal structures and one with describing internal operation. The first and larger body of research describes what structures children can name within the body (Mintzes, 2006). The second is a collection of conceptions children have about how their body works (Songer & Mintzes, 2008), including function, behaviour and mechanisms of the body systems. The earliest research of Schilder and Wechsler (2000) attempted to discover what children knew about the structure of the inside of their bodies. What they found was that children primarily described what was under their skin as blood and bones. They often viewed their body as just a sack to hold food. The authors suggested that, normally, our sensations would never disclose to us the existence of heart, lungs, and intestines. Our experience of our own bodies is based on visual and tactile impressions, on our perception of the weight of the body and its various parts and on the happenings within the sensitive zone close to the surface. In other words, 'if you can't see anything, you can only go on your gut feelings'. While function is considered a major biological prerequisite for assigning importance to a structure, much remains unknown about students' conception of

function. Students have been asked to name organs and assign behaviour without delving into the reason behind this behaviour (Porter, 2002).

A conceptual understanding of respiratory system at a cellular level is critical to an understanding of several of the organizing conceptual schemes of the discipline biology, including energy flow in natural ecosystems and metabolic activities of multicellular organisms such as digestion, respiration, circulation, and excretion (Songer & Mintzes, 2000). Teachers find respiratory system a difficult topic to teach and discover that students have a poor understanding even after instruction (Eley, 2006). Bishop, Roth, and Anderson (2008) examined four major issues in children's conceptions of respiration, comparing students' naive conceptions to a target biological conception: the nature and function of respiratory system, location of respiration, as chemical conversion, and respiration as energy conversion. The authors found that even at the high school level students considered respiration to be breathing, to take place only in the lungs, and to involve a conversion of oxygen to carbon dioxide. There was, overall, little understanding of cellular function in respiration. This was supported by later research (Songer, 2001) which showed a general lack of understanding of the cellular level of respiration in college students and that alternative conceptions often persist even after instruction. In addition, many of the erroneous ideas about respiration appear to be based on external sensation and observation. In summary, past research gives us glimpses into students' conceptions; it has dealt primarily with structure and secondarily with function. Respiration was not the main focus of most of these studies as the researcher was much concern about respiratory system but they provided some small pieces of information gained as students either drew or discussed another respiratory system. Students were asked to fill in as many organs as they could within an outline of the human body (Porter, 2002). While this may actually provide a good

approach to find out what students know, it does not differentiate the naming of various structures from an understanding of these structures in regards to their function or their mechanism of action. Only through further empirical research can we begin to understand the mental models' students have developed that help them to explain complex systems such as respiratory system. Conceptual change can be broken down into theories of conceptual change as they have evolved throughout history and strategies that researchers have employed to promote conceptual change. In this section, I will undertake to discuss both of these areas in some detail so as to lay a foundation for the major fields of thought that have influenced and may continue to influence new strategies and theories that are just now coming about in the research. It additionally will lay the theoretical foundation upon which this study is built.

2.4 Theories of Conceptual Change

Certain strategies have been proposed in other areas of scientific learning to aid students in developing more scientific understanding about a concept (Eley,2006). These strategies are based on the notion that in order for understanding to take place conceptual change must occur within the individual student. Since it is supposed that this also occurs in the area of respiratory system, I believe it is important to review these theories as they are the basis for later assumptions and strategies used in this research. Conceptual change is defined as learning that results in a change in a concept (mental model), in some form, from one conceptual model to a new or revised conceptual model. It may be that when new knowledge is learned, this new knowledge needs to be integrated into other existing schemata, which are then also altered. In this instance, while the student may never have encountered the new information, he/she relies on other knowledge structures to begin to understand this new information and construct a new conceptual model. Complex knowledge systems involve much more than mere

transformation or replacement of one isolated conception with a new conception (Smith, diSessa & Roschelle, 2000). The construction of new knowledge relies on prior knowledge imbedded within schemata whether the student is aware of a relationship or not. The following sections will review the major theories concerning conceptual change. This is important as it may not be just one theory but a compilation of theories that provide the most information.

2.5 Instructional Materials

In order to facilitate effective teaching and learning, it is important for the teacher to use instructional resource or a technology which will be able to address the needs of all learners irrespective of learner's background, intelligence level and academic need (Bennett, 2005). Various aids known as instructional materials may be employed to help a teacher to effectively deliver a lesson on respiratory system to the understanding of all learners (Okori, 2005). Broadly, the term instructional materials as explained by Antwi (2000) refers to a range of educational materials that teachers use in the classroom to support specific learning objectives. He further added that they are those materials that help the teachers to teach with ease and the learners to learn without stress. Ministry of Education (as cited in Antwi, 2000) stated that the use of teaching and learning materials is very important at all levels of pre-university education. Instructional materials appeal to the senses of seeing, touching, smelling, feeling and hearing. On the other hand, they are used by teachers to convey and put emphasis on information, arouse interest and ease the learning process (Bennett, 2005). At the stage of production of instructional materials for respiratory system, teachers should bear these attributes of the materials in mind (Daniel, 2001):

They must be clear;

They must be legible;

They must relate to the instructional objectives set

They must be relevant to the interests, needs and aspirations of the learners;

They must be accurate;

They must be durable; and

They must be portable or manageable.

2.6 Improvised Instructional Materials

Improvised instructional materials are teaching materials designed and produced from the available local materials in order to promote effective teaching and learning in schools. They are materials that are used in the absence of the original or the ideal objects to bring about the same learning effect that the standard materials would have brought (Ahmed, 2008).

Ndirangu, Kathuri, and Mungai (2003) investigated the effective use of improvised materials designed by biology teachers during their teaching practice. This study presented evidence that improvised teaching aids designed by science teachers during practice had a great influence in the teaching of biology in schools particularly respiratory system. These materials were found to be durable and could last for a longer time to enhance effective teaching and learning of science in school that are unable to afford expensive standardized instructional materials. Science teachers should be encouraged to make their own teaching resources from the locally available materials to teach respiratory system. Improvised materials have been used across a number of scientific disciplines. For example, Ahmed (2008) presented in his study some biological instructional materials that biology teachers can improvise to replace the standardized ones. Biology teachers should find out materials from their local environment that they could improvise without losing the originality of the concept

which is taught. Examples of these improvised materials include replacing D.N.A. models with stripped cardboard for illustration in teaching genetics, using clothes hangers (pegs) in place of test-tube holders, replacing measuring cylinders with graduated feeding bottles for measuring liquids and so on. Onasanya and Omosewo (2011) discovered in their study that the use of improvised instructional materials have the same importance in the teaching and learning of respiratory system. This study's results showed that both improvised materials and standardized materials were successful in teaching the students. Biology teachers should teach with improvised materials if the standard ones are not readily available to enhance effective teaching and learning of respiratory system.

Aina (2013) also investigated the necessity of using improvised materials to replace scarce standardized instructional materials in teaching physics in schools. This study showed the difficulty in teaching physics in schools where there is an unavailability of standardized instructional materials. Furthermore, the paper elaborated the use of improvised instructional materials in advancing teaching and learning of physics. Similar studies have also been conducted in mathematics. For example, Clement and Rea-Ramirez (2014) presented the effective use of improvised instructional material in teaching a concept in Geometry in higher levels. This study elaborated on the fact that teachers teach respiratory system concepts abstractly. This is because some science teachers believed that instructional materials used to teach biology concept (respiratory system) are not readily available or do not exist. Improvisation was applied in teaching respiratory system in this study, and from their results, the use of improvised instructional materials significantly improved students' achievement more than teaching the concept without improvised materials.

Ramel-galima, Rivera and Almanza (2013) designed a colour chart of Acid-Base indicators from indigenous plant extracts to assist in the teaching and learning of chemistry. The leaves and flower plants in the local environment were collected for the study. The paper discussed that plants are known to contain pigments like anthocyanin that provide colour to their flowers, leaves, stem, root and fruits. The design of the colour chart helped in teaching about acids and bases in the classroom.

2.7 Technical Factors for improvisation materials of respiratory system

This relates to the teachers' skills in developing the improvisation materials for respiratory system while providing the appropriate learning experiences to the learners. Fatubarin (2001) reported that lack of adequate professional training as a major problem militating against the effective use of local resources for teaching respiratory system. Oyediran (2010) stressed the need for a definite well planned training programme of improvisation for teachers. He suggested regular meaningful workshop on improvisation techniques for biology teachers to improve and update their competence. Most at times teachers do not have access to the resources needed to conduct biology experiments. Improvisation is the act of creating something or using something in the absence of the ideal tools, biology teachers often try to teach students about scientific principles through the use of laboratory experiments, though they do not always have access to the resources needed to optimally perform experiments. Innovative teachers can use cheaper products to stimulate experiments especially teaching respiratory system; teachers can also help students to learn improvisation as an important life skill. If the technical and the human factors are taken into consideration the process of improvisation becomes very successful Fatubarin (2001).

2.8 Teachers Training Level and Use of Improvised Instructional Materials

Teachers training level plays an important role in teaching and influences the use of instructional resources in teaching and learning of respiratory system. According to MOEST (2003), the training that teachers receive affects the way they teach respiratory system in the Senior High School. Trained teachers have a positive relationship with the learners and they also socialize well with learners as they use the IM (Homes,1997). There is need for Biology teachers to undergo intensive training so that they can get equipped with knowledge and skills to cope well with the demanding nature of students (Munyeki, 1987). The study further advocated that when Biology teachers are trained they are in a better position to provide students with appropriate materials during teaching of respiratory system. The requirements for teachers vary worldwide, in USA, a minimum of a higher diploma is required for one to be licensed teacher for child care centers. In France, a minimum of a degree is required for one to enter into the profession. In New York, one should attain a masters degree in 5 years after employment (Whitebook, 2003). In Japan at least a degree is required for one be a preschool licensed teacher while in Ghana, the minimum is a Degree for one to teach in the Senior High School (MoE, 2009).

A study done by Skamp (2011) on preschool teachers' knowledge and attitudes towards use of visual media, confirmed that trained preschool teachers frequently used visual media than the untrained teachers. The study concurs with Aila (2005) which found out that trained teachers used instructional visual aids more often than the untrained teachers. The above studies generally focused on how the level of teachers training influences the use of instructional materials in the entire teaching and learning process while this study focused only on science instruction. Teachers' level of training and qualifications is essential in determining the teaching process. This is because teachers

influence the IM used as well as detecting any problem associated with teaching and learning in the classrooms. A study done by Rotumoi (2012) on factors influencing the choice of approaches used by preschool teachers in Baringo county revealed that majority of teachers were O level/KCSE holders, followed by A level then diploma holders, CPE/KCPE and degree holders were the least in number. The study appeared to look at how teachers' level of training affect the choice of approaches used in Senior High schools while the current study explored how the teachers level of training influences the frequency of use of IM during science instruction.

Biology teachers undergo different level of training that influence the way they use materials during instruction. Lack of knowledge and skills inhibits Biology teachers' chances of showing and teaching learners on how to handle IM during science instruction. A study done by Wambui (2013) on effect of use of IM on leaner participation in science activities in pre-primary classrooms in Kiine discovered that out of the 30 participants, 10 (33%) were diploma holders, 15 (50%) were certificate holders while 5 (17%) were untrained teachers. The study found out that IM are underused in the area of study. One of the reasons attributed to this was lack of professional skills. The teachers in this study location were not highly qualified since the highest level of education was diploma while other teachers were not trained. It is not clear if this level of training could be the main reason as to why materials were not effectively used. Education of young children should take into account the increasing experience of the teacher (Dewey, 1982). This implies that the Biology teachers needs to be well trained and experienced to meet all the developmental and educational needs of students. The Biology teachers are supposed to support, inform, inspire, listen to and respect students during the teaching and learning process. This can be made possible through provision of adequate materials from the local environment. The number of

years a teacher has in the teaching profession influences the use of instructional materials during instruction.

Ngure (2014) did a study on utilization of instructional media in pre-primary school training teachers college. The study revealed that majority of the tutors had teaching experience of over 3 years. The study further confirmed that most tutors had been teaching for long period of time and that's why they are well equipped to prepare and utilize instructional materials during instruction. Adegbija and Fakomogbon (2012) study on the use of instructional media in teaching and learning in selected schools in Nigeria, also confirmed that the experience a teacher had with IM through in-service training, workshops and conferences promoted utilization of instructional materials.

2.9 Improvisation in science teaching and learning

Science educators commend the use of improvisation in science lessons (Fatubarin, 2001). According to Adeniran (2006), the improvisation process of instructional materials makes students exposed to creativity, innovation, imagination and curiosity, which are essential to science teaching and learning of respiratory system. Hence, improvisation should not be the prerogative of teachers only. Rather, students should be also being engaged as integral parts of the process (Aina, 2013). Learning science should start with hands-on experiments that the students are familiar with and not with abstract definitions of scientific concepts. Low-cost apparatus from locally available materials assume to enrich the capacity to observe, explain and do real science (Sileshi, 2012). Thus, as students apply various facets of their intelligence for the purpose of understanding their natural environment, they are also hold accountable for their observations, inferences, and conclusions (Flick, 2000).

2.10 Utilization of Science Resources in Teaching Respiratory System

The process of managing and organizing resources is called resource utilization. The utilization of resources in teaching respiratory system brings about fruitful learning as such it stimulates students' senses as well as motivating them. Shimizu (2004), in his study on science game in national curriculum in the United Kingdom reported that game used as resource enable less able children to stay on task and remain motivated for a longer period. There are varieties of resources in our environment (local materials) which causes a lot of nuisance and also pollute the environment, which could be used in place of standard ones, which the biology teacher can readily use to teach respiratory system (Iwuozor, 2000). Other resources are models, charts, preserved specimen of plants and animals, culturing equipment, herbarium and microscope which are also biology instructional materials, according to Olagunju and Abiona (2008) as cited in Okori (2005). The resources should be provided in quality and quantity in science, technology and mathematics (biology inclusive) classroom for effective teaching-learning process Adeniran (2006).

Nwoji (1999) in an empirical study revealed that essential facilities such as equipment like radio, television, computer, chemicals, specimen, videotapes, stove, burner, models and charts are not available in most schools, teachers should be trained on how to improvised as substituted. This inadequacy of teaching material resources, laboratory equipment / reagents / chemicals and laboratory space has been a great concern to science educators. The implementation of biology program has been a matter of serious concern to biology educators. This interest stem from the fact that biology, which is the science of life, occupies a central position in the scientific and technological development of any nation (Maduabum, 1992). It is often referred to as the gateway to noble professions such as Medicine, Nursing, Pharmacy, Dentistry, Agriculture. The

teaching and learning of biology specifically respiratory system just like any other science topic demand active student's participation, involving the use of resources. Resources according to Ityokyaa (2010), refers to that facilities / equipment that can be used to ensure effective teaching and learning. These include laboratory equipment, reagents, visual and audio-visual aids, models. Nwagbo and Chukelu (2011)) poised that biology is activity based and students centered and as such, cannot be taught or learnt without resources. Similarly, Adeyemi (2008) found out that students learn better through practical approach with the use of resources.

2.11 Importance of Effective Utilization of Science Resources in Teaching Respiratory System

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 (Oludipe, 2017). The teaching and learning of respiratory system involving students' interaction with resources will no doubt enhance student acquisition of much desired process skills. One of the general objectives of Senior High education according to Ministry of Education (2015), is the preparation of students for useful living. The attainment of these objectives requires adequate production and utilization of requisite laboratory facilities; that will help the students acquire the much-desired practical skills. In spite of the immense importance of biology resources to effective teaching and learning of the subject, Ityokyaa (2009), found out that essential resources for teaching and learning of biology and other sciences are inadequately provided in schools, It is a noted facts that biology teachers do not put the available resources in their school into use. Nwosu (1993) found that biology teachers do not utilize the resources available in their schools.

Resources are indispensable in the teaching and learning of science, technology and mathematics education (Biology inclusive) process.

2.12 Influence of Improvisation of Resource Materials in the Teaching and Learning of Respiratory System

Improvisation becomes imperative in situation where there are scarce resources and facilities. According to Smith (2022), some of influence that improvised materials would have on biology teaching and learning process are as follows:

- Improvised materials provide a cognitive bridge between abstraction and reality to students.
- Improvisation saves cost and in addition the teacher and the students makes positive effort towards effective instruction.
- Improvisation undertaken by the teacher enable him to think and research for cheaper, better and faster methods of making the teaching and learning process easier for student.

2.13 Need for Improvisation of Science Resources

In an Ideal world, all science students would be taught in small classes held in well-equipped laboratories. In absence of those well-equipped laboratories, the place of practical activities cannot be over emphasized, yet those materials required for the teaching and learning of science are very much in short supply as Mukwambo (2016) lamented that these is a total or partial absent or inadequacy of the science teaching resources and gross inadequate finances most especially for the purchase of science equipment, galloping inflation using enrolment of students generally down ward trend in the nation's economy, poor maintenance culture and at times attitude of some school heads towards science and science equipment for effort at making science teaching and

learning what it is supposed to be. With all these heinous problems, it seem 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 school system today is experiencing a boost in population explosion, giving size 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.

2.14 Use of Improvised Instructional Materials in Teaching Biology

Improvised instructional material is a method or way of minimizing loss of equipment and materials and an inexpensive method of widening the scope of inquiry Johnson (2000). Improvised instructional material is a meaningful attempt towards finding suitable substitute or alternative to conventional science materials Balogun (2006).

Eniayeju (2014), Due to state of our nation's economy, Teachers, students, school authorities and communities should engage in improvising instructional materials in order to: Develop in students and teachers' adequate skill for improvisation. This will generate interest and motivation for indigenous technology. Have practical and physical links between science and theory, eradicate the menace of lack of or inadequate instructional materials for science sensitize both students and teachers that alternatives for some of the conventional science teaching materials especially for respiratory system are possible. Achieve the set out educational objectives through the use of improvised instructional materials in teaching. Biology teachers should find out those materials that could be improvised without; much cost, many complications in handling, and losing the originality of the concepts to be taught (Alonge,2015).

Improvised instructional materials make teaching respiratory system concepts more interesting to both students and teachers in the classroom, improvised materials are usually simple, because they are made from local raw resources that are acceptable to students. Improvised instructional materials help Biology and other science students to realize that science has to do with ordinary things and will possibly motivate them to carry out experiments and learning activities themselves using such improvised materials, (Johnson, 2000).

Zarewa (1991) as cited by Johnson (2000), noted that no matter how rich and generous educational authorities might be they are not always in position to provide their schools with all the materials they may need. Therefore, the schools, students and teachers might be obliged to make the most of what they can get or construct from locally available raw materials. For instance, certain things like herbarium press, aquarium tank, and wooden splint can easily be improvised by competent science teachers instead of waiting for supplies by the educational authorities.

2.15 Role of Students in Improvisation

According to Zarewa (1991), improvisation helps to change students' attitudes towards science. This portrays that if we can encourage students to partake in the improvisation exercise in teaching respiratory system, they stand a better chance of having a positive attitudinal change towards biology. Students should be engaged in the collection, assembling, fixing, of some basic and non-injurious items for improvisation. This will relate the abstracts concept, theories, laws of Biology to the real-life situations (Johnson, 2000).

2.16 Role of School Authorities in Improvisation

According to Eniayeju (2014), the fundamental role to be played by the school authorities are: To assist the teachers financially in the production of improvised materials, Solicit the support of parents to assist to procure improvised materials or materials meant for improvisation, Render motivations to deserving teachers, provide storage facilities for the improvised materials in order to maximize usage within their life span. Solicit the support of experts within the community to assist in the improvisation exercise. Other researches carried out by different educationists such as that conducted by Zarewa (2005), revealed that students taught with improvised materials performed better than those taught without such materials in teaching some components of Physics. According to Eniayeju (2014) Due to alarming rate of admission into our Senior High Schools as well as tertiary institutions and the nation's economy, and the importance of Biology to humanity, the task of improvisation becomes an important one due to the following reasons; it relates concept, law and theories in Biology, Minimizes abstraction and monotony in handling Biology topics (more especially those with respiratory system), provides to the student a first-hand experience in the use of the improvised materials, saves cost from the government side.

2.17 Evaluation of the Improvised Materials

The teacher might use the first try out of the materials on his class to evaluate them, since it might be possible to try out using separate samples other than his class, to determine the effectiveness of the materials. The feedback exposes the strengths and weakness of the improvised materials such as inaccuracy, complexity, lack of clear objectives over simplicity or irrelevancy. The feedback will be used to improve the quality of the instructional materials (Oludipe, 2017).

Ministry of Education (2016) stated that Science Education has always been a part of the Ghanaian culture. It included both the formal and informal forms of education that were present prior to the advent of modern education. Modern education in Ghana came with the advent of European missionaries and mercantile enterprises and has largely become the vehicle for social upward mobility. The significance attached to science education has been a yardstick to the continuous presence of the science subject at all levels of the Ghanaian education system. The Ghanaian Science curriculum follows the spiral approach which treats the same themes at different time and in greater depths within each educational level. This is a generalist survey course, which exposes students to the universe. At this stage, the students get the basic exposure to scientific ideas; learn about the history of science and the basic Science vocabulary at this level.

2.18 Instructional Materials from Local Resources

Locally sourced instructional materials for teaching of respiratory system can be categorized based on their mode of production. These divisions, as adapted from Ogunmilade (as cited in Aktamis, 2009) are: Models and ready-made materials (packages), Local materials which are made by experts in visual resources and Self-made (inexpensive) materials. Zarewa (2005) incorporated puppetry in basic education in the teaching of respiratory system using local materials such as cotton fabrics, old socks, old newspapers, bottle-like plastic containers, straw, balloons, raffia, wood shavings, corn tassel, leather, bamboo, egg cartons, coconut fibre, cane, and others. His works encouraged the collaborative effort of both teachers and students in producing models for teaching and learning and can be classified as self-made according to Ogunmilade's categorization. He explained that the collection and use of local materials and a variety of materials is vital to help students identify with and explore their environment. Chukwuka (2013) produced instructional materials from local leather for

pre-school education. Salami and Olotu (2014) as science educators worked hand-in-hand with local teachers in Timon-Leste to use locally-rooted materials as resources and design principles for the successful development of science and mathematics curricular and instructional materials for use in community schools. Locally-rooted materials such as certain palm leaves indigenous to Timon-Leste communities, bamboo, and local Timorese baskets were used as instructional resource materials. This means that local materials are indeed very viable resources in the production of instructional materials at all levels of education and more especially in Senior High Schools. In order to efficiently produce instructional materials from local resources, sufficient basic skills are needed by teachers. This acquisition of skills can be made possible by constant practice and observation done by professionals. Teachers also must have the knowledge of basic design principles and be familiar with the materials in their environment in order to utilize them in the classroom to support instruction.

2.19 Criteria for Selection of Improvised Materials for Teaching Respiratory System

As much as instructional materials are crucial for effective teaching and learning of respiratory system, care has to be taken by the teacher or school when choosing these materials. The choice of instructional material should fulfill the objectives of a lesson to be taught since an aid used in one lesson might not relay the same message when used in another lesson. This implies that there are specific roles that each instructional material plays in the teaching and learning process especially with respiratory system. Therefore, instructional materials if not properly chosen might mislead students instead of promoting understanding of a lesson being taught. There is therefore the need for teachers to acquire various materials to satisfy the objectives of different lessons to be taught, understand their roles and more importantly get training on how to use them.

Lanzano (2013) suggests the following criteria should guide a teacher or school in their selection of instructional materials. They include: Appropriateness, Authenticity, Interest, Organization, Balance and Cost. DeMonte (2013) explained that a good educational media are those that require the minimum intervention by the teacher. Good instructional material needs little or no explanations, stimulate ideas, demand an active response from the learner, must be appropriate to the maturity and culture of the user as well as be flexible in use. They should also provide enjoyment and be strongly made. This means that in the selection of instructional materials for instruction, consideration should be given to the mutuality of the material to be used by both learners and teachers as a study resource. For instance, instructional materials for respiratory system should provide a main source of science content, present specific views about the nature of scientific practices, and how scientific knowledge is developed. This is because instructional materials can serve as a major influence on how science should be taught by teachers. Instructional materials should help to produce instruction that actively engage students in the learning process and encourage the inclusion of hands-on engagement with daily occurrences laying emphasis on student responsibility since these are more likely to increase conceptual understanding hence a good instructional material should fulfill these.

2.20 Importance of using Improvised Instructional Materials for Teaching Respiratory System

The use of locally produced instructional materials in teaching and learning especially in respiratory system has many advantages (Ahmed, 2008). The use of improvisation in teaching respiratory system makes the concept more practical and subsequently reduces abstractions. Again, they are cost effective, because they could be obtained from the local environment. They are generally very safe to use during demonstrations

and experiments; it might not be capable of inflicting injuries, which means it could be hazard free. In addition, they serve as a motivation to learners inasmuch as they participate in the activities during the production of the materials and also arouse learners' interest in learning respiratory system. Moreover, the use of these materials minimizes concerns about breakage, repair and loss since they are readily available in the environment. It informs both students and teachers that alternatives for some of the conventional biology teaching materials are possible. It also shows that people can do scientific experiments with the materials around them. Furthermore, Ramel-galima et al. (2013) indicated that the use of indigenous local materials is definitely safer, cheaper and cultural-sensitive alternative to the use of commercial and factory produced chemicals. When teachers and students use improvised instructional materials, it could lead to the discovery of new knowledge, and students' talents may be discovered. Using improvised instructional materials assist teachers economically and may make students more interactive. Beyond these, it makes students make use of their intellectual ability in the process of teaching and learning (Onasanya & Omesewo, 2011).

A very important opportunity of using improvised materials for experiments is that, it enables learners to participate fully in the actual construction of the apparatus and gives them more ideas about how such materials work. Again, improvised instructional materials bring home to the classroom, and clarify unfamiliar principles and concept of biology to learners. More-so, when teachers improvise instructional materials for teaching respiratory system, teachers develop their potentials.

2.21 Contribution of indigenous practices in respiratory system

Ferreira and Morais (2010) view respiratory system as an important concept in the learning of science. They suggest that it plays a vital role in our daily life situations

whereby most of life's processes taking place in our bodies use respiration. In understanding respiratory system, teachers may use various indigenous practices to demonstrate how it occurs or what might lead to respiration taking place, to broaden the understanding of such concept (Ahmed, 2008). For instance, there are some examples by Gemma (2014) that indicate how respiration (aerobic and anaerobics), occurs in our daily life situations which may act as prior knowledge when teachers mediate learning of respiratory system using easily accessible resources. These include; "fermentation, making of alcoholic beverages, bread making. This suggests that respiration is important in various processes such as preservation of foods (Asogwa, Okoye, & Oni, 2017).

This traditional practice has gained popularity in rural areas and used to preserve staple food such as grains for humans and animals (Krishnan, 2014). The decision taken to preserve food has resulted due to the lack of proper retailing and inadequate refrigerator's facilities in some rural areas (Yadav & Agarwala, 2011). The local fruits and vegetables that are preserved include: Fruits berries, palm fruits, and Vegetables dry wild spinach, tomatoes, beans peas, maize, seeds, sweet potatoes. Food preservation can be costly and expensive when using modern practices; whereas, it can be cheap or costless when using indigenous practices (Colon-Singh, 2016). For instance, modern preservation mostly includes freezing, vacuum drying, using a dehydrating machine, canning, pickling, smoothing, and baking. Most of the modern practices such as vacuum drying, canning and others are very expensive and not easily obtainable or accessible in some communities, and teaching of such practices can be difficult (Colon-Singh, 2016). In contrast, common indigenous preservation includes sun-drying, okufumika ombelela (rough meat cooking), okushika omashini (shaking milk to form sour milk) and salting the meat

2.22 Hands-On Practical Activities

Practical activities refer to any teaching and learning activity which requires students to do observation or manipulation of objects and materials they are studying (Millar, 2004). Practical activities are further defined as hands-on learning activities which prompt scientific thinking about the world (SCORE, 2009).

Jokiranta (2014) describes hands-on practical activities as useful, enjoyable and an effective form of learning in science. Practical activities are thus considered as essential part of science education by researchers, scientists, educators and learners (Akuma & Callaghan, 2016). There is also no single definition of practical activities as it depends on the individual person as they have different understandings of inquiry, so the way they view practical activities is definitely not the same (Leon, 2015). It is therefore believed that every day there is an increase in scientific knowledge and new things are being discovered (Akbar, 2012). This indicates that practical activities should be carried out in schools to foster conceptual understanding of science terminology (Jokiranta, 2014). Furthermore, practical activities of good quality stimulate learners to actively engage in them, which may result in the development of important skills to understand scientific concepts and the process of scientific investigations (Woodley, 2009). The inclusion of practical activities in science pedagogy involves key factors such as engaging, enthusing and inspiring learners to take up careers in science related fields (Ghana Association of Science Teachers, 2015). Learners are expected to learn through their eyes, ears and their hands to master the respiratory system concepts (Salami & Olotu, 2014). In this case, learners may engage in various practical activities to foster productive learning.

2.23 Mediation of Learning

Mediation involves the use of cultural tools such as language and materials to achieve the learning goal (Vygotsky, 1978). It is known to be central in learning (Shabani, 2016). Teachers are expected to be mediators of learning for the learners to play an active role and be able to learn (Amineh & Asl, 2015). In this study, teachers used easily accessible resources and indigenous knowledge to teach respiratory system.

Millar (2004) believe that as part of a socio-cultural theory mediation cannot properly be comprehended unless the role of the tools for mediation are acknowledged. In relating this to the study, the use of practical activities using easily accessible resources (improvisation) and the integration of indigenous knowledge during intervention and hands on practical lessons acted as a tool to help teachers mediate the learning of respiratory system.

CHAPTER THREE

METHODOLOGY

3.0 Overview

This chapter describes the procedures the researcher used in carrying out the research work. These include the design of the study, area of the study, population of the study, sample and sampling techniques, instruments for data collection, validation of the instrument, reliability of the instrument, method of data collection and method of data analysis.

3.1 Research methodology

In order to investigate the effectiveness of improvised materials in biology instruction, a mixed-methods research approach was employed. Both quantitative and qualitative data was collected to answer the research questions.

3.2 Research Design

The research design adopted for this study was quasi-experimental. This design is a useful way of obtaining information about students opinions, attitudes, preferences, and experiences simply by asking questions, pre-test treatment, treatment and post-test treatment to find out solution to their problems.

3.3 The Study Area

The study was carried out in the Ahafo Ano North Municipality in the Ashanti Region of Ghana. The administrative capital of the Municipality is Tepa. The Municipal share boundaries with Mankranso in the Ahafo Ano South Municipal to the south, Tano north Municipssal to the North and Tano South district to the east. The main occupation of the people in the Ahafo Ano North Municipality is cocoa farming. The Municipal

consist of 150 primary schools, 70 Junior High Schools, Two Senior High Schools and Nursing Training College. In the Tepa Municipal, Tepa Senior High School where the study was conducted is located at the out skirt of the town along Bechem road opposite Jusbro filling station.

3.4 Population of the study

The population of the study was form three biology students. The target population was 300 students and 15 teachers and the accessible population was 120 students and 10 teachers because some of them did not show interest of the studies as they were preparing for WASSCE Exams.

3.5 Sampling and Sampling Technique

The researcher adopted simple random sampling technique in selecting the accessible population for the study. A sample size of 10 biology teachers and 120 students were selected at random from Tepa Senior High School for the study.

3.6 Instrument for Data Collection

The instruments the researcher used to gather views, opinions and suggestions were observation of practical lessons, document analysis, and questionnaires, pre and post-test intervention. In agreement with Barnes (1985), the Researcher undertook unscheduled observation of some practical lesson organized by the biology teachers in the school, this gave the Researcher a clear picture of what happens during biology practical lessons in the school. A thorough examination of some documents related to the study was also done. The documents analysed included biology curriculum and materials such as text books and syllabuses.

Two types of questionnaires were designed: Appendix A contains questionnaire for the students, and Appendix B also contains questionnaire for the teachers, Appendix C contains pre and post-test intervention questions and appendix shows construction of improvised materials. Both sets of questionnaires were designed in such a way that they contained open -ended and close- ended type of questions. For the close – ended type of questions options were given and the respondents were asked to tick the answer which was applicable. With the open - ended type of questionnaires respondent were required to expressed their own kind of responses in spaces that were provided on the questionnaire.

Questionnaire items were constructed to afford answer to the research questions formulated to guide the study. The questionnaire consists of thirty-three (33) items structured to provide answers to the major research questions. The researcher chose a questionnaire, pre and post-test intervention instruments to enable the respondent feel convenient and easy to answer questions for accurate data to be collected.

3.7 Validity of the Instrument

According to Jopper (2000), validity determines whether the research truly measures that which was intended to measure.

The research instrument was validated by my Supervisor, University of Education, Winneba in the Biology Department, Head of Biology Department, Tepa Senior High School, Measurement and Evaluation Department, G.E.S Tepa in the Ahafo Ano North Municipality. They made the necessary corrections in the items and their input was incorporated in the final draft of the instrument. The final copy of the instrument after the validation was used for data collection.

3.8 Pilot Test

The questionnaire was pre-tested in a pilot test carried out at Mabang Senior High School in the Ahafo Ano North Municipality in the Ashanti Region of Ghana. The school was selected because it shares similar characteristics such us having large students' population and inadequate infrastructure and equipment with the selected schools. The pilot test enabled the researcher to restructure the questionnaire to help elicit the right responses. This is emphasized by Johnson and Christensen (2000), who stated that pilot – testing of instrument can reveal ambiguities, poorly worded questions, questions that are not understood, and check how long it takes participant to complete the test under circumstances similar to those of the actual study.

3.9 Reliability of the Instrument

A pilot study was required to determine the reliability of the test instrument. Reliability is a measure of how consistent and reliable a test is at measuring the same thing every time. The questionnaire was pre-tested in a pilot test carried out at Mabang Senior High School with Form Three biology students in Ahafo Ano North Municipality; 50 students were chosen at random. In terms of location and status, the chosen school was similar to those featured in the main study (form three biology students at Tepa Senior High School). Similarly, in terms of age, exposure to instructional resources, and biology learning, these chosen students are comparable to the subject of the study. The teaching facilities and environmental conditions for the students were similar to those featured in the main study. The students were tested and re-tested to determine the test instrument's reliability. The tests were carried out at two-day intervals. The Pearson product moment correlation formula method was used to calculate the test instrument's reliability. This resulted in an internal consistency result of 0.81, and this was compared with tabulated coefficient of the reliability according to Bryman and Cramer (2002) is

capable at 0.8, considered adequate in terms of the test instrument's internal consistencies indicating high reliability of the test instrument.

3.10 Data Collection Procedure

Quantitative data was collected through pre-intervention test and post- intervention tests to assess the academic achievement of the students. The pre- treatment test was administered before the improvised materials were introduced in the classroom, and the post- treatment test administered after the completion and use of the improvised materials. The test covered the basic concepts and principles of respiratory system, and the results was compared to determine the impact of the improvised materials.

Qualitative data was collected through interviews and questionnaires, document analysis with the biology teacher and the students. The questionnaires explored the advantages and limitations of improvised materials and how they can be effectively integrated into biology instruction especially teaching respiratory system. The interviews was transcribed, coded, and analyzed to identify common themes and patterns.

Respiratory system is one of the science topics which students find it difficult to understand especially, if teachers use lecture method to teach. The researcher is trying to find out from students and teachers on how this topic can be delivered well for students to understand.

In finding the effect of improvised materials on student performance, the researcher conducted pre-intervention test and post intervention test for 120 form three biology students for both control group (60 students) and experimental group (60 students) and The remarks were 0-4, below average, 5 average, 6-7 above average, 8-10 excellent.

3.11 Pre-Treatment

The students were pre-tested at the same time to determine their entry points with respect to the teaching of respiratory system. The test questions were sampled from the set of past questions (WAEC, 2022) and were significantly testing critical thinking and understanding of the content knowledge. The pre-treatment test consisted of 20 items. The test was administered to one hundred and twenty (120) students during the first week of the study. The duration was 20 minutes. These tests were collected and scored.

3.12 Treatment

Considering the performance of the students in the pre-test, improvised instructional materials of lungs, lower respiratory system was used to teach the experimental group reference Appendix D, to find out if improvised materials could serve as an alternative or in place of standard materials to enhance students performance. During the preparation of the improvised materials students were involved, at every stage, the

Activities were explained to the students and teachers, the various materials were gathered by the students and the researcher at week 1and 2 because some of them needed to be sanitized before used especially the empty bottles. At week 3, both teachers, students and the investigator started the whole process which ended at the week 5, and the were taught using the improvised materials. Reference Appendix D, showed the materials used and how the improvised materials were constructed.

3.13 Post-treatment test

A post-treatment test was carried out to assess the students understanding of the respiratory system after various improvised materials were used to teach the topic. The students were given tests on the topic. Twenty (10) different items were used for the post-test. The duration of the test was 20 minutes.

3.14 Data Analysis

The data was analysed using descriptive statistics (frequency, graphs, mean, median, and standard deviation) and inferential statistics (t-tests and ANOVA) to determine the effectiveness of the improvised materials on academic achievement. Paired sample t-test was used to compare two related samples (pre and post test conducted for the experimental group), Independent sample t-test was used to compare two sample which are unrelated (comparing the test score of control and experiment as different teaching were used to teach the respiratory system, experimental group, improvised materials were used whilst, the control group no material was used). The ANOVA was used to compared means of four test items (pre- test and post- test of control and pre and post-test of experimental). In statistical analysis, the degree of freedom represents the number of independent pieces of information used to calculate statistical parameter.

Df = n-1. The research questions used for the pre-test was 10 and also the post test was also 10, the degree of freedom was, 10 -1= 9.

Coding schemes were developed to organize the data meaningful and manageable categories. This involved the data obtained from the questionnaires. The data were later converted into frequency counts and simple percentages and used to answer the research questions addressed in the study. This study in keeping with current trends in the learning environment with regards to the classroom, used both qualitative and quantitative method in analysing the data that was collected Fraiser and Tobin (2022). This was done using statistical package for social and science (SPSS 23) version and Microsoft Excel Spreadsheet.

According to Fraiser and Tobin (2022), combining quantitative and qualitative methods of research provide multiple theoretical perspectives (observation and interpretive

methods) into education in general, and the classroom, in particular. The practice whereby a combination of qualitative and quantitative measures is included in a research study is generally accepted as enhancing the study Fraiser and Tobin (2022).

3.15 Ethical Consideration

Permission was sought from the Headmaster and the staff of Tepa Senior High School, and was granted. The purpose and the importance of the study was explained to the staff and students.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.0 Overview

This chapter presents the results gathered from the respondents on the questionnaire items and test. It also contains the discussion of various responses from the respondents.

4.1 Research Question One

What are the improvised materials available for teaching respiratory system?

Table 1: Views of Student on availability of improvised materials for Teaching respiratory system

Items Description	Yes	No
Ballons, straw, card board to construct how lung function	91.7%	8.3%
Total		100

According to Table 1: The research tried to find out from students if some common materials such as straw, empty bottles, balloon, cardboard, were available in their community for construction of improvised material on how the lungs function during respiration and also if teachers had been using them for teaching, as many as 91.7% confirmed that such materials were there in the community, but do not know the uses, and also had not come into contact with any lesson on respiratory system where teachers had used them, their teacher, demonstrate how respiration take place on the board but only a few of them 8.3% answered yes with the reason that they had seen some on the internet where it was been used for teaching. From the discussion, the research came into conclusion that, these materials and waste substance were available in the

communities but teachers are not using them for teaching especially respiratory system. Students were asked if their teacher had engaged them in construction of improvised material before, the results was tabulated in Table 1.

Table 2: Does your Teacher Engage you in Construction of Improvisation Materials

Response	Frequency	Percentage
Yes	13	10.8
No	107	89.2
Total	120	100

From Table 2, students were asked if teachers had engaged them in improvisation activities, and the responses from the students showed, only a few of the students, 10.8%, commented that, their teacher sometimes demonstrate on the Board how to use waste materials to construct certain items, but majority of them, 89.5% indicated, never involve in any such activities. The students were engaged in some construction activities in Appendix D, and it was realized, students does not even know how to construct some basic items like the funnel. Students were really happy and actually involved themselves and contributed to the lesson, when the post- test was conducted most of these participants scored above the average mark as against their counterpart who did not took part.

4.2 Research Question Two

What improvised materials are used by teachers to teach respiratory system?

Table 3: Views of Teachers on the use of Improvise Materials Support or Against

Response	Frequency	Percent
Yes	7	70.0%
No	3	30.0%
Total	10	100

From Table 3, It was found from teachers their views on the use of improvised materials and the reason why most of the teachers are not using improvise materials in the lesson delivery especially teaching respiratory system. Out of 10 teachers, 70.0% indicated that they are in support of the use of teaching materials in place of standard one as against the lecture method, however, some of them 3 out of 10 representing 30%, said they are against the use of improvised materials in place of standard one, their concerned was improvise materials confuse students, time wasting, and also does not represent the exact standard one. Though some few teachers who are not in support of the use of improvise had a point, but the research is align with those teachers who are positive, emphatically it is more appropriate to use improvise materials in the absence of standard one, since student learn best when they are involve in oriented activities than just abstract or teaching without any teaching material, especially teaching respiratory system in the classroom, what was observed, most of the teachers lack the technical ability to construct some basic improvise materials. It was also found from students their level of achievement when improvised materials were used compared to teaching without teaching materials, the results was tabulated in Table 5. ranking it as Highest, High, Low.

Table 4: Level of Academic Achievement of students on the use of improvise materials

Response	Frequency	Percentage
Highest	72	60.0
High	30	25.0
Low	18	15.0
Total	120	100

From Table 4, out of 120 students, 72 of them representing 60.0%, indicated that when lesson is taught using improvisation materials, their level of performance is highest, 25.0% also said that their level of performance is high, but only a few of the respondent, 15.0% emphasis that though they understand, but it makes lesson sometimes complicated as those materials does not look exactly like the original one. It was noted that, some teachers lack the skills, to build the improvise materials and sometimes it was also difficult to come by, some of these materials, where students have to buy with their own money, the Headmasters and the Head of the department especially Biology should provide workshops and in-service training by bringing qualify technical person to train their teachers.

4.3 Research Question Three

What are the effect of improvised materials on students' achievement in respiratory System

Table 5: Pre-treatment test for control group

REMARKS	FREQUENCY	PERCENTAGE
1-4 Below average	25	20.8%
5 Average	30	25.0%
6-7 Above average	5	4.2%
8-10 Excellent	0	0.0%
Total	60	100

From Table 5, the pre-treatment test conducted for the control group 30 out of 60 participants scored 5 marks, average representing 25.0% whilst 20.8% scored below the average marks of 1-4 and only a few of them 4.2% scored 6-7 marks above average, none of the students scored 8-10 marks.

Table 6: Pre-treatment Test for Experimental Group

REMARKS	Frequency	Percentage
1-4 below average	27	22.5%
5 Average	29	24.2%
6-7 Above average	4	3.3%
8-10 Excellent	0	0.0%
Total	60	100%

According to Table 6, 27 out of 60 students scored below the average mark 1- 4, representing 22.5%, whilst only 3.3% scored above average marks. Most of the students scored below the average marks, because the students were taught without any teaching materials, students did not get the concept. Investigation was conducted further to found out the suitable teaching material to use to address the abysmal performance of the students. Treatment was conducted for the experimental group by using improvisation material to construct some teaching materials out of waste materials to teach the respiratory system, reference Appendix D, and the control group lecture method was used no teaching material was used to teach the respiratory system, the reason was to find out the impact using the improvised material on teaching respiratory system.

Table 7: Post-treatment test for Control Group

Remarks	Frequency	Percentage
1-4 Below average	23	19.2
5 Average	34	28.3
6-7 Above average	3	2.5
8-10 Below average	0	0.0%
Total	60	100

Results of Table 7, indicates that, no teaching material was used, comparatively the number of students who scored below the average marks of 1-4 for both the pre and the post intervention were almost the same 25 and 23 representing 20.8%, 19.2% respectively. It could be deduced from the result; student did not perform well because teaching materials were not used. It was investigated further to found out if there was any improvement of the performance of experimental group, after treatment of improvised materials were used to enhance students' achievement.

Table 8: Post-treatment Results of Experiment Group

Remarks	Frequency	Percentage
1-4 Below average	7	5.8
5 Average	20	16.7
6-7 Above average	28	23.3
8-10 Excellent	5	4.2
Total	60	100

Data analysis according to Table 8, reviewed that, the post-treatment test, the experimental group tremendously did well compared to pre-treatment test, as 28 out of 60 students representing 23.3% showed improvement in achieved scored of above average marks of 6-7 as against the previous achievement where just a few of them 3.3% did well. This excellent achievement put up by participants, is an indication that, the treatment carried out was perfectly executed.

Table 9: Comparison of the results of Pre and Post-treatment test of Experimental Group with ten (10) test items using paired sample test

	Paired Sample Test							
	Mean	Std.Deviation	Std. error Mean	Lower	Upper	t	df	Sig
Pre-nt.Exp Post-int.Exp	-4.500	1.434	.453	-5.526	-3.474	-9.925	9	.000

From Table 9, the p-value = 0.000 less than the Alpha (α) value of 0.05, statistically, this an indication that there was tremendous improvement of the post treatment test as against the pre-treatment test, as indicated in Table 4 majority, 23.5% of the students scored above the average after the improvised material was introduced in the lesson as against only 3.5%. The treatment introduced actually had a positive impact which enhanced the students achievement of excellent results. Paired t-test was used because both the pre -treatment test and post -treatment test was conducted for the same class, (experimental group) the reason was to find out if there were improvement in students achievement after the improvised materials was introduced in the lesson. The question items used was 10 as indicated in Appendix C, so the frequency was also 10, and the degree of freedom was 9 (10-1). The questions was used to ascertained the student level of achievement of the respiratory system as most of the student scored the above average marks, to prove how best they had grasped the concept of the respiratory system.

4.4 Research Question Four

What are student attitude towards the use of improvised materials in teaching respiratory System?

Table 10: Positive Attitude Improve Level of Students achievement in Class when Improvised Materials are used compared to Lecture Method using Likert Scale

Responses	Frequency	Percent
Strongly Disagree	5	4.2
Disagree	17	14.2
Not Sure	10	8.3
Agree	8	6.7
Strong agree	80	66.7
Total	120	100

According to Table 10, responses from students if positive attitude improves students achievement in class using likert scale, 80 out of 120 students representing 66.7%, strongly agree that if students develop positive attitude in class such as interest, participation, contribution, avoiding truancy and many more, it improves students' performance. Only a few of them disagree, with a simple reason, though using improvised materials as an activity method of teaching had advantage, improving student attitude in class compare to the traditional lecture method of teaching, where teacher talk and student listen, but it is time wasting and teachers are not able to cover the syllabus which affect them in WAEC Exams. Upon critical analysis, it was realized that improvise materials used enhanced students' performance, and the research recommend to GES, to train teachers on how to develop simple improvise materials in place of standard one which will not waste time and still help the class room activities than teachers relying so much on traditional lecture method (teaching without using materials).

Table 11: Comparing student post-treatment test of Control and Experiment

Independent Sample Test

	F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Control	.557	.466	-11.578	17	.000	-4.911	.424
Experiment			-11.397	14.763	.000	-4.911	.431

According to Table 11, the results obtained, from the independent sample test indicates that the p-value which is 0.00 is lower than the Alpha value of 0.05, this shows that the treatment (improvisation) used for the experimental group sustained the students interest and the participation as they were allowed to do hands on activities in the lesson, 45 out of 60 students representing 23.3% scored 6-7 which was above an average mark, total mark was 10, as against their counterparts the control group whose scores was abysmal only a few of them 2.5% scored, above the average mark, their treatment was lecture method, where the teacher do the talking and students listened. This results from the researcher are an indication that when the right method is used by teachers in their lesson delivery especially respiratory system, students develop positive attitude towards the lesson and therefore enhanced students' achievement and participation in class, and also serve as an antidote to truancy as they are always happy to be in class.

Table 12: Positive attitude in line with Improvement of students Achievement

	N	Test items	Mean	Std. Deviastion	Std. Error Mean
Control	60	10	3.20	.789	.249
Experiment	60	10	9.11	1.054	.351

From Table 12, the data analysis indicates the mean score between the control and the experimental group after the treatment was introduced. There was satisfactory achievement in the post-treatment test result when the treatment was provided. The experimental group had a mean score of 9.11 whilst the control mean scored was 3.20, in average most of the participant in the experimental group had an above average score of 6-7, pass mark, however, only a few of the respondent of the control scored above the average mark. The good achievement showed by the experimental group could be attributed to the improvisation treatment introduced, where students positively involve themselves in the activities, through hands on practice, interest, participation and contribution.

Table 13: Effective improvised teaching materials on students' attitude that enhance achievement in respiratory system.

	Sum of Squares	Df	Mean Square	F	Sig.
Between G	219.300	3	73.100	66.121	0.00
Withing G	39.800	36	1.106		
Total	259.100	39			

From Table 13, the researcher compares improvised materials that were used throughout this research, statistically there was significance difference when the improvised materials were used, as ANOVA analysis, indicates the p-Value = 0.000 lower than Alpha Value of 0.05, pre-treatment test, when no teaching materials were used for the control group the test results showed that 20.8% scored below the average mark, for the experimental group 22.5% also scored below average, when the treatment was introduced, the outcome of the post-treatment test indicates that 23.3% scored above the average mark, the pre and post-treatment test results for the experimental group is obvious since the same students took the pre and post- treatment test but the

only difference was the activity-oriented method used during the treatment, this was a proved that activity-oriented method had positive impact on students attitude, makes lesson enjoyable, sustain students interest and participation, improve achievement.

4.5 Discussion

According to Jokiranta (2014), the factors that influence learning outcomes include interest and learning motivation of students, as well as the state of the social environment this is in line with the experimental group when the students were introduced to the activities-oriented method where they were able to construct an improvised material on how the lung function in Appendix D, most of the students scored above the average mark as indicated in Table 8, however, the results obtained from the pre-treatment and post-treatment test, clearly showed that there was no difference between the control and the experimental group test results as 25.0% of the students scored average marks of 5 almost similar to their counterpart in the experimental group 24.2%, this is because the same teaching method had been used to teach respiratory system by their teachers, this confirmed to Serwaa (2007), most teachers despite the role that practical work played in arousing the interest of students during learning, neglected its uses in their teaching due to factors such as time constraints, lack of laboratories, overloaded curriculum, large class sizes and inadequate resource. According to Table 8, when treatment was provided for the experimental group where improvised materials was used to deliver lesson on respiratory system as against the control group, lecture method was introduced as an intervention, the experimental group significantly enhanced their achievement, as 23.3% scored above the average marks indicating excellent results, whilst only a few, 2.5% of control group attained the above average marks this is in connection with Carin and Bass cited in Eminah (2009) opined that science is a subject that is best learned

through practicals. Literary approaches to the teaching of the subject cause the learners to be deficient in the processes of science. The excellent outcome of the experimental group is in line with the good intervention carried out by the teacher, which raised the students' interest and confidence to fully participated in improvised activities of the lesson, respiratory system. According to Anni (2007), learning outcomes are influenced by internal and external factors. Internal factors can influence the process and learning outcomes including physical conditions (the health of body organs), psychological conditions (emotional intellectual abilities), and social conditions (ability to socialize with the environment). With reference to Table 10, 80 out of 120 students representing 66.7% strongly agreed that the used of improvised materials compared to lecture method of teaching enhance student performance in biology this is in consistent with previous findings of the Nuffield (2022), encouraging students to pursue their own enquires taps into their natural curiosity; finding things out of yourself through your own effort appears natural and defensible, additionally, Mary (2022), explained that group work during practical is a pervasive and influential feature of the classroom ecosystem which must be encouraged in the teaching and learning of biology in the senior high schools. According Table 2, majority of the students, 89.2 % said, teachers do not engage them in construction and use of improvised materials in teaching biology most specially respiratory system but rather result to lecture method, this is one of the main problems while Tepa Senior High biology students, most of them are not doing well especially in their WASSCE Exams, this is in reality, as confirmed in Antwi (2000), who found out that biology teachers did not conduct practical work especially at the lower levels of study but only engage in practical work with students when they are in form three and are preparing for their final examination similarly, Zarewa (2005), in his research, revealed that students taught with improvised materials performed

better than those taught without such materials in teaching some component in physics. He cautioned that, often teachers use teacher-centered instructional techniques and assign work to unmotivated students while more motivated students perform hand-on activities and are given assignment involving problem solving. Teachers and students attitude towards improvisation, in Table 12, the p-Value = 0.000 less than the Alpha (α) value of 0.05, statistically, this an indication that there was tremendous improvement of the post intervention test as against the pre-intervention test, the achievement was attributed to the treatment introduced which actually had a positive impact enhanced the students achievement of excellent results when the improvised materials were introduced, this is in connection with Ahmed (2008), the use of improvised materials in teaching and learning especially respiratory system makes the concept more practical and subsequently reduces abstraction, again they are cost effective, because they could be obtained from the local environment, additionally, Adeniran (2006), the improvisation process of instructional materials makes students exposed to creativity, innovation, imagination and curiosity, which are essential to science teaching and learning of respiratory system.

CHAPTER FIVE

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

5.0 Overview

The final chapter of the study has been used to present the summary of findings in relation to the statement of problem and the literature review. Recommendations and suggestions were also offered to improve upon the effective use of improvisation materials to enhance students' achievement of biology at the Senior High School especially Tepa Senior High.

5.1 Summary of Findings

The use of improvisation to enhance students' achievement was paramount in Tepa Senior High School as the research came out with the following findings though, the school has a biology laboratory, the school have inadequate standard practical materials for practical lessons, lack of skills for improvisation among most teachers of Tepa Senior High School, inadequate biology laboratories, used of laboratories for classroom because of large school population and inadequate classrooms.

The researcher found out, when the improvised materials was used in place of standard one due to inadequacy, the students' performance was excellent as indicated in Table 8. From discussion according to Table 8, reviewed that, the post-treatment test, the experimental group tremendously did well compared to pre-treatment test, as 28 out of 60 students representing 23.3% showed significance improvement scored above average marks of 6-7 as against the pre-treatment scores where just a few of students 3.3% did well. The findings, as we could see from Table 8, clearly shows students achievement when the improvised materials were used as against the teaching without

teaching materials. The findings had demonstrated that even if there is insufficient standard equipment for practicals, teachers are encouraging to use improvised or local materials rather than lecture method to enhance student's classroom participation and involvement in lesson which leads to high retention ability.

5.2 Students' attitude towards the use of improvised materials in teaching respiratory system

The findings, came out with the following observation during one of the classroom lessons:

When the teacher used lecture method (teaching without materials) of respiratory system instead of activity oriented:

1. The class was boring, as indicated in students' attitude, that is sleeping, noise making, lack of concentration, frustrated teacher as he tries to control the class.
2. Lack of understandings, as most students gave wrong answers
3. Some of the students were roaming about, as they seek permission to go out.

When intervention was provided in Appendix D, student attitude changed as they were asked to practice on their own with some improvised materials. When students were asked if the use of improvised material compare to lecture method develop positive attitude in students.

According to Table 8, the research found out from students if positive attitude improve students understanding in class using likert scale, 80 out of 120 students representing 66.7%, strongly agree that if students develop positive attitude in class such as interest, participation, contribution, avoiding truancy and many more, it improve students understanding and high retention ability. The findings are in line with Nuffield (2022), encouraging students to pursue their own enquires taps into their natural curiosity;

finding things out of yourself through your own effort appears natural and defensible, this helps students develop positive attitude in class and develop interest in classroom environment.

5.3 The use of improvised materials by teachers to teach respiratory system?

The researcher, find out from students if their teachers have been using improvised materials as substitute for laboratory practicals as results of ill-equipped laboratory in the school. According to Table 2, 107 out of 120 students, representing 89.2% answered negative, saying their teachers do not always engage them in construction and use of improvised materials for teaching but rather use the traditional talk and chalk method, lectures, where the teacher only do the talking, writing on the board, as students listen and copy respectively, only 13 out of 120 students representing 10.8% answered affirmative, indicating positive, their teachers always use the improvised materials in their environment in lesson delivery with mere reasons that, the teacher mention some materials as an examples, which are common in their community. After discussion, the following were the findings for the above objective. Equipment and facilities available at the biology laboratory were not appropriated for practical lessons. It was however found that it was only during WASSCE that a lot more of specimen, chemicals and regents are procured for practical. Another finding was that equipment and facilities at the laboratory were not enough. This led to practical activities being organized in groups rather than individualized. This does not lead to individual specialisation of practical activities at the laboratory. Another finding was that due to the insufficient laboratory equipment and facilities teachers mostly adopted the lecture method, and to some extent whole class demonstration method. The preference of the students was that of activity-based method in order for them to get hands-on experience with practical activities. From Table 11, it came out from the teachers that most of them are not using

improvise materials in the lesson delivery especially teaching respiratory system. Out of 10 teachers, 70.0% indicated that they are in support of the use of teaching materials in place of standard one as against the lecture method, however, some of them 3 out 10 representing 30%, said they are against the use of improvise or local materials in place of standard one, their concerned was improvise materials confuse students, time wasting, and also does not represent the exact original standard one.

Though some few teachers who are not in support of the use of improvise or local materials have a point, but the researcher is align with those teachers who are positive, emphatically it is more appropriate to use improvise or local materials in the absence of standard one, since student learn best when they are involve in oriented activities than just abstract or lecturing especially teaching respiratory system in the classroom, from the findings from the teachers, some of the reasons why, they are not using improvised materials were.

1. lack of the technical ability to construct some basic improvise materials.
2. The improvised materials are not exactly the same as the original material.
3. Some improvised materials are expensive than the standard one.

From the findings, G.E.S, should provide in-service training for teachers to at least develop their skill, to build basic improvise items using local materials example, the funnel, aspirator, catching net and many others.

5.4 Availability of improvised materials for teaching respiratory system

The researcher tried to find out from students if some common local materials or improvisation materials are in their community and can relate to various topic in Biology especially teaching respiratory system. According to table 1, it was discovered that out of 120 students 91.7% admitted that those materials such as straw, empty

bottles, ballons, cardboard were common in their community and their teachers had been mention them but had never been used to construct any improvised material for teaching respiratory system, however 8.3% of the students said sometimes teachers demonstrate on board how respiration take place on the board. The researcher guided some teachers and students to construct some improvisation materials, using waste materials such as straw, empty bottles, balloons, cardboard, constructed some improvised materials for teaching and learning of respiratory system. The process of how these materials were constructed was indicated in Appendix D. After the improvisation material was constructed students and teachers were educated:

1. Some students and teachers developed improvisation skill on how to construct basic teaching materials for respiratory system.
2. Improvisation reduced stress students go through during respiratory system lessons and enhanced students understanding
3. Waste materials used for the construction of improvisation materials assemble in the environment, which help to reduce pollution and dirt in the environment.
4. Improvisation is cheaper compares to the use of standard materials, as waste materials are abundant in the environment.

5.5 Conclusions

The findings of the study enhanced the student's achievement as against teaching without any teaching materials in teaching and learning of respiratory system. The findings again confirmed that, no meaningful assimilation can be made in the teaching and learning of respiratory system without activity-oriented. On the issue of attitude, students develop positive attitude towards the use of improvisation materials, research findings of the study confirmed that, attitude can be altered should all the necessary equipment and facilities be provided. The absence or lack of it may induce a negative

attitude of students towards a subject, and there is the need of teachers to improvised in place of standard one.

5.6 Recommendations

Based on the research findings, the study recommends the following:

1. Teachers of Tepa Senior should be trained on how to at least construct basic improvisation materials.
2. More equipment and facilities should be secured for Tepa Senior High to ensure individualised practical activities.
3. Management of Tepa Senior High School should ensure that teachers avoid lecture method, and in place of inadequate standard teaching materials, improvised to enhance students understanding especially in respiratory system.
4. Ghana Education service should ensure lecture method is minimize in lesson delivery at Tepa Senior High School, motivate teachers to develop interest in improvisation by given some allowance.

5.7 Suggestions for further studies

Since Society continues to be dynamic with continuous changes in Societal needs, there is always the need for further research to be conducted into many aspects of education at all levels to meet the aspirations of Society. It is therefore recommended that:

1. Research should be conducted to find out whether formation of Science Clubs in the various Schools could help develop students' interest in improvisation in a form of competitions, for students to demonstrate their crafts or skills.
2. Study should be conducted to find out whether gender has any influence on improvisation as these materials are assemble from the environment.

3. Research should also be conducted on importance of improvisation in reduce waste in our environment.
4. Studies should also be conducted to find out the influence of teacher qualification and area of specialization on construction of improvisation materials.

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APPENDIX A

UNIVERSITY OF EDUCATION, WINNEBA

QUESTIONNAIRES FOR STUDENTS

The study is purely meant for academic purposes. You will be contributing to its success if you answer the items as frankly and honestly as possible. Your responses will be kept confidential.

Kindly read through each of the items carefully and indicate your opinion.

Please tick [✓] the appropriate bracket or column or fill in the blank spaces provided where possible.

1. Do you have improvised materials in your school?

   (a) Yes [ ] (b) No [ ]

2. (i) If yes to [1], is the improvised materials the same for all the elective sciences

   (a) Yes [ ] (b) No [ ]

   (ii) If no to [1] above, where do you normally have your improvised materials from?

   (a) Community [ ] (b) Farm [ ]

   (c) Market [ ] (d) Not at all [ ]

3. How often are improvised materials used for biology, physics, chemistry conducted in your school laboratories?

(a) Once a week [ ] (b) Twice a week [ ] (c) Thrice a week [ ]

(d) Sometimes [ ] (e) Not at all [ ] (f) Specify others (if Any……

……

……

4. Who normally prepare improvised materials?

The……

……..……

(a) The biology teacher [ ] (b) Lab. Technician [ ]

(c) Lab. Assistant [ ] (d) Headmaster [ ].

5. Is your school laboratory equipped with materials necessary for WASSCE practical work? (a) Yes [ ] (b) No [ ]

6. If yes to (5) above how is it equipped?

(a) Very adequate [ ] (b) Adequate [ ] (c) Inadequate [ ]

7. Are these materials enough for effective teaching and learning during practical lessons?

(a) Yes [ ] (b) N o [ ]

8. Are the equipped and apparatus adequate to go round all during practical work?

(a) Yes [ ] (b) No [ ]

9. If you say No to item (8) above, then what do you normally do in such situation?

……

……

10. How are available teaching materials used during practical lessons?

(a) Individually [ ] (b) In group [ ]

(c) Whole class demonstration [ ]

11. Do you think there are other important equipment and facilities that should have been provided but are not available in the laboratory?

(a) Yes [ ] (b) No [ ]

12. If Yes to item (11) above, please list them

……

……

13. How often does the school authority provide / supply the laboratory with materials?

(a) Very frequent [ ] (b) Frequent [ ]

(c) Not frequent [ ] (d) Not frequent [ ]

14. Do the school authorities provide local materials for preparation of improvisation materials?

(a) Yes [ ] (b) No [ ]

15. What makes you think so? Give reasons

……

……

16. How many period(s) is / are allocated for practical work in your school?

0 [ ] 1 [ ] 3 [ ] 4 [ ]

17. Do your teacher allow you to gather local materials for improvisation?

(a). Yes [ ] (b). No [ ]

18. Do your laboratory assistant assist you during preparation of improvisation materials?

(a). Yes [ ] (b). No [ ]

19. Are your teachers always present during preparation of improvisation materials?

(a). Yes [ ] (b). No [ ]

20. If No to (19) what do you do when you have difficulty?

……

……

21. Which methods of teaching have your teachers been using during practical lessons?

(a) . Activity- oriented [ ] b. Lecture [ ]

22. Which of the method will you consider as the best for teaching and learning of biology practical?

(a). Activity oriented (b). Lecture

(c). Demonstration (d). Specify if any

……

……

(23). Do you like using improvisation materials?

(a). Yes [ ] (b). No [ ]

ii). Give reasons for your answer in (23) above

……

……

(24). i) Do you perceive that preparation of improvisation materials is a waste of time?

(a). Yes [ ] (b). No [ ]

(25). ii) Give reasons for your answer above

……

….

26). Are there other facilities and equipment that you feel should be use other than standard equipment in case of it is absent?

a). Yes [ ] (b). No [ ]

27). If your answer to (26) is yes, what are these equipment and facilities? Specify……

……

28). Every human endeavor is bound to meet problems. What problems do you often encounter during preparation of improvisation materials? Specify such problems in the space provided below

…….

……..

……..

29). Do you think usage of improvisation materials will improve upon student's performance?

a). Yes [ ] b). No [ ]

30). Would improvisation enhance students performance in Biology?

a). Yes [ ] b). No [ ].

31). If Yes or No to question (30) Explain your answer?

……

……

……

32). Are the equipment and facilities in the laboratory appropriate for practical work?

a). Yes [ ] b). No [ ]

33). What type of practical work do you often perform in your school laboratory?

Tick as many as possible.

a). Drawing [ ] b) Food test [ ]

c). Analysis [ ] d). Identification & Classification [ ]

APPENDIX B

UNIVERSITY OF EDUCATION, WINNEBA

QUESTIONNAIRE FOR TEACHERS

The study is purely meant for academic purposes. You will be contributing to its success if you answer the items well. Your responses will be kept confidential. Kindly read through the questionnaire and give your opinion.

General instruction

Please tick [/] the appropriate bracket or column or fill in the blank spaces provided where applicable.

1. Do you have available local materials for improvisation in place of absences of standard equipment for practicals?

a). Yes [ ] b). No [ ]

2. i) If yes to [1] , is the improvisation materials the same for all the / elective Sciences ?

a) Yes [ ] b) No [ ]

ii) If no to (1) above , where do you normally have your improvised materials from

a) Community [ ] b) Farm [ ]

c) Market [ ] d) Not at all [ ]

3.How are the available teaching materials use during practical lessons?

a) Individually [ ] b). In groups [ ] c) Whole class demonstration [ ]

4). Do you support with the use of improvisation materials in place of standard one

a). Yes [ ] b). No [ ]

5). If Yes or No to (4) give your reasons

……

……

6). How many students do you have in your class?

……

7). Does the number of students in your class promote effective teaching and learning during practical lessons?

a). Yes [ ] b). No [ ]

8). Give reasons to your answer provided above?

……

……

9). Do you have laboratory technician in your school to assist you during preparation of improvisation materials?

a) Yes [ ] b) No [ ]

10). What type of practical work do you often perform in your school laboratory?

Tick as many as possible

a) Drawing b). Identification and classification c). Food test

d). Specify other if any…….

11. Which method of teaching have you been using during practical lessons?

Tick as many as possible

a). Activity oriented b). Lecture c). Demonstration d) Specify if any……

12). Which of the following skills do you often teach during practical lessons? Tick as many as you have been instilling in your students. Skills of

a). Drawing [ ] b). Observing [ ] c) Analysing [ ]

d). Manipulating [ ] e). Recording [ ] f). Inquiring g) Interpreting [ ]

h). Specify if any ……

13). Every human endeavour is bound to meet problems. What problems do you often encounter during preparation of improvisation materials?

……

……

14). How do you think such problems could be solved to improve upon the use of improvisation materials in the absence of standard equipment to enhance teaching and learning of Biology?

……

……

……

15). Do you think organising local material for improvisation are difficult and mere waste of time?

a). Yes [ ] b). No [ ]

16). Do lab technicians assist you during preparation of improvisation materials?

a). Yes [ ] b). No [ ]

17). Would reduction in class size promote effective practical work?

a) Yes [ ] b) No [ ]

18). Do you think allotting enough time for practical session will improve students' performance? a) Yes b) No

19). How do students perform during test of practical lesson?

a) Excellent [ ] b) Good [ ] c) Below average [ ]

20) Do students see practical work as waste of time?

a). Yes [ ] b). No [ ]

21. If Yes to (20) above give reasons?

……

……

22. How often are biology practical lessons conducted in your school laboratories?

a). Once a week [ ] b). Twice a week [ ]

c). Thrice a week [ ] d). Sometimes [ ]

e). Not at all [ ] f). Specify if any other

……

……

23. Who normally organizes improvisation materials lessons?

a). Teacher [ ] b). Lab Technician [ ]

c). Class prefect [ ] d). Specify if any other……

24. Is your School Laboratory equipped with materials necessary for WASSCE practical work? a). Yes [ ] b). No [ ]

25. If yes to (5) above how is it equipped?

a). Very adequate [ ] b). Adequate [ ] c). Inadequate [ ]

26. Are these materials enough for effective teaching and learning during practical lessons?

a). Yes [ ] b). No [ ].

27. Are the equipment and apparatus adequate to go round all students during practical work?

a). Yes [ ] b). No [ ]

28. How many period(s) is / are allocated for practical in your School per class?

SHS 1 0 [ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ].

SHS 2 0 [ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ].

SHS 3 0 [ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ].

29. Do the School authorities support you to prepare improvised materials?

a). Yes [ ] b). No [ ]

30). What makes you think so? Give reason (s)

……

APPENDIX C

PRE-TREATMENT TEST

1. All the following processes occur during inspiration in human body except
   A. The contraction of the diaphragm muscles
   B. The contraction of the intercostal muscles
   C. The increase in the volume of the chest cavity
   D. The increase in the volume of the lungs
2. Exhaled air may readily put off a burning candle because it contains high level of
   A. Oxygen and nitrogen
   B. Nitrogen and heat
   C. Heat and oxygen
   D. Carbon dioxide and moisture
3. Which of the following structures has mucus and celia for trapping dust and germs
   A. Alveolus b. Bronchiole
   c. Bronchus d. Trachea
4. Exchange of gases in plants occurs mainly through the
   A. Buds B. Cuticle
   C . Epidermal cells D. Stomata
5. Surface used for gaseous exchange in mammals characteristically have
   A. Thin walls with small surface area
   B. Moist and small surface area
   C. Moist surface and well supplied with blood vessels
   D. Large volume and well supplied blood vessels

6. Which of the following is true about anaerobic respiration?

   A. Carbon dioxide and water are produced

   B. Oxygen gas is released

   C. Oxygen gas is used up

   D. Glucose is broken down

7. In order for inhalation to take place

   A. The rib cage must be lowered

   B. Muscle of the diaphragm must be relaxed

   C. Pressure in the lungs must be reduced

   D. The volume of the thoracic cavity must be reduced

8. The alveoli are very efficient in the exchange of gas because they

   A. Arise from bronchioles

   B. Are highly vascularized

   C. Are terminal

   D. Are small in size

9. The bronchi in the lungs divide into smaller branches which end in tiny sacs called

   A. Alveoli B. Bronchioles

   C. Spiracles D. Tubules

10. The structure that covers the opening of the trachea during swallowing and prevents food from entering it is the

A. Epiglotis B. Lungs

C. Pharynx D. Rib cage

POST-TREATMENT TEST

1. The correct path of air- entering the lungs through the nostrils of a mammal is represented as A. Glottis- trachea – bronchi – bronchioles- lungs

B. Trachea – glottis – bronchi – bronchioles – lungs

C. Bronchi – Trachea – glottis – bronchioles – lungs

D. Bronchioles – bronchi – trachea – glottis – lungs

2. Anaerobic respiration can be employed in industry in the

A. Brewing of bear B. Manufacturing of linen

C.Gas welding D. Making soap

3. A feature of anaerobic respiration that differentiate it from aerobic respiration is the

A. Production of a lot of energy

B. Requirement of oxygen

C. Occurrence in the cytoplasm

D. Production of carbon dioxide and water as a by product

4. Which of the following statement about anaerobic respiration is correct

A. Carbon dioxide and water are produced

B. Oxygen gas is released

C. Oxygen gas is used up

D. Glucose is broken down

5. All the following processes occur during inspiration in human body except

A.The contraction of the diaphragm muscles

B.The contraction of the intercostal muscles

C.The increase in the volume of the chest cavity

D.The increase in the volume of the lungs

6. Exhaled air may readily put off a burning candle because it contains high level of

   A. Oxygen and nitrogen

   B. Nitrogen and heat

   C. Heat and oxgen

   D. Carbon dioxide and moisture

7. Which of the following structures has mucus and celia for trapping dust and germs

   B. Alveolus b. Bronchiole

   d. Bronchus d. Trachea

8. The rate at which green plants release carbon dioxide during the night is higher than during the day because

   A. Light inhibit respiration

   B. Stomata are closed during the day

   C. Darkness is required for respiration

   D. The carbon dioxide produced during the day is used up.

9. Combustion of organic fuels increases the

   A. Inert gas in the air

   B. Carbon dioxide content in air

   C. Oxygen content in the air

   D. Nitrogen content in the air

10. In order for inhalation to take place

   A. The rib cage must be lowered

   B. Muscle of the diaphragm must be relaxed

   C. Pressure in the lungs must be reduced

D. The volume of the thoracic cavity must be reduced

PRE-TREATMENT TEST ANSWERS

1.D	2. D	3. D	4. D	5. C
6. D	7. C	8. B	9. A	10. A

POST – TREATMENT TEST ANSWERS

1. A	2. A	3. C	4. D	5.D
6. D	7. D	8. D	9. A	10. D

APPENDIX D

PROCESSES IN THE CONSTRUCTION OF IMPROVISED MATERIALS FOR TEACHING AND LEARNING OF RESPIRATORY SYSTEM.

Plate 1: Assembling of materials for construction.

Plate 2: Researcher guides students to improvised material on how the lung function

Plate 3: Demonstration on how lungs function

Plate 4: Demonstration how lungs function breathing

Plate 5: Construction of lower respiratory system

Plate: 6 Researcher guide students to identify various part of respiratory system

Plate 7: Teacher involves students to construct Inhalation and exhalation improvised material.

Plate 8: Students construction of inhalation and exhalation of lungs improvised material

Plate 9: Some teachers involve in construction activities

Plate 10: Students demonstration of how inhalation and exhalation take place using improvised material

Plate 11: Final stage of the hand on activities and improvised created.

SUMMARY OF HOW THE IMPROVISED MATERIALS CONSTRUCTED

BREATHING PROCESS

MATERIALS USED WERE

Bottle, ballons, straw,

PROCEDURE

1. Cut the bottom off a plastic bottle.

2. Attach a ballon over the bottle mouth, so it hangs inside.

3. Fix a straw through the bottom top and attach 1 or 2 ballons to the end inside the bottle.

OBSERVATION

Pulling the plastic bags or ballon down causes the ballon to inflate, pulling the bags up cause the ballon to deflate

The ballon represents the lungs, the plastic bag represents the diaphragm, the bottle represents the thoracic cavity, the straw represents the oesophagus.

Pulling the plastic bag or ballon down causes an expansion of the cavity which cause the ballon to inflate and pulling the ballon up reduces the volume which cause the ballon to deflate.

Materials for construction of respiratory system are

Cardboard, colour, pencil.

Teacher showing parts of respiratory system to students

Parts of the lower respiratory system are

1. Trachea
2. Right primary bronchus
3. Left primary bronchus
4. Brochioles
5. Left lung
6. Right lung