UNIVERSITY OF EDUCATION, WINNEBA

USING COOPERATIVE INSTRUCTIONAL APPROACH TO IMPROVE TEACHING AND LEARNING OF RESPIRATION AMONG FORM 2 HOME ECONOMICS STUDENTS IN PRESBYTERIAN GIRLS SENIOR HIGH SCHOOL, ODUMASE-KROBO

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

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CHAPTER ONE

INTRODUCTION

1.0 Overview

The chapter focuses on the background to the study, statement of the problem, purpose and objectives of the study, research questions, hypothesis, significance of the study, delimitation, limitations to the study and organization of the study.

1.1 Background to the Study

The interest of Senior High School (SHS) students towards the study of science has declined in many countries across the globe including Ghana. On the 14th-15th of November, 2005 member countries of organization for Economic Co-operation and Development (OECD) met in Amsterdam to discuss the Declining Students Enrollment in sciences and technology, and suggested that graduates turn out in the sciences in some member countries showed a drop of 30%-50% over the last 8-10years. West African Examination Council (WAEC) 2008-2015 at the SHS level, suggests that most students perform poorly in biology because they have difficult learning some biology concepts, such as respiration. This is because biology is taught by most teachers in an abstract manner without any teaching and learning materials which in most cases are readily available in our environment, making some of the concepts seem complex and confusing for students. Finley, Steward and Yarroch (1982) have shown that photosynthesis, cellular respiration, protein synthesis, Mendelian genetics mitosis and meiosis, were difficult and important

topics for students to learn. Anderson, Sheldon and Dubay (1990) have also indicated that respiration and photosynthesis are difficult for students to learn. Again, Abimbola (1998) has noted that a concept like physiology is mostly abstract and involve many processes that require better explanation to enable students understand them. Tekkaya, Ozcan and Sungur (2001) have attributed the possible sources of student's difficulties in learning some biology concepts to, among others, the SHS biology curriculum and the teaching-learning strategies employed by some teachers. The traditional teaching-learning strategies employed by some biology teachers are mainly to blame for student's difficulty and their poor performance there off in biology at all levels of science education. That is, feeding learners with information into promoting intellectual development which was the subject for public discussion in the 1980's (Arhin & Asimah, 2006).

An understanding of how students learn can help teachers to devise effective strategies for teaching. This requires research into the learning difficulties, to be made accessible (Cawley, Hayden, Cade & Baker-Kroczynski, 2002). For learners to retain and comprehend knowledge, it must be placed in a conceptual framework (Slavin, 1995) based on sound knowledge theory and research. Two prominent perspectives on learning and knowledge acquisition are the behaviourist and the constructivist. To the behaviourist education is the establishment of behaviour which will be advantage to the individual and to others at some future time (Skinner, 1954). To the constructivist, learning occurs as learners are activity involved in a process of meaning and knowledge construction as approved to

passively receiving information. Learners are the makers of meaning and knowledge.

Meaningful learning requires active involvement and inquiring, problem solving reflection, interaction and cooperation on the part of the teacher and learners. Knowledge is internalized and framework established when social discourses takes place. This discourse leads to the conceptual framework which relate to the new knowledge (Bruffee, 1992).

Cooperative learning is one of the most remarkable and fertile areas of theory research and practice in education (Johnson, Johnson & Stanne, 2000). Cooperative learning exists when students work together to accomplish shared learning goals (Johnson, 1999). Cooperative learning activities instilling learners important behaviours that prepares them to reason and perform in an adult world (Adams & Hamm, 1996; Marzano, Pickering, & Pallock, 2001). Attitudes and values of learners are formed through social interaction. Observation reveals that the approach currently being used to teach and learn biology in some Senior High Schools, is most often based on classrooms and laboratory work, which are intended only to meet examination requirements. It is of this and many other reasons that this research was conducted to find other methods that make the teaching and learning of biology concepts for example respiration more meaningful such as cooperative learning.

1.2 Statement of the problem

Several studies have shown the importance of respiration concept because of its direct link to life. In Ghana, teaching sciences in SHS generally appears to be through lecturer notes-giving and taking, chalkboard illustrations, demonstrations and other teacher centered methods which enable students to only form mental models of concepts presented to them. This method of presentation of concepts may lead to loss of interest in learning, as students tend to forget easily what they learn. Also, since it is the same monotonous of only teachers doing the talking and learning, the enthusiasm to learn is absent. Science subjects, especially Biology, tend to be the most affected since most of the concepts presented are abstract and also requires the student to put in a lot of effort in forming mental models to aid understanding. The perceived nature of Biology and its big and long terminologies make students shy away the subject. In most cases, they regard Biology as a difficult subject. Another factor related to the way biology is taught is lack of relationship between the topic and daily lives as environment.

During the researcher's years of teaching and examining students, she realized that students do not have better understanding of some biology concepts they are been taught but rather had to resort to note-learning for only examination and not for life as it supposed to be. Koc (2005), stated that teachers need to use variety of teaching activities in their classrooms, and that the variety should include cooperative learning. To Koc (2005), the use of cooperative instructional technique as a teaching

strategy enables students to have a clearer idea of the biological concepts been taught and to get the understanding. It is against this background that the researcher undertook this action research to improve the teaching and learning of respiration among SHS 2 Home Economics Students of Presbyterian Girls SHS in Odumase - Krobo.

1.3 Purpose of the study

The purpose of this study was to use cooperative instructional approach to improve the teaching and learning of respiration among SHS form 2 Home Economics Students of Presbyterian Girls SHS in Odumase - Krobo as against individual learning in Odumase Krobo.

1.4 Objectives of the study

The following are the objectives of the study:

1. To find out the effect of (STAD) cooperative instructional approach on SHS form

   2 biology students 'achievement in respiration in Presbyterian Girls SHS in Odumase - Krobo.

2. To determine if any significant difference exists in students' achievement when exposed to STAD cooperative and individualized approaches to teaching and learning of respiration in Presbyterian Girls SHS in Odumase - Krobo.

3. To find out student's perception and attitudes toward the use of cooperative and individualized approaches to the teaching and learning of respiration among SHS form 2 Home Economics Students of Presbyterian Girls SHS in Odumase - Krobo.

1.5 Research questions

The study sought to provide answers to the following research questions:

1. What is the effect of (STAD) cooperative instructional approach on SHS form 2 biology students' achievement in respiration in Presbyterian Girls SHS in Odumase - Krobo?
2. What differences exist in students' achievement when exposed to (STAD) cooperative and individualized approaches to teaching and learning of respiration in Presbyterian Girls SHS in Odumase - Krobo?
3. What are student's perception and attitudes toward the use of cooperative and individualized approaches to the teaching and learning of respiration in Presbyterian Girls SHS in Odumase - Krobo?

Null Hypothesis

HO_1: Students taught using the Individual approach will show improved performance than students taught using the STAD approach.

1.6 Significance of the study

The study would provide empirical evidence that cooperative learning improves understanding of concepts such as respiration in Biology. It would also provide an insight into the effect of cooperative learning on SHS students' attitudes and motivation towards learning biology as well as their perception about the benefits of peers and cooperation in their academic achievements. For the fact that majority of students, who are direct beneficiaries of teaching, preferring cooperative means a lot to education policy makers. This could provide guidance for policy makers and stakeholders in Science education when revising curricula in Science biology. Findings of the study would contribute to the body of knowledge as it provides evidence needed to justify whether to adopt cooperative instructional learning strategy in Ghanaian SHS, or continue with the widely used individual learning instructional strategy in teaching (biology) science concepts. It would also serve as basis reference document for further research work.

1.7 Limitation

Although this research was carefully prepared, there were some unavoidable limitations. The first limitation was the sample size. Generally, sample size should be large in order to make a valid general conclusion. However, the sample size in this study was only restricted to seventy-two (72) SHS form 2 students. Therefore, the sample size was too small in order to make a general conclusion on the study.

1.8 Delimitation of the Study

The scope of this study was restricted to only Presbyterian Girls SHS students in Odumase-Krobo, in Lower Manya Municipality in Eastern Region of Ghana. This study was also delimited to only SHS 2 Home Economics students who offer biology as an elective subject. The study was additionally delimited to an aspect of biology focusing on respiration in the SHS elective biology syllabus (section five, unit four, pp, 33-34).

1.9 Definition of Terms

Attitude: Refers to positive or negative feeling or mental state of readiness learned and organized through experience that exerts specific influence on a person's response to people, objects, and situations.

Cellular respiration: It is a set of metabolic reactions and processes that take place in the cells of organisms to convert biochemical energy from nutrients into adenosine triphosphate (ATP), and then release waste products.

Cooperative learning: It is an educational approach which aims to organize classroom activities into academic and social learning experiences.

Learning: A relatively permanent change in behaviour as a result of practice and experience.

Meiosis: It is a type of cell division that reduces the number of chromosomes in the parent cell by half and produces four gamete cells. This process is required to produce egg and sperm cells for sexual reproduction.

Mitosis: It is a type of cell division that results in two daughter cells each having the same number and kind of chromosomes as the parent nucleus, typical of ordinary tissue growth.

Individual Learning: It is a user (student) specific program or strategy of education or learning that takes into consideration the student's strengths and weaknesses. **Perception:** It is the ability to see, hear, or become aware of something through the senses.

Physiology: It is the study of normal function within living creatures. It is a sub-section of biology, covering a range of topics that include organs, anatomy, cells, biological compounds, and how they all interact to make life possible.

Photosynthesis: It is the process by which plants, some bacteria, and some protists use the energy from sunlight synthesis to produce sugar from simple inorganic materials (CO_2 and H_2O), which cellular respiration converts into ATP, the "fuel" used by all living things.

Protein synthesis: It is the process whereby biological cells generate new proteins; it is balanced by the loss of cellular proteins via degradation or export.

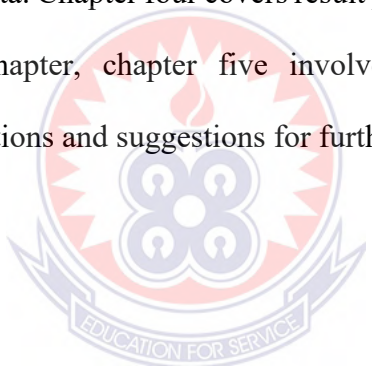
Respiration: It is a process in living organisms involving the production of energy, typically with the intake of oxygen and the release of carbon dioxide from the oxidation of complex organic substances.

1.10 Acronyms and their Meanings

ATP:	Adenosine triphosphate
CIRC:	Cooperative Integrated Reading and Composition
CL:	Cooperative Learning
GI:	Group Investigation
IL:	Individual Learning
LT:	Learning together
MEYS:	Ministry of Youth and Sports
OECE:	Organization for Economic Cooperation and Development
PGSHS:	Presbyterian Girls Senior High School
SHS:	Senior High School
STAD:	Student Team Achievement Division
TAI:	Team Assisted Individualization
TGT:	Team Games Tournament
WAEC:	West African Examination Council
ZPD:	Zone of Proximal Development

1.11 Organization of the study

The study has been organized into five chapters. The first chapter is the introduction to the study which deals with the background to the study, statement of the problem, purpose and objectives of the study, research questions and significance of the study, delimitation and limitations to the study, definition of terms and acronyms as well as organization of the study. Review of relevant literature is presented in chapter two, whilst chapter three deals with the methodology, comprising the study area, the design of the study, population, sample and sampling techniques used, instrument and its validity and reliability, data collection procedure as well as the procedure for analyzing data. Chapter four covers result presentation and discussion of findings. The last chapter, chapter five involves summary of findings, conclusions, recommendations and suggestions for further studies.



CHAPTER TWO

LITERATURE REVIEW

2.0 Overview

This chapter presents the review of related literature to the study. The review is organized under the following sub-headings: Theoretical Framework, Science Education in Ghana, The Study and Learning of Biology, Cooperative Learning and Alternate Traditional Method, Importance of Cooperative Instructional Method, Models of Cooperative Teaching Methods, The Concept of Respiration and its Importance and Summary of Literature Reviewed

2.1 Theoretical Framework

The research was conducted based on the constructivism theory of learning science. Constructivism is one of the most influential theories in contemporary learning theories. This theory is basically based on how people can learn on their own with little or no guidance (Educational Broadcasting Cooperation, 2004). It states that people construct their own understanding and knowledge of the world around them through experience events and situations and reflecting on them. From the constructivist point of view, we are active creators of our own knowledge.

According to Dewey (2006), education depends on action. Knowledge and ideas emanate from situations in which learners had to draw on experiences that had meaning and importance to them. These situations have to occur in social context such as a classroom, where students join in manipulation materials. This creates a community of learners who build their knowledge together. The underlying

premise of cooperative learning is founded in constructivist epistemology. It utilizes the ideas of Vygotsky (1978) in that both the individual and social settings are active dynamics in the learning process as students attempt to imitate real life learning.

Piaget's (1964) theory of cognitive development is a comprehensive theory about nature and development of human intelligence. According to Piaget (1964), this theory deals with the nature of knowledge itself and how humans come gradually to acquire, construct and use it. Cognitive development is a progressive reorganization of mental processes as a result of biological maturation and environmental experience. Thus, children construct an understanding of the world around them and then experience discrepancies between what they already know and what they discover in their environment (Piaget & Inheldor, 1973). According to Piaget (1964), the cognitive development of children towards formal thought could be facilitated through three cognitive processes: Assimilation, Accommodation and Equilibrium.

Assimilation refers to how humans perceive and adapt to new information. It is the process of taking one's environment and new information and fitting it into preexisting cognitive schemas (McLeod, 2010). Accommodation, unlike assimilation, may be described as the process of taking one's environment and new information and altering one's pre-existing schemas in order to fit in the new information. In other words, humans understand what ever information fits into their established view of the world schemas.

According to Piaget (1964), accommodation results as children reframe or modify their existing schemas or mental representations of the external world to fit their new experiences for learning to occur. Equilibrium refers to the biological drive to produce an optimal state of equilibrium between people's cognitive structures and their environment (Duncan, 1995). As children progress through the stages of cognitive development, it is important to maintain a balance between applying previous knowledge (assimilation) and changing behaviours to account for new knowledge (accommodation).

Equilibrium helps to explain how children are able to move from one stage of thought unto the next. Thus, in the view of Piaget (1954), students are actively involved in the construction of their own knowledge. Vytcotsky's (1978) theory is unique in that unlike Piaget, he believed that learning could not be separated from social context. Central to

Vytcotsky's (1978) theory is his belief that biological and cultural development do not occur in isolation (Driscoll, 1994). Driscoll (1994) argued that all cognitive functions begin as a product of social interaction and that learning was not simply assimilated but collaborated process. Vytcosky (1978) was fascinated by the way that children absorb the culture of the society around them. He examined the process by which human beings as social animals grow up together, watching and listening, trying things out in speech and action, looking for the effect on others and so learning from each other. From these ideas, he developed the idea of "social construction". Early learning takes place between parent and baby, and sometimes between baby

and siblings. Much learning from age four onward takes place between children in a group but this process needs to be well managed by an adult (Vytcosky, 1978).

Vytcosky (1978) as cited in (McLeod, 2010) described what children can do unaided and what they can achieve with little help from their friends as the zone of proximal development. To Vytcosky (1978), learning is a continual movement from the current intellectual level to higher level which more closely approximate the learner's potential. This movement occurs in the **Zone of Proximal Development (ZPD)** as a result of social interactions. Also, the role of the adult and the learner's peers as they converse, questioned, explained and negotiated, meaning is emphasized.

Many schools have traditionally held a transmission model in which a teacher or lecturer transmits information to students. Vytcosky's (1978) theory however requires that the teacher and the students play untraditional role as they collaborate and cooperate with each other. Instead of the teacher dictating her meaning to students for future recitation, a teacher should collaborate with her students in order to create meaning in ways that students can make their own understanding (Hausfather, Toharia, LaRoche & Engelsmann, 1997). Learning becomes reciprocal experience for the student and teacher.

The constructivist position holds that knowledge is not passively received, but is actively built up by the cognizing subject (Glasersfeld, 1989). The social constructivist approach emphasize that knowledge is acquired through interaction with others as well as by individual processes. This assertion ties in with the current study on students Team Achievement Division Cooperative Learning, where learners study in small heterogeneous teams and then break to do exercises individually. Cooperative learning is thus an instructional strategy in which small groups of students work together to accomplished shared goals. It has a well-defined classroom structure as well as a teacher and learner roles.

2.2 Science Education in Ghana

The general goal of the science education in Ghana, according to the Ministry of Education Youth and Sports MEYS (2004), in the report of educational reforms review committee, is to provide relevant and quality education for all Ghanaians, especially the disadvantaged to enable them to acquire skills which will make all functionally literate and to facilitate poverty alleviation and promote the rapid socio-economic growth of the country. The vision of the educational ministry to achieve the above goal is through the following action plans; Making science education more relevant to national goals and aspiration, by focusing on science, vocational and technical education; Expanding access to science and technology education at all levels of education; Raising the quality of teaching and learning of science and technology for effective outcomes. This means that the basic school

curriculum must be designed to build on integrated science programme with the aim of providing fundamental knowledge and understanding of basic science concepts.

Fensham (2000) was quick to add that, for children to understand science concepts, requires that they wrestle with how those concepts are more satisfactory than their own current beliefs. This implies therefore that learning science effectively requires the direct involvement of students with many teaching learning materials and much discussion on how to interpret their observations. Also, science has to be experimental in order to stimulate and sustain student interest and enhance the understanding of key concepts. This helps to develop a sense of curiosity and a desire for research among the students. Cerini, Murray and Michael (2003), in their study on students' view of the science curriculum, observed that many science concepts are inconsistent with the children's beliefs about how the natural world works. Fensham (2000) however explained that the curriculum is organized to provide holistic learning experience and develop skills across interconnected disciplines.

Barton and Tobin (2001) added that the rural schools have more severe problems than their counterparts in the urban areas as wells as students with handicapped and learning disabilities. He further pointed out that part of the curriculum for these students contain many overloaded major topics, man subtopics with excessive details that make teaching and learning difficult. Many high school teachers lack the

necessary skills and know-how to develop, design and undertake age-appropriate inquiry-based practical science lessons for their students. This compels teachers to focus entirely on the theoretical aspect of science, sometimes leaving students confused and creating an erroneous impression that science is difficult and abstract. Nevertheless, the purpose of school is to promote learning and the science teacher holds it as a duty to help students to learn.

Ghana has seen various forms of educational reforms since the attainment of independence in 1957. Until mid-1980s, the main focus of the reforms was on development of new curriculum at all levels of education. The range of science content was expected to extend beyond the traditional conceptual content of physics, chemistry and biology to include application of science and technology. Despite this, one of the most significant aspects of the new science curriculum in Ghana was only a pragmatic reduction in range of content in the 1980s and 1990s. This has resulted in the retention of much of the traditional content with little new materials on technology and development at the basic level of education. Hence students find the science they are learning at school isolated from their everyday experiences. It is therefore not surprising that more recently, there has been general agreement from the public that the general educational reform in 1987 has failed to meet expectations in terms of coverage, quality, equitableness and economic utility (MEYS, 2004). Science can no longer be detached from the values and priorities of the societies in which it is embedded. For this reason, the evaluation of science education curriculum should be an ongoing process that

provides input and feedback to guide change and offer directions for the programme and its modification (Njoku & Anyakoha, 1992).

Biology is a natural science discipline that involves the study of life and living organisms, including their physical and chemical structure, function, development and evolution. Despite the broad scope and complexity of science, there are certain unifying concepts that consolidate it into simple, coherent field. Modern biology is a vast field composed of many branches. In general biology recognizes the cell as the basic unit of life, genes as the basic unit of heredity and evolution as the engine that propels the creation of new species. It is also understood that all organisms survive by consuming and transforming energy and by regulating their internal environment.

Sub-disciplines of biology are defined by the scale with which life is studied, and the methods used to study them. Biochemistry examines the rudimentary chemistry of life; molecular biology studies the complex interactions among biological molecules. Cellular biology examines the basic building blocks of life. Ecology examines how organisms interact in their environment. Biologists study all the above disciplines to make life comfortable on this earth. For example, Biologists study the intimate details of the human brain, the composition of our genes and even the functioning of our reproductive system.

The study of deoxyribonucleic acid (DNA) has enable us determine much of our innate capabilities and predispositions to certain forms of behaviours and illnesses. DNA sequencing has played major roles in criminal cases as well as reversal of death penalties for many wrongly convicted individuals. More so, many individuals are now turning to herbal medicine to ease arthritis, pain, improve memory, as well as our moods. Biology helps he scientists to deduce what kind of nutrition and exercise would best work on the human body for health, longevity and prolonged physical performance. Treatment vaccines and cures for ailments and diseases are mainly an outcome of biology researchers.

2.3 The Learning of Biology

Osborne and Collins (2000) proposed that the learning cycle in children consists of exploration which is the manipulation of materials, investigating, testing of of hypotheses, reflection that is more important on the activity. Young (1990) also says that if you are to teach science (biology) well, you need to use a well-organized classroom with the right kind of specimen and also one need to prepare carefully. He continued that teachers often think that they cannot teach science without experience and complicated apparatus. It is certainly true that some apparatus are necessary but most of the things needed can be collected or made with the help of students (Diego, 2014).

Biology is the study of life and teaches us about ourselves and the natural world around us. A good starting point when studying biology is to admire the perfection of nature and the principles of life. Diego (2014) suggested five ways of learning biology:

- Learning the terminology by breaking down the complex word to identify their root or origin.
- From the general to the specific; tackle the general concept before the specific.
- Embrace the laboratory; Put biology theory into practice by using the laboratory whenever possible to explore your curiosity. Once in the laboratory, you can test your hypothesis and prove your theories.
- Using drawings: Drawing can help you understand a concept and remember information that would be difficult to define in words.
- Past exam questions: Practice sample answers to past exam questions, past papers which should be available from your teacher.

According to Tekkaya, Özkan and Sungur (2001), Student's difficulties in learning biology have been studied by various researchers across the world. Many concepts and topics in biology include protein synthesis, respiration and photosynthesis can be perceived as difficult to learn by secondary school students. Tekkaya, Özkan and Sungur (2001) also found that hormones, genes and chromosomes, mitosis and meiosis, the nervous system were also considered difficult concepts by secondary school students.

Experiencing difficulties in so many topics in biology negatively affect students' motivation and achievement (Ozcan, 2003). Students' difficulties in many topics in biology have stimulated researchers to investigate why students experience such difficulties and how to overcome these difficulties. There are many reasons why students have difficulties in learning biological concepts (Lazarowitz & Penso, 1992; Cimer, 2004; Zeidan, 2010). The nature of science itself and its teaching methods are among other factors, the reasons for the difficulties in learning, while according to Lazarowitz and Penso (1992), the biological level of organization and abstract nature of concepts make biology learning difficult. Overloaded biology curricula, the abstract and interdisciplinary nature of biological concepts and difficulties with the textbooks are the factors preventing students from learning. This overloaded curricular may lead the students to memorize. This of course prevents meaningful learning. Fraser (1998) indicates that there is a close relationship between students' perception of their classroom learning environment and their success. Osborne and Collins (2001) reported that students diminishing interest in learning science (biology) was due to the curriculum content being overloaded and not generally related to working life. The lack of discussion of topics of interest, the absence of creative expression opportunities, alienation of science from society and the prevalence of isolated science subject.

Teacher's style of biology teaching and teaching methods and techniques may also affect students learning in biology (Cimer, 2004). If students are not happy about

the way biology is taught, they may show disinterest in the negative attitude towards biology and its teaching. In addition to determining the factors that negatively affects the students learning in biology, understanding students view on what makes their biology learning effective is crucial as many researchers suggest that in order to improve the quality of biology and learning in school, student views must be taken into consideration by researchers, teacher educators, schools and teachers (Fullan, 1991; Macbeath & Mortimore, 2001; Cimer, 2004; Ekici, 2010). The authors argued that what students say about teaching and learning and schooling is not only worth listening to but provides an important foundation for thinking about ways of improving teaching and learning. More so, it is thought that how students perceive the learning environment affects their attitudes toward biology and its learning (Atilla, 2011). Therefore, understanding secondary school students' perception of biology will help policy makers, teachers and teacher educators to plan more effective teaching activities that can help students learn biology better and have more positive attitudes towards it.

Reasons for why the students have difficulties to learn these topics in biology are:

- The concepts topics are overloaded giving them the opportunity to memorize. When text and classroom activities do not appear to be relevant to student's daily lives and do not include practical work or experiment, students may consider biology a science that requires the memorization of factual knowledge. When they think this way, perhaps, students may not connect biology with their daily lives. (Science and Engineering Indicators Report,

1993; Roth, Druker, Garnier, Lemmens, Chen, Kawanaka, Rasmussen, Trubacova, Warvi, Okamoto, Gonzales, Stigler & Gallimore, 2006; Kidman, 2008)

- The next factor affecting the students learning in biology was the way in which it was taught. According to research, biology topics are taught by lecture method of teaching, which are teacher- centred lessons. Practical work and student-centered activities in biology classes were merely used. Another r related way biology is taught was the lack of relationship between what was taught in the biology classroom and students daily lives.

- More so some of the teachers lack mastery in biology and teaching negatively affected their learning. Biology teachers usually prefer to employ mainly the traditional teaching approaches and techniques (Cimer, 2004). Biology lessons are mainly run in a teacher-centered manner; teachers transfer the knowledge that they have and that is written in the textbooks without conducting student-centered activities. This of course has negative effects on students' attitudes towards biology and their motivation to learn. Indeed, Zoller (2000) asserts that teacher centered or traditional lessons can be non-productive and in some cases, detrimental to student learning. Therefore, teachers' competence and knowledge in both biology as a discipline and its teaching are crucial for enhancing students learning.

- Furthermore, students learning and study and study habits were one of the reasons they had difficulties in learning biology. Students do not learn

biology regularly, review previous material taught or work on biology questions on regular basis.

Some of the students do not show interest in the topic taught.

- The final reasons students have difficulties in learning biology according to the researchers are facilities materials and lesson time. It was reported that lack of biology laboratories and teaching materials hinder the understanding of the concepts.

Nevertheless, the students view on what makes biology learning effective was sought from the researcher. They are: Teaching and learning biology through visual materials, teaching through practical work, Reducing the content of biology curriculum using various techniques of study. Also, biology topic must be connected to daily lives thereby making the teaching interesting, Zoller (2000) found that the kind of science teaching which students experience was the most important factor forming their attitudes towards science.

2.4 Cooperative Learning and Alternative Traditional Method

The American Association for the Advancement of Science (1989) reported that the collaborative nature of scientific and technological work should be strongly reinforced by frequent group activities in the classroom. A variety of teaching strategies have been advocated for use in the teaching of science and mathematics in the classroom; thus, ranging from teacher-centered approach to more student-centered ones. According to Effandi and Zanaton (2007), grouping enables pupils

to focus on good relationship, facilitate the learning, and present a shift in educational paradigm that is from a teacher centered approach to learner centered approach whereby learning takes place in small groups.

2.4.1 Theories of Cooperative Instruction

The success of cooperative instructional strategy is largely based on its having a clear theoretical foundation (Johnson & Johnson, 2001). According to Slavin's (1995), model of cooperative learning, cooperative instructional strategy is supported by two major categories of learning: (1) motivational and (2) social cognitive theories. Relevant theories pertaining to cooperative instructional strategies are: information processing theory, social independence theory, and social cognitive theories which include: Vygotsky and Piaget's theories, respectively.

2.4.2 The Information Processing Theory

The information processing theory is a group of theoretical frameworks that address how human beings receive, think about, mentally modify, and remember information and on how such cognitive process change over the course of development (McDevitt & Omrod, 2004). The three areas of the memory that hold information are called the sensory register, the working memory and the long-term memory. Information from the environment is first received at the sensory register;

it is then processed by the working memory, and after some other complex processes it may be transferred to the long-term memory (McDevitt & Omrod, 2004).

There are many factors that cause information to move through these memory banks. These factors include: attention, rehearsal, organization and elaboration. Information processing theorists claim that group discussion in cooperative learning helps learners to rehearse, elaborate and expand their knowledge. Furthermore, as learners discuss, rehearse, organize, listen and elaborate on the learning tasks, they trigger the process that supports information processing and memory (Woolfolk, 2010). Group discussion in cooperative learning also promotes learning as it helps learners perceive, understand, use and remember the information they are given during group work. (McDevitt & Omrod, 2004).

2.4.3 Social Interdependence Theory

The social interdependence theory is based on the claim by social scientists that peer interaction and relationships play an essential role in socialization and learning (Johnson & Johnson, 2009). It provides the frame work for understanding the role of positive interdependence among group members in promoting learning. According to Susan (2007), the social interdependence perspective began in the early 1990s, when one of the founders of the Gestalt school of psychology, Kafka (1925), as cited in Xiaoqing, (2015) proposed that groups were dynamic wholes in which the interdependence among members could vary. Lewin (2010) citing Susan (2007) refined Kafka's (1925) in the 1920s and 1930s, stating that: (a) the essence of a group is interdependence among members (created by common goals), which

results in the group being a "dynamic whole" so that a change in the state of any member or subgroup changes the state of any other member or subgroup; and (b) An intrinsic state of tension within group members, motivates movement toward the accomplishment of the desired common goals (Susan, 2007). Johnson and Johnson (2009) extended Lewin's (2010) notions by examining how the tension systems of different people may be interrelated. The authors conceptualized two types of social interdependence, positive and negative interdependence. Building on the work of Deutsch (1985), Johnson and Johnson (2005) developed the social inter-dependence theory. The social interdependence theory assumes that the way social interdependence is structured determines how individuals interact, and this in turn determines outcomes. The social interdependence theory supports the use of cooperative learning as it emphasizes positive interdependence or cooperation which encourages and motivate group members to facilitate each other's efforts to learn. This, in turn, helps the group to achieve their learning goal.

In cooperative learning, positive interdependence can be created by having group members take on complementary roles such as checker, recorder, elaborator, time keeper, reporter and group leader (Woolfolk, 2010). However, this would depend on the group's goal. Assigning roles to group members would encourage them to work cooperatively, participate fully in the learning tasks, and ultimately lead to effective learning. In line with this view point, Slavin (2009) posited that when group members are assigned roles in cooperative learning, it creates in them the feeling of positive interdependence and challenges them to encourage and help one another achieve the group's goal. Other strategies that can be used to create positive

social interdependence cooperative learning include "task specialization" methods or instance in jigsaw method of cooperative learning, learners study a topic which is divided into subtopic and distributed among group members. Learners assigned the same subtopic meet in "expert groups" to share information on their topics after which they return to their teams, and then take turns teaching their topic to their team.

2.4.4 Social Cognitive Theories

Based on Slavin's (1995) model, cooperative instructional strategy facilitates learning not only by motivating learners with shared goals but also by situating learners in a social context which provides a stage for cognitive development through elaborated explanations, peer-tutoring, peer-modeling, cognitive elaboration, peer-practice, peer assessment and correction (Liao, 2005). This section therefore explores social cognitive theories that support the use of cooperative instructional strategy.

2.4.5 Vygotsky's Theory

Vygotsky's socio-cognitive theory perceives learning as a social process that takes place in a context that allows for social interactions and communication which eventually leads to the construction of knowledge and cognitive development (Mcleod, 2007). According to this theory, learning first occurs through human interaction, after that, with help of tools (including language) and human mediation,

it is eventually internalized (Fushino, 2010). The internalization of knowledge, according to Vygotsky (1978) is a progression that begins with an interpersonal process before it proceeds into an intrapersonal one. In other words, a learner's higher mental processes are first co-constructed during shared activities with other learners before they become internalized as part of the learner's cognitive development.

The fundamental concept in Vygotsky's theory is the ZPD. According to Vygotsky (1978), the ZPD is the area between the learner's current development level as determined by independent problem-solving and the level of development that the learner could achieve through adult guidance or in collaboration with more capable peers.

According to this theory, learning is a path through the zone of proximal development, with the zone referring to the space between that which a learner cannot do alone and that which he/she can do with the help, guidance and encouragement from capable individuals (Mcleod, 2007). Thus, Vygotsky (1978) believes that through help from more knowledgeable individuals, the learner can potentially gain knowledge already held by them. However, the knowledge must be appropriate for the learner's level of comprehension. According to Vygotsky (1978), anything that is too complicated for the learner to comprehend that is not in their ZPD cannot be learnt at all until there is a shift in the zone of proximal development. When the learner does attain his/her potential, this shift occurs and the learner can

continue to learn more complex higher-level material. From this, Liao (2005) argues that Vygotsky's (1978) theory supports the use of cooperative learning citing that when learners work closely within one another's level of proximal development, they can receive explanations that are presented to them in a simpler and more comprehensible fashion than if they were provided by one of a very different mental age. Further reinforcing the relevance of Vygotsky's (1978) theory in cooperative learning, Fushino (2010) contends that cooperative learning can improve learning as it offers learners the possibility of interaction and mediation during which more competent learners, scaffold or provide learning support for their less competent peers.

2.4.6 Piaget's Theory

Piaget's socio-cognitive theory proposes that when learners perceive a contradiction between their existing understanding and their experience interacting with others, cognitive conflict arises. In order to resolve this conflict, learners may examine their own ideas and beliefs again, pose questions to one another, and seek further information in order to reconcile the contradictory ideas (Fushino, 2010). He argues that all cognitive developments consist of momentary conflicts and incompatibilities which must be overcome to reach a higher level of equilibration. Piaget's theory provides support for the use of cooperative learning considering that in cooperative learning, learners with different ability and viewpoints work together, this provides maximum opportunity for them to experience and resolve cognitive conflicts (Fushino, 2010).

Advocates for Piaget's theory contend that cooperative learning improves learning as interactions in groups during cooperative learning, creates cognitive conflict and disequilibrium that make learners to question their understandings and try out new ideas (Woolfolk, 2010). Furthermore, in cooperative learning, learners engage in discussions in which cognitive conflicts occur and are resolved, and inadequate reasoning is exposed and modified leading to cognitive development (Susan, 2007). The key concepts involved in Piaget's theory include: schemas, assimilation, accommodation and equilibration. A schema describes both the mental and physical actions involved in a learner's understanding and acquisition of knowledge (Kendra, 2012). In Piaget's view, a schema includes both a category of knowledge and process of obtaining that knowledge. As experiences happen, this new information is used to modify, add to or change previously existing schemas. According to Kendra (2012), a child may have a schema about a type of animal, such as a dog. If the child's sole experience has been with small dogs, the child might conclude that all dogs are small. However, if that child encounters a very big dog, he/she will take in this new information, and modify the previously existing schema to include this new information that some dogs are big. On the other hand, the process of integrating or taking in new information into the learner's existing schema or internal structures is known as assimilation (Eames & Cates, 2011).

Accommodation involves altering existing schemas or ideas as a result of new information or new experiences (Kendra, 2012). In cooperative learning, as learner

come across new information or experience in their learning teams, they may develop new schemas or alter their previously existing schemas (Eames & Cates, 2011). Piaget believes that learners try to strike a balance between assimilation and accommodation; this according to Piaget is achieved through a mechanism called equilibration (Kendra, 2012). Equilibration, according to Piaget (1954), is a process of achieving a balance between assimilation and accommodation which leads to cognitive development (Woolfolk, 2010). In cooperative learning situations, the process of assimilation, accommodation and equilibration occur naturally as learners encounter new knowledge, skills and experiences in the context of team learning.

2.5 Relevance of Cooperative Instructional Method

Information processing theorists claim that group discussion helps learners to rehearse, elaborate, and expand their knowledge. As group members discuss questions and explain things to one another, they trigger the process that supports information processing (Woolfolk, 2010). The social interdependence perspective of cooperative instructional strategy proposes that the way social interdependence is structured determines the way learners interact, which in turn determines outcomes. Positive interdependence results in primitive interaction as learners encourage and facilitate the achievement of group goal (Susan, 2007).

Proponents of Vygotsky's (1978) theory suggest that social interaction is important for learning because mental functions or cognitive development originate in social

interactions and are then internalized by learners (Fushino, 2010). Piagetian theory advocates contend that cooperative instructional strategy improves learning as interactions in groups creates cognitive conflict and disequilibrium that lead an individual to question his or her understanding and try out new ideas (Woolfolk, 2010). The next section that follows provides brief historical development of cooperative instructional strategy.

2.6 Models of Cooperative Teaching Methods

Amongst the numerous models of cooperative learning, the following, according to Sarah and Cassidy (2006) have been mostly researched: Student - Teams Achievement Divisions (STAD), Learning Together (LT), Jigsaw technique, Group Investigation (GI), Teams-Games-Tournament (TGT), Teams Assisted Individualization (TAI), and Cooperative Integrated Reading and Composition (CIRC).

2.6.1 Student - Teams Achievement Divisions (STAD)

Student - Teams Achievement Divisions (STAD), is a method of cooperative learning in which learners are assigned to 4-5-member learning teams that are diverse in performance level, gender and ethnicity (Slavin, 1996). The main purpose of STAD is to drastically improve and accelerate learner performance (Van, 2007).

In STAD, the teacher presents a lesson, and then learners work within their teams to make sure that all team members have mastered and achieved the team

outcome. Finally, all learners within the teams take individual quizzes on the material which they may not help one another. Learners' quiz scores are comparing to their past averages, and points are awarded on the basis of the degree to which learners' mode or exceed their own earlier performance. These points are then summed to form scores and teams that meet certain criteria may earn certificates or other rewards. The whole cycle of activities, from teacher presentation, to team practice to quiz, usually takes three to five class periods (Slavin, 2009). According to Slavin (1995), the STAD method consists of the following components: class presentations, teams, quizzes, individual improvement scores, and team recognition. These components are discussed below:

2.6.2 Class Presentations

This stage is characterized by whole class instruction during which the teacher introduces the lesson and explains what will be done. The lesson incorporates audiovisual presentations and various forms of multimedia. After the class presentations and briefings, learners work in their teams to review the worksheets, discuss problems, and help one another master the subject matter (Asherson, 2008).

Teams

Teams consist of heterogeneous groups of four or five members composed by the teacher on the basis of performance, level of development, gender and ethnicity.

Each week the teacher introduces new subject matter and worksheets. The team members in groups and study the learning material until all members have successfully mastered the subject matter and work assignments. The goal of the teams is for the members to help one another to learn and achieve the learning outcomes (Asherson, 2008).

Quizzes

To ensure individual accountability and learning within groups, learners take individual quizzes on the learning material at which time they may not help one another. The sum of the individual points scored by learners in the quiz serves as basis for the points allocated to the group (Slavin, 2009).

Individual Improvement Scores

This stage of cooperative learning provides all learners with an equal opportunity to contribute maximum points for their teams in the scoring system. Individual learners can achieve this by showing definite improvement over their past performance (Reena & Nandita, 2010). At the beginning of the programme, each learner is given a base score derived from the learner's average performance on similar quizzes. Then learners earn points for their teams based on how much their quiz scores exceed their base scores (Reena & Nandita, 2010).

Team Recognition (TR)

Teams earn daily points throughout the cycle for working well together and meeting certain criteria. Rewards are based on both the academic improvement of individual team members and the points learners in the teams earned. Certificates are awarded to teams that meet certain standards in terms of high levels of performance, which means that group members are motivated to do their best within the group (Van, 2007).

2.6.3 Learning Together (LT)

Learning together instructional strategy was originally developed by Johnson and Johnson (2009) at the University of Minnesota. In the LT method, learners work in four or five heterogeneous groups on a group assignment or a single topic and turn in a single project as a team. During group discussion, if learners ask the teacher a question the teacher refers such learners to their groups to find the answer. After the group discussion, a leader is chosen to present the group's result to the entire class, and groups receive rewards together. However, there is individual accountability because each group member must demonstrate learning. The scores awarded by the teacher to groups are based on both individual performance and the success of the group. The learning together model of cooperative learning provides a conceptual frame work for teachers to plan and tailor cooperative learning according to their circumstances, learners' needs, and school contexts (Ghazi, 2003).

2.6.4 Cooperative Integrated Reading and Composition (CIRC)

Cooperative Integrated Reading and Composition (CIRC) was developed to teach reading and writing skills in the upper elementary grades. Like other methods of cooperative learning, CIRC begins with instructions from the teacher. Learners are assigned to different heterogeneous reading teams of four or more who operate at different reading levels. The teacher works with one team at a time, while learners in other teams work in pairs with their team members and focus on learning activities such as reading, summarizing stories, discussing texts, learning new words, and predicting how stories will end (Susan, 2007).

In CIRC, teams move through a sequence of teaching, team exercises, team evaluation and quizzes. Quizzes are only held once the teams feel that their members are ready. Cooperative rewards are given, which encourages, teams to work toward recognition. Individual assessments are carried out to ensure individual learning. Scores obtained from individual assessments are averaged to create scores for student teams (Susan, 2007).

2.6.5 Jigsaw Technique

According to Sarah and Cassidy (2006), the jigsaw cooperative learning model was developed by Aronson and his students in 1978. In jigsaw technique, learners work together in groups of four or six on academic material divided into different sections. Each group member is given part of the material to be learned by the whole group. As soon as each earner has mastered his or her section of the subject matter, he or she goes on to learn the subsection of the other learners in the group. Learners

remain in the same group for six to eight weeks, until they have fully studied and mastered the subject matter. Such a group becomes known as expert group (Woolfolk, 2010). After thorough discussion of the topic, the expert group members return to their original groups and teach the information to their group members. In the end learners take an individual test covering all the material and earn points for their learning team score (Woolfolk, 2010). The jigsaw is an effective way of engaging learners both with course material and with each other. The peer teaching aspect requires that each learner becomes an expert or understands the material well enough to teach it to other group members.

2.6.6 Group Investigation (GI)

Group investigation is a general classroom organization plan in which learners work in small groups using cooperative inquiry, group discussion, cooperative learning and projects. In group investigation method, learners form their own two to six-member groups. After choosing subtopics from a unit that the entire class is studying, the group breaks its subtopics into individual tasks and carries out the activities that are necessary for group reports. Each group then makes a presentation or display to communicate its findings to the entire class (Slavin, 2009).

2.6.7 Team – Games-Tournaments (TGT)

In Teams-Games-Tournaments (TGT), learners are assigned to four-member learning teams that are mixed in performance level, gender, and ethnicity. The teacher presents a lesson; learners then work within their teams to make sure that all members have mastered the learning content. Like other cooperative learning models, the main idea behind TGT is to motivate learners to encourage and help one another master skills presented by the teacher.

At the start of TGT, the teacher organizes the games which composed of content relevant questions designed to test the knowledge learners gained from class presentations and team practice. Games are played at tables of three learners, each of whom presents a different learning team. Most games are simply numbered questions on a ditto sheet. A learner picks up a number card and attempts to answer the questions corresponding to the number. A challenge rule permits players to challenge each other's answers. The tournament is usually held at the end of the week, after the teacher has made a class presentation and the teams had practiced with the worksheets. For the first tournament, the teacher assigns learners to tournament tables; assigning the top three learners in past performance to Table 1, the next to Table 2, and so on. This equal competition makes it possible for learners of diverse ability levels to contribute maximally to their team scores if they do their best.

2.6.8 Team Assisted Individualization (TAI)

Team Assisted Individualization (TAI) is an instructional strategy that combines cooperative learning with individualized instruction. It is specifically designed to teach mathematics to learners in grades 3-6 or older learners not ready for a full algebra course. In TAI, learners enter an individualized sequence according to a placement test and then proceed at their own pace. In general, four-member mixed ability teams work on different units. Teammates check each other's work against answer sheets and help one another with any problems (Susan, 2007). Final unit tests are taken during which team mates are not allowed to help each other. Each week, the teacher totals the number of units completed by all team members and give certificates or other rewards to teams that exceed a criterion score based on the number of final tests passed, with extra points for perfect papers and completed homework.

2.7 The Concept of Respiration

Respiration can be defined as a process by which food substances in the body are oxidized to release energy. It is an important biochemical process, the understanding of which is critical to a meaningful appreciation of life at organism and community levels of biological organization. Respiration is a biochemical process in which the cells of an organism obtain energy by combing oxygen and glucose resulting in the release of carbon dioxide, water, and ATP**.** This metabolism can be divided into two sections, namely catabolism anabolism. Catabolism refers to the exergonic process by which energy is released by the breakdown of organic compounds such as glucose

can be used to synthesize adenosine triphosphate (ATP), the form of energy required to do work. Anabolism is endergonic process that uses the energy stored in ATP to synthesize the building blocks of the macromolecules that make up the cell. As can be seen, these two metabolic processes are closely linked. Another factor that links catabolic and anabolic pathways is generation of precursor metabolic (Seymour & Longden, 1991). When we examine the equation for cellular respiration, we see that the reactants are glucose and oxygen (for aerobic respiration), and the products are carbon dioxide, water, and ATP. Note the number of oxygen, carbon dioxide, and water molecules involved in each 'turn' of the process, as in the equation below;

$C_6H_{12}O_6 + 6O_2 \Longleftrightarrow 6CO_2 + 6H_2O + ATP$

Glucose + Oxygen ⟺ Carbon Dioxide + Water + Energy

Fig. 2.1: Equation for Respiration

Respiration is the opposite to the process of photosynthesis. In photosynthesis, carbon dioxide and water are taken in by autotrophs, along with sunlight, to make glucose and oxygen. Autotrophs are organisms that are able to form nutritional organic substances from simple inorganic substances such as carbon dioxide. Autotrophs include any photosynthesizing organisms, such as plants and algae, all of whom also undergo respiration. The products of photosynthesis are taken in by heterotrophs, organisms that cannot make their own food and rely upon autotrophs and other organisms for food. The by-products of their respiration; carbon dioxide and water are then used for photosynthesis. In a balanced ecosystem, this exchange is an example of a negative feedback loop.

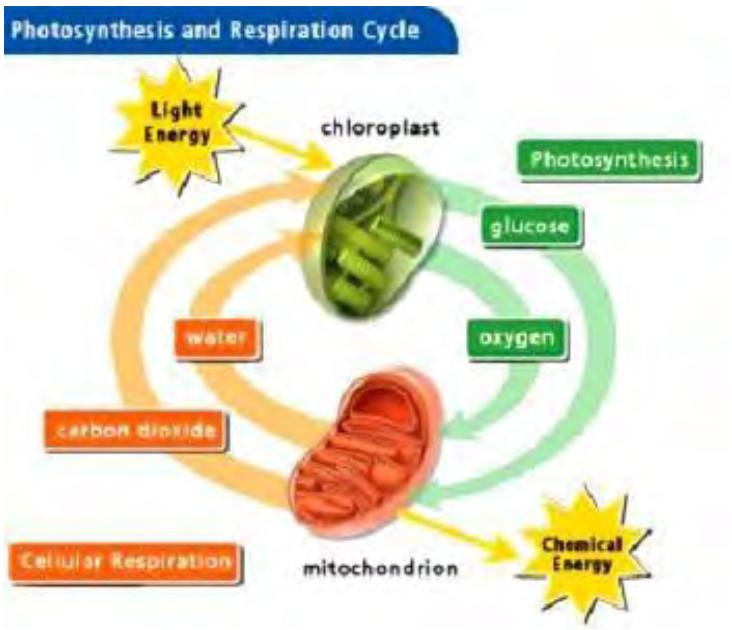


Fig 2.2: The balance of photosynthesis (green) and respiration (red)

2.7.1 The Three Phases of Respiration

In prokaryotic cells, respiration takes place in the cytosol and across the cell plasma membrane. In eukaryotic cells, it occurs both in the cytosol and in the mitochondria. Mitochondria are the powerhouses of eukaryotic cells, and contain large surface areas of membrane folds on which respiration activity can be maximized. Respiration occurs in a similar way to the internal combustion of your car engine where organic compounds and oxygen go in, carbon dioxide and water come out, and the energy released in the process powers the car or cell. Respiration and combustion are both exergonic processes, in which energy is released from the breaking of molecular bonds. To crank out ATP from the breaking of glucose bonds, respiration occurs in three phases:

- **Glycolysis**: The original glucose molecule (from food) is broken down into two pyruvic acid, or pyruvate molecules, which are then oxidized into CO_2 and water, leaving two of carbon molecule called acetyl-CoA. Two ATP are generated in this process. This occurs in the cytosol.

- **The Citric Acid Cycle**: The Acetyl-CoA from glycolysis is added to an existing carbon chain and sequentially broken down, releasing more CO_2 as a byproduct and releasing electrons, which are added to the acceptor molecules. Two ATP are generated for each of two turns of this cycle. This occurs in the mitochondrial matrix.

- **Oxidative Phosphorylation**: The electron acceptor molecules drop off the electrons, which work to pump H^+ ions in high concentration on one side of the plasma membrane, creating a gradient pressure that churns the ATP synthase enzyme, generating about 32 ATP. The remaining electrons are taken by oxygen, which then combines with free hydrogens to create water. Think of the enzymes like a water mill, with water pressure moving the mill, and kinetic energy generating electricity.

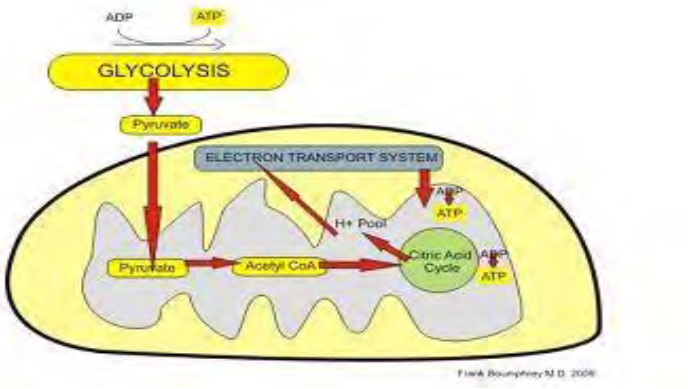


Fig 2.3: A mitochondrion and the stages of cell respiration

In a nutshell, breaking the glucose molecule and subsequent carbon chains during the citric acid cycle releases free electrons to be used in firing up the electron transport chain, thus powering the ATP synthase enzyme to crank out ATP.

2.7.2 The Importance of Respiration

Respiration is important because it produces energy that is essential for the normal functioning of the body. Respiration provides cells with oxygen and expels toxic carbon dioxide. Physiological respiration occurs across the respiratory system, which includes the upper and lower respiratory tracts. The upper respiratory tract includes the trachea, lungs, bronchi and the diaphragm. Physiological respiration is also known as ventilation and breathing. Physiological respiration involves inhalation and exhalation processes. Ventilation occurs involuntarily, but a person can modify breathing. The respiratory system also warms, humidifies and filters air during gaseous exchange.

Energy production occurs in cells through the metabolic process of cellular respiration, which produces energy in the form of adenosine triphosphate (ATP). Cells harvest this energy from food in three stages, which are glycolysis, the citric acid and electron transport. Fats contain more energy than protein and carbohydrates. Cells use oxygen to produce energy through the process of aerobic respiration, which releases carbon dioxide as bi-product. Water is also released in

metabolic respiration. Anaerobic respiration produces small amounts of energy in the absence of oxygen or with very little oxygen.

2.7.3 Students' Perception of Respiration

Understanding the events in cellular respiration is critical to conceptual understanding of several other topics in the biology discipline, including energy flow in the Ecosystem and metabolic activities of multicellular organisms. When students have difficulty in understanding a particular science concept, they develop erroneous views, which may impede their understanding of related concepts in subject matter. The identification of error is an important and obvious stage in remediation of students' misconceptions and error. Driver and Easely (1978) cited in Okoli (2006) opined that not until the reasons for students' misconceptions are understood will progress be made in instructional terms. It is these possibilities that have informed the need to identify errors held by secondary school students about respiration and the possible influence of teachers in the correction of these errors.

2.7.4 Cognitive Structure Researches on Respiration in Living Beings

When the study conducted on the concept of respiration are reviewed, it is seen that the subject is highly complex and has many dimensions as it pertains to all living beings from humans to single-cell organisms. It has been determined that the dimensions of respiration and the concepts under these dimensions differ by species. In researches, generally, it is indicated that students experience difficulties in

comprehending the subjects of "photosynthesis" and "respiration" (Waheed & Lucas, 1992); they mistake one for the other (Ozay & Oztas, 2003) and they struggle to understand the correlation between respiration and vital biological functions (e.g. circulation) common among living beings (Songer & Mintzes, 1994). One of the striking research findings is that students at all educational levels have alternative conceptions on the subjects of "photosynthesis" and "respiration", although they are taught beginning from the primary school (Tekkaya, Cap & Yilmaz, 2000; Tekkaya & Balci, 2003). A detailed analysis of the researches in the literature shows that there are many alternative conceptions. It is believed that it would be appropriate to present the review of these studies under the categories of respiration in human biology and respiration in plant biology, because it is observed that most of the studies focus on one of the above two categories.

2.7.5 Respiration in Human

Incidents in human are interrelated at the levels of anatomy, physiology and biochemistry. It is of high importance to be able to think of the system that provides the basis for the mechanisms maintaining these systems and that explains their relations, and to be able to attain a cognitive structure that requires thinking at that level. For example, since respiration occurs at the cellular level along with the level

of organism (Hmelo-Silver & Barrows, 2002), it is among the subjects that students struggle to comprehend. While Hmelo-Silver, Holton and Kolodner, (2000) found that 6th grade students have problems related to their learnings of human respiration system, Ben-Zvi, Assaraf, Dodick and Tripto, (2013) determined that 2/3 of high school students stated that the obligatory role in both circulation and respiration systems is the transition of CO_2 and O_2, that they group concepts related to life (concepts related to structures such as "cell nucleus, nerves and bones", concepts related to processes such as cellular processes like "diffusion and cellular respiration" and organismic processes like "growing and breathing"), yet they fail to relate them at the microscopic level.

Garcia-Barros, Martínez-Losada and Garrido, (2011) determined that children at the ages of 4 -7 are aware of the organs in their bodies related to the intake of air and food that they give examples from organs of animals they know; however, their knowledge on the respiratory system is limited. On the other hand, Gultepe, Yildirim and Sinan, (2008) found that 6th grade students have alternative conceptions regarding the human respiratory system such as "air taken from outside goes to the stomach", "breathing can only be executed through the mouth", "no water outflow occurs during the respiration", "venous blood goes out and arterial blood goes in", "water enters alveoli", "oxygen goes in and water goes out".

Abimbola (1986) found the following alternative conceptions among high school students related to human respiration: “During breathing, oxygen is taken in and carbon dioxide is given off. Oxygen serves in the body as the energy source”, “the body uses air/oxygen in order to oxidize food during digestion”, “blood ossifies if the body does not have air”, and “air is used as a liquid form for blood”; whereas Tekkaya *et al.* (2001) determined that student teachers have the misconception that “respiration takes place in lungs while cellular respiration, which is a different happening, takes place in tissues”.

Kao (2007) stated that high school students have important alternative conceptions regarding the chemical process dimension of respiration and that these conceptions differ between students living in urban and rural areas. The alternative conceptions that Kao has determined are the following: under the theme “continuity and necessity of respiration, “microorganisms do not have respiratory organs such as lungs or trachea; this is why they cannot realize respiration”, “oxygen is the raw material required for blood production”, under the theme respiration gas, “lungs filter O_2 and intake O_2 for CO_2 production that is released during respiration”; and under the theme aerobic respiration, O_2 may support CO_2 release and breathing” and “O_2 is a sort of nutrition and it contributes to development”. These studies show that participants from all levels experience difficulties in learning the subject of respiration and that they have alternative conceptions.

2.7.6 Respiration in Plants

Respiration in plants focuses on the concept of photosynthesis, which has numerous different features from other biochemical processes. These features make photosynthesis one of the most important subjects of biology courses at all levels, especially secondary and high school (Marmaroti & Galanopoulou, 2006). The relationship between cellular respiration and photosynthesis renders these concepts almost inseparable, and makes it one of the most difficult subjects in biology (Waheed & Lucas, 1992). The difficulty of these subjects lies in the complex transformations and biochemical processes that they involve, and their connections with many other subjects in curricula such as ecology, physiology, biochemistry, transformation of energy, autotrophic nutrition, and so forth (Marmaroti & Galanopoulou, 2006). While these processes are misunderstood by students most of the time, cellular respiration is perceived by many students as synonymous with breathing (Seymour & Longden, 1991; Lin & Hu, 2003). In fact, this perception is correct, because the purpose in respiration is to produce energy. However, students have misunderstandings related to the inputs, outputs as well as the role and necessity of chlorophyll in cellular respiration and photosynthesis (Marmaroti & Galanopoulou, 2006). This situation requires them to understand the chemical reactions occurring between organic and inorganic molecules at the micro and macro levels along with the relationship between chemistry and biology (Tekkaya *et al.,* 2001). It has been reported that students experience difficulties in understanding the subjects of respiration and photosynthesis due to their lack of knowledge in chemistry (Marmaroti & Galanopoulou, 2006), in learning the

chemical process aspect of respiration apart from being a physical process (Kao, 2007), that they consider plant respiration as the opposite of gas exchange when compared with most of animals, and that they see photosynthesis as a type of respiration.

Jin and Anderson (2012) investigated the conceptual structures of secondary and high school students regarding processes that have socioeconomic aspects such as photosynthesis, digestion, biosynthesis, cellular respiration, oxidation and energy.

Students wrote that it provides 90% of human energy and all the energy in living systems. They also wrote that the primary reason behind global climate change is the imbalance between these systems. Lin and Hu (2003) determined that secondary school students fail to comprehend and correlate energy concepts embedded in energy-production processes, that they have misconceptions related to photosynthesis, respiration and energy flow in the food chain, and that they fail to transfer their knowledge to energy conservation. Yilmaz and Capa (2000) found that student teachers have the misconception regarding the source of energy that "photosynthesis is a mechanism where the energy needed by metabolisms of plants is produced and the energy required for life comes directly from the sun".

Kao (2007) states that high school students have important alternative conceptions regarding the chemical process dimension of respiration in plants and that these conceptions differ between students living in urban and rural areas. The alternative

conceptions that Kao has determined are the following: under the theme continuity and necessity of respiration, "trees can live during photosynthesis, because it serves as respiration", "trees can live without respiration if food is stored when leaves reserve light"; under the theme respiration gas, "plants store O_2 during the night and release it during the day", "plants need oxygen at night since they cannot photosynthesize during that time"; and under the theme aerobic respiration, "plants need O_2 at night for nutrition production" and "O_2 can be used as a raw material in photosynthesis".

Yuruk and Cakir (2000), in the study they carried out with high school students, determined the following alternative conceptions: "plants cannot respire", "germinated seed needs energy while photosynthesizing", and "fungi photosynthesize in illuminated environments". Similarly, Kose and Usak (2006) found the following alternative conceptions among science student teachers on respiration in plants and the nature and process of photosynthesis: "green plants photosynthesize", "respiration in plants occur only at night", "photosynthesis is the opposite of respiration", and "plants obtain their food from water". Gunes, Dilek, Hoplan and Gunes (2012), in their study carried out with 8th grade students, determined the following alternative conceptions: "plants only photosynthesize during the day", "plants respire only at night", "plants produce energy through photosynthesis", "photosynthesis and respiration are opposite acts", "CO_2 emerges as a result of photosynthesis", "photosynthesis is the respiration that plants perform during the day" and "plants do not need energy".

On the other hand, in studies conducted with the participation of science student teachers and high school students, the following alternative conceptions were found: "the most important use of photosynthesis for green plants in production of energy", "energy is produced as a result of photosynthesis reactions", "plants do not respire", "plants respire at night", "energy is produced as a result of photosynthesis", "photosynthesis is the respiration of plants" and "plants do not respire and energy is produced as a result of photosynthesis" (Kose & Usak, 2006; Tekkaya & Balci, 2003; Yenilmez & Tekkaya, 2006). These findings indicate that the alternative conceptions that emerge during the elementary education persist until the university, and even the student teachers, who are going to provide science education, have alternative conceptions regarding photosynthesis and respiration.

However, understanding the relationships between the macro-level and micro-level biological systems is of importance for biological literacy (Brown & Schwartz, 2009). It is observed in studies that participants fail to adequately notice these relationships. They fail to figure out that both photosynthesis and respiration are the bases of energy reactions within biological systems, and the global and local ecosystems are founded on these bases. That is, it is a process that starts in the cell and continues at the global level; in which more than one chemical reaction occurs simultaneously. For example, while the cellular respiration in plants occurs in more than ecological level and more than one complex systems, students fail to comprehend these continuous and simultaneous complex processes (Brown & Schwartz, 2009).

Biology teachers are among the most important ones who are responsible for teaching the concept of respiration to students. As it is seen in the research examples presented above from the relevant literature, participants have numerous alternative conceptions on both respiration and photosynthesis. However, no cognitive structure research was found, which was carried out with the participation of biology student teachers, on the concept of respiration. Using free word association test and drawing-writing technique, cognitive structures and alternative conceptions of biology student teachers can be revealed.

Therefore, it is believed that the results of the current study, which was carried out using the abovementioned techniques, will provide a significant insight into the subject. Cognitive structures of biology student teachers about the concept of respiration are of high importance for their construction of biological concepts. The objective of this study, therefore, was to identify the conceptual perception errors on respiration held by biology students and their teachers, and the extent to which teachers' errors have influenced students' understanding of respiration concept.

2.7.7 Student's Perception and Attitude toward Cooperative Learning and Individualized Learning Approaches.

Many studies have been conducted on cooperative learning (Reena & Nandita, 2010; Slavin, 2009; Van, 2007; Sara & Cassidy, 2006). A thesis written by a Chinese graduate student attempts to use the method of action research on cooperative learning to change the traditional way of student learning and improve teaching effectiveness in Chinese classrooms. The author described the different reactions and the results of the student learning when he used the cooperative learning approach in class. By observing his 33 students one semester after using cooperative learning, he found that (1) cooperative learning greatly enhanced the class participation, (2) cooperative learning effectively improved the students' interest and confidence class, and (3) students are provided more opportunities to get assistance from peers and exchange ideas with others.

Also, Li, Chu and Woo (2010) studied 5th grade, elementary students' attitudes and perceptions toward cooperative learning in China using interviews and questionnaire instruments. The participants were 59 students and one teacher. The results were as follows: (1) according to the questionnaire, most students perceived collaborative writing as beneficial in improving their motivation to write and the four themes included learning benefits (83%), group interaction (75%), technology advantages (58%) and audience (67%). However, the results also showed some negative themes such as collaborative problem (38%) and time issue (13%). For example, a student talked in the interview that when they discuss the division of labor, some of the group members scramble to do the easy part (Li, Chu, Ki & Woo, 2010).

Contrary to the findings presented above, there are some studies, which reported negative outcomes (Law, 2011; Rao, 2002). Rao's (2002) article reports the perceptions of 30 Chinese university students toward the communicative activities and individual study in an English class. The researcher found through the survey and interview that the students enjoyed some classroom activities, but that they (22 subjects) prefer individual study than communicative one.

Literature presented on students' perception toward the cooperative learning approach used in the Chinese classroom showed positive consequences while others showed negative outcomes. Some researchers have studied Chinese teachers' or students' perceptions toward cooperative learning. Different from previous studies, my present research aims to look into teachers' and students' perceptions. Numerous research studies have revealed that students completing cooperative learning group tasks tend to have higher academic test scores, higher self-confidence, greater numbers of positive social skills, and better comprehension of the content they are studying (Johnson, Johnson, & Holubec, 1993; Slavin, 1995) while few researchers have investigated how students and teachers think of it. Besides, while many researchers have conducted research regarding the cooperative learning approach in colleges and have proved it to be effective, studies of students' and teachers' perceptions towards cooperative learning are not too many.

This study will focus on college students' and teachers' attitudes towards CL. Ransdell and Vickie (1999) opined that cooperative learning is a viable but underused teaching and learning tool. They contend that educators can best utilize

this teaching strategy in their classrooms more effectively if they themselves were active participants in their teacher education training programme. They asked these three (3) questions.

1. Can we change the post-secondary instructional paradigm from predominantly lecturers to a student participatory teaching and learning style such as cooperative learning?

2. How do teacher education students internalize cooperative learning techniques into their cognitive domain, so that they can use the techniques with their future students?

3. In our merit based American society marked indelibly with the ideals of individualism and competition to favour competition and collaboration?

There are other educators who have conducted studies within their own classrooms. One such is Mourtos (1997) who implemented cooperative learning strategies in engineering courses over a four-year period commencing in Spring 1993. He made an effort to implement these strategies in projects, lecturers and exams. Mourtous (1997) is of the view that cooperative learning in engineering courses is important since:

1. Students learn better when working together than in isolation.
2. It forces students to practice team and small group communication skills. Based on this four-year study it was discovered that students performed better, learnt and integrated much more within their classes.

In other societies cooperation, rather than competition is promoted. In this regard Meng (2005) examines the application of cooperative learning in the Chinese classroom. He found that the nature of the Chinese culture which is marked by collectivism enabled this learning style to be more successful. Collectivism places emphasis on a more extended self which is understood in a wider context that is in relation to a physical and social environment which one seeks to harmonise (Meng, 2005). Meng (2005) outlines an experiment conducted by Tang (1996) in Hong Kong in which he tested Chinese students' habitual learning approaches, tendency to collaboration and their distribution of test and assignment. Based on the findings Chinese students tended to be in cooperative learning groups which were at times spontaneous, student centered and based on group effort-individual reward structure. This cultural phenomenon of collectivism is opposite to the western idea of individualism. Meng (2005) in concluding indicates that cooperative learning is an effective motivating style and can be applied to many instructional fields. He however noted that students' characteristics and cultural backgrounds must be considered; as such it should be flexible and change depending on the situation.

Other studies of cooperative learning also conclude that it is an effective teaching learning strategy one such by Felder and Brent (1994). Felder taught five chemical engineering courses in five (5) consecutive semesters using several non-traditional instructional methods including cooperative (team-based) learning. The aim was to examine the benefits, problems and solutions to cooperative learning in technical courses.

Felder (1994) found that students became so accustomed to working in groups that this work translated into other courses. For instance, in the third semester of the study the same group of students were in the class with a traditional instructor who utilized lectures. It was noted that in this traditional classroom students typically gained average of 50%, however, the group that was involved in the study of Cooperative learning gained an average of 72% on the first test and 78% on a second test. Felder (1994) therefore concluded that the cooperative learning technique had the desired effect of changing students' work ethic.

There have been surveys conducted in Third World cities such as Nigeria to assess student views of cooperative learning strategies. One such as conducted by Akinbobola (2009) to discover the attitude of students towards the use of cooperative, competitive and individualistic learning strategies in Nigerian senior secondary school physics. The research design for this study was quasi-experimental. There were a total of one-hundred and forty (140) students taking part in the study who were selected by a random sampling technique. A structured questionnaire titled Students' Attitude Towards Physics Questionnaire (SATPQ) on 4-point scale was used to collect the data. Poor student performance can be attributed to poor teaching methods, unqualified and inexperienced teachers; poor student attitude toward physics, poor learning environment and gender effect (Ivowi, 1997 in Akinbobola, 2009). Also, in the present Nigerian educational system, competition is valued over cooperative learning strategies (Akinbobola, 2009). The findings showed that cooperative learning strategy was the most effective in facilitating

students' attitude towards physics. This was then followed by competitive strategies with the individualistic learning strategies being seen to be the least facilitative.

According to Akinbobola's (2009), this study was in line with the findings of Johnson and Johnson (1989) that cooperative learning strategy promotes more positive attitudes toward the instructional experience than competitive or individualistic strategies. Akinbobola (2009) concluded that the result is not surprising because in cooperative learning, students are trained on how to interact positively, resolve disputes through compromise or mediation and encourage the best performance of each member for the benefit of the group. Akinbobola (2009) contends that when students are successful, they view the subject with a very positive attitude because their self-esteem is enhanced.

A study by Abu and Flowers (1997) was conducted to determine the effects of the cooperative learning approach of Student Teams-Achievement Divisions (STAD) on the achievement of content knowledge, retention, and attitudes toward the teaching method. The researchers utilized a quasi-experimental research design to compare the competitive and cooperative learning classroom structure. An achievement test, consisting of items from the state competency test-item bank for the course, and an attitude questionnaire were administered immediately following instruction on the unit of special nutritional needs (Abu & Flowers, 1997).

Abu and Flowers (1997) found that there was also no significant difference in student attitudes toward the teaching methods. They contend that even though the study showed no significant difference between competitive and cooperative learning, the literature suggests there may be additional reasons to use cooperative learning. For instance, the ability to work with others within a group and to develop interpersonal skills may be justification for using cooperative learning strategies. Abu and Flowers (1997) therefore contend that cooperative learning methods were as effective as non-cooperative methods with regard to achievement and retention, so concerns about the effectiveness of cooperative learning methods in these areas have been addressed.

Another research consulted was conducted within the secondary educational context in Jamaica. Kirby (2007) conducted an action research of cooperative at a High School in Rural Jamaica. The researcher's aim was to find out how effective the use of cooperative learning is in improving academic performance among Grade Nine (9) students. The study was a descriptive design with a sample size of seventy-two (30) students. Kirby (2007) collected the data through formal questionnaires, learning journals and focus group interview. The researcher discovered that based on the attitude questionnaire only 28% of respondents thought that accounting class was interesting using traditional teaching strategies, however this increased to 86% after the implementation of cooperative learning strategies. Overall, students believe that cooperative learning positively impacted on their learning experience (Kirby, 2007).

The following were the specific conclusions from Kirby's study.

- There was an improvement in the minimum and maximum scores of students. Students believed that cooperative learning allowed for a more relaxing environment where they exhibited better understanding.

- Students' self-esteem was enhanced; they stated that they felt more comfortable in answering questions. Student were more accepting of the help received from peers and they did not feel inferior to any other student as they all helped one another.
- Students developed team spirit during and after implementation. Competition was eliminated and all group members were focused on ensuring that everyone understood what was being taught.

The following question came to mind in assessing cooperative learning in our present societal context. Is cooperative learning practical in a society that requires social cohesion, but places emphasis on individualism and promotes competition? Individualism and competition seemingly are greater components of our educational system. According to Johnson and Johnson (2000), there are three basic ways students can interact with each other as they learn. They can compete to see who is "best," they can work individualistically toward a goal without paying attention to other students, or they can work cooperatively with a vested interest in each other's learning as well as their own. Of the three interaction patterns, competition is presently the most dominant. Research indicates that a vast majority of students in the United States view school as a competitive enterprise where one tries to do better than other students. This competitive expectation is already widespread when

students enter school and grows stronger as they progress through school (Johnson & Johnson, 1991). Cooperation among students-who celebrate each other's successes, encourage each other to do homework, and learn to work together regardless of ethnic backgrounds or whether they are male or female, bright or struggling, disabled or not, is still rare.

2.8 Summary of Literature Reviewed

The literature Reviewed Student's Perception and Attitude towards Cooperative Learning and Individualized Learning Approaches; and the relevance of the constructivism theory of learning science relevant to this study. The majority of the material consulted revealed that student-centered learning strategies are key to unlocking students' potential. This is so because, students receive hands on experience. Student-centered learning also enables students to interact more intimately with their teachers as well as their peers. Cooperative learning has theoretical grounding in various theories of psychology including Information processing theory, social interdependence theory, social cognitive theory, Vygotsky's socio-cognitive theory and Piaget's socio-cognitive theory. The idea is that man is a social being and as such, various forms of social interaction are essential for human societal survival. Within the classroom, the concept of cooperation can be promoted since individuals will be learning to work together for the overall benefit of the group. The literature also revealed that cooperative learning

is a very useful and beneficial strategy. However, can cooperative learning flourish in an individualistic society?

CHAPTER THREE

METHODOLOGY

3.0 Overview

This chapter provides description of the methodology employed in the study and includes the study area, research design, population, sample and sampling procedures, instrumentation, data collection (pre-intervention activities, intervention design and post- intervention activities), and methods of data analysis.

3.1 Study area

The study was carried out at Presbyterian Girls SHS, Odumase - Krobo in the Eastern

Region of Ghana.

3.2 Research design

The design for this study is action research, since it seeks to find solution to students' inability to understand the concept in respiration effectively. Mills (2011) defined an action research as any systematic inquiry conducted by teachers, administrators, counsellors, or others with a vested interest in the teaching and learning process, for the purpose of gathering data about how a particular school operates or how teaching is done and how students learn. Furthermore, an action research deals with an intervention which is appropriate for a small heterogeneous group context to improve the understanding of concept. This study was carried out in three major phases. The first pre-intervention activities, the implementation of intervention and the post-intervention activities.

3.3 Population

This study was carried out in Presbyterian Girls SHS in the Eastern Region of Ghana. It is single sex institution with a population of two thousand, five hundred students (2,500) as of 2017 academic year. The targeted population for the study was SHS form two students in the Home Economics department of Presbyterian Girls SHS. The targeted population is made up of one hundred and thirty-five (135) students.

3.4 Sample and sampling technique

A sample size of seventy-two (72) form two home economics students was selected from the target population of one hundred and thirty-five (135) students, using the purposive sampling technique. The justification for the choice of this sampling technique was because the researcher taught that class and therefore has sufficient knowledge on the performances of the students.

3.5 Research instruments

The data collecting instruments was a teacher-made-test (pre-test and post-tests). The test instruments were Pre-test questions (Appendix A), Post- test questions (Appendix B) and observational guide which were all developed by the researcher. The pre-test questions were used to assess the participants' knowledge and difficulty in respiration in order to have a baseline about all participants before the implementation of the interventions. The post-test questions were however, designed to measure participants' achievement after the implementation of the interventions. Both pre-test and post-test were a 45-item paper-and-pencil test. The basis for using the observational guide was to find out students' perception and attitudes towards the use of cooperative and individualized approaches towards the teaching and learning of respiration.

3.6 Pre - Intervention Phase

The researcher tested student's knowledge on respiration on her first visit to the class and found out that most of the students scored low marks. Upon discussions held with the students and students score in the test, it came to light that their background in biology was very low. As such, it was difficult for them to pick up. Marks were awarded according to pupils' performances and recorded for data analysis. Based on that, the researcher decided to come out with some interventions to help solve the problem. A pre-test was administered to the target group to find out their strength and weaknesses in the respiration concept; before the selection of the sample. The pre-test questions were given to students during a normal class teaching periods to solve individually. The duration of the pre-test was thirty (30) minutes. Answers provided by the respondents were marked using a marking scheme (Appendix C).

3.7 Intervention and its Implementation Phase

The main intervention adopted was to use cooperative learning strategy to improve the teaching and learning of respiration. The interventions were carried out for three weeks, taking place on Wednesdays each week within the normal classes' hours and lasted 30 minutes (2 periods), implying 15 minutes per period. Using the two (2) periods allocated for lessons each day per week, a total of six (6) periods were utilized for the designed intervention. Intervention implementation commenced on Wednesday 9th November, 2016 and ended on Wednesday 23rd November, 2016. The post test was conducted on

Wednesday 30th November, 2016.

Problems Encountered

The following factors hindered the pace of the study. Inadequate support from other instructors as they see the process as time wasting and cumbersome. Inadequate instructional aids in the school for the teaching and learning process. Less spacious classroom environment. Regular absenteeism of most student's due to poor health conditions and in some cases, long distance from their residence to the school.

3.8 Post- Intervention Phase

After the intervention, a post-test was conducted to find out how the intervention activities helped the students to improve their performance in the concept respiration. The post-test was not exactly the same as the pre-test, with the reason that if the intervention has been effective then the students should be able to answer simple questions on respiration. The post- test consisted five (5) items and the duration of the test was forty-five (45) minutes. (Appendix A2). Answers provided by the students in answering the post-test questions were marked using a marking scheme (Appendix B).

3.9 Validity of instruments

Validity of a test instrument was conducted to ensure that participants' scores from the instrument made sense, are meaningful and enable good conclusion to be drawn from the sample to the research population (Creswell, 2008). Both test instruments were presented to one senior biology lecturer in the Science Education Department of the University of Education, Winneba and two SHS elective biology teachers with considerable teaching experience in the Kpando District for their comments and suggestions in order to correct the errors that were associated with items on the pre-test and post-test questions.

3.10 Reliability of instruments

Reliability of a study instrument is the consistency of the instrument in producing the same or similar results given the same condition on different occasions. It is the degree to which a study instrument such as a questionnaire, or an interview guide measures a subject or a variable at different occasions and on all occasions, consistently giving the same or similar results. Reliability was established by using a pilot test, and collecting data from 30 subjects from Ola girls, Ho which has similar characteristics like the school under study. The instrument's reliability estimate was established through the split-half reliability estimate method. Data from the pilot test were statistically analyzed to determine the reliability of the test instruments using Pearson Product Moment Correlation Coefficient (PPMCC) formula since all items on both pre-test and post-test were

dichotomously scored. The analysis yielded reliability coefficients of 0.63 and 0.74 for the pre-test and post-test instruments respectively.

According to Ary, Lucy and Asghar (2002), if the measurement results are to be used for making a decision about a group or for research purposes, or if an erroneous initial decision can be easily corrected, then the scores with modest reliability coefficients in the range 0.50 to 0.60 may be acceptable. Therefore, the reliability coefficients for the pretest and post-test signifies that both test instruments are considerably reliable.

3.11 Method of Data Analysis

Data collected were analyzed using SPSS version 23, and converted to frequency counts and simple percentages in the form of tables. Data collected were analyzed using descriptive statistics of frequency counts and simple percentages and presented in frequency tables. A paired sample t-test was conducted to test hypothesis one at 0.05 level of significance.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.0 Overview

This chapter presents the statistical analysis of the research data, findings and discussions of the research data. The analysis was conducted based on the research questions posed.

4.1 Results

Research Question One:

What is the effect of (STAD) cooperative instructional approach on SHS 2 biology students' achievement in respiration in Presbyterian Girls SHS in Odumase - Krobo? In this section, the mean score of students of taught using STAD approach was compared with the mean score of students of taught using the individual approach.

Null Hypothesis

HO_1: Students taught using the Individual approach will show improved performance than students taught using the STAD approach.

In this section, the mean score of students of taught using STAD approach was compared with the mean score of students of taught using the individual approach. Table 4.1 describes the Means and Standard deviations of the Pre-test and Post-test were computed. The means represent the average score of individualized approach and STAD approach. From Table 4.1, it is evident that the average score using individual approach was 4.65, whereas students taught using STAD approach was 6.40. Conclusions cannot be drawn that STAD approach was better than the individualized approach without examining the statistical significance of the result.

Table 4.1: One-Sample Statistics

Table 4.1: One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Pre- Test	72	4.65	1.74	.205
Post-Test	72	6.40	1.47	.173

Source: Student's scores, 2017

Table 4.2: Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Pre-Test Post-Test	-1.750	1.536	.181	-2.111	-1.389	-9.668	71	.000

A paired sample t-test was conducted to examine whether there was a significant difference between the Pre-Test (individualized approach) and Post-Test (STAD approach) results. The test revealed a statistically significant difference between the two approaches ($t = -9.668$, $df = 71$, $p < 0.01$). Students taught using the STAD approach (M= 6.40, SD=1.49) reported significantly higher levels in academic performance than using the individual approach (M= 4.65, SD=1.74). The means of the STAD approach increased by 1.750 compared to that of the Individualized approach. Since the results were significant, it implies that the null hypothesis was rejected. Thus the hypothesis which states that Students taught using the Individual approach will show improved performance than students taught using the STAD approach is hereby rejected. This implies that the null hypothesis is rejected. Thus, suggesting that using (STAD) cooperative instructional approach had a significant effect on SHS 2 biology students' achievement in respiration in Presbyterian Girls SHS in Odumase- Krobo.

Research Question Two:

What differences exist in students' achievement when exposed to STAD cooperative and individualized approaches to teaching and learning of respiration in Presbyterian Girls

SHS in Odumase - Krobo?

Table 4.3: One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Pre-Test				
	72	4.65	1.74	.205
Post-Test	72	6.40	1.47	.173

Source: Student's scores, 2017

Table 4.3 describes the Means and Standard deviations of the Pre-test and Post-test were computed. The means represent the average score of Individualized and STAD approaches. From Table 4.3, it is evident that the average score using individual approach for Pre-Test was 4.65, whereas students taught using STAD approach for Post-Test was 6.40. The means of the STAD approach increased by 1.750 compared to that of the Individualized approach indicating that there was a significant difference in the two approaches.

Research Question Three:

What are student's perception and attitudes toward the use of individualized approaches to the teaching and learning of respiration in Presbyterian Girls SHS in Odumase - Krobo?

Table 4.4: Showing Means and Standard Deviations of Respondents' Perception and Attitude towards Individualized Approach

	Attitude Items	N	Mean	SD
Perception and attitudes	Students were asking questions to show their level of understanding	90	1.62	.74
	Students contributed massively towards the lesson	90	2.19	.79
	Students were able to understand concepts	90	1.28	1.03
Mean = 1.86 SD = 0.89	Students were able to apply concepts taught.	90	2.01	.94
	Students could explain concepts taught to their colleagues.	90	2.06	.99
	Students enjoyed the lesson taught	90	2.01	.84

Key: Strongly Agree= 5; Agree= 4; Uncertain=3; Disagree=2; Strongly Disagree=1

The result in Table 4.5 revealed that the students generally exhibited negative attitudes towards the individual learning approach. The results indicated a mean score on Perception of Importance (X = 1.86, SD = 0.89). This implied that students had a negative attitude towards the individual learning approach.

4.2 Discussion

The purpose of this study was to use cooperative instructional approach to improve the teaching and learning respiration among SHS 2 Home Economics Students of Presbyterian Girls SHS in Odumase - Krobo as against individual learning in Odumase - Krobo.

The researcher conducted tests items (pre-test and post-tests) and observational guide to collect data from the subjects. Findings obtained from research question one revealed a statistically significant difference between the two approaches.

Students taught using the STAD approach reported significantly higher levels in academic performance than using the individual approach. Results of hypothesis one was statistically significant, suggesting that using (STAD) cooperative instructional approach had a significant effect on SHS 2 biology students' achievement in respiration in Presbyterian Girls SHS in Odumase - Krobo. The means of the STAD approach increased by 1.750 compared to that of the Individualized approach. The results of this current study corroborates with findings of Balfakih (2003) that in teaching 10th grade chemistry, students team achievements division (STAD) is a more effective teaching method than the traditional-teaching method.

Findings obtained from research question two indicated that the means of the STAD approach increased by 1.75 compared to that of the Individualized approach indicating that there was a significant difference in the two approaches. Results support Kaufman (1997) that, the cooperative learning is more successful as a teaching learning practice as compared to customary teaching method.

Results of research question three showed that students in this study generally exhibited negative attitudes towards the individual learning approach. This implied that students had a negative attitude towards the individual learning approach. Findings agreed with Rai (2007) that STAD is ensures good interaction among students, improves positive attitude towards subject, better self-esteem, increased interpersonal skills.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS AND SUGGESTION FOR FURTHER STUDIES

5.0 Overview

This chapter examined how key findings and themes which emerged from this study can be compared and contrasted with those obtained from previous studies. It also looked at how the study's findings might be used to support or apply the theoretical framework discussed in the Literature Review. This chapter presents the summary of the study, and conclusions drawn from the study and recommendations.

5.1 Summary of the study

The purpose of this study was to use cooperative instructional approach to improve the teaching and learning respiration among SHS 2 Home Economics Students of

Presbyterian Girls SHS in Odumase - Krobo as against individual learning in Odumase - Krobo. Literature on the topic was reviewed under the following headings: Theoretical Framework, Science Education in Ghana, The Concept of Biology, The Study and Learning of Biology, Cooperative Learning and Alternate Traditional Method, Student-Teams Achievement Division (STAD), Cooperative Learning and its Development, Cooperative Learning, Cooperative Instructional Strategy and its theory, Elements of Cooperative Learning, Importance of Cooperative Instructional Method, Models of Cooperative Teaching Methods, The Concept of Respiration and its Importance, Students Perception and attitudes towards the use of cooperative instruction versus individualized instruction, individualized instruction and theory. The design for the study was action research. The population of the study comprised all SHS students of Presbyterian Girls SHS in the Eastern Region of Ghana. The accessible population consists one hundred and thirty-five (135) students. A sample size of seventy- two (72) SHS two home economics students were selected from one hundred and thirty-five (135) students using the purposive sampling technique. The data collecting instrument were teacher made tests (pre-test and post-tests) and observational guide, which were used to collect data from subjects. The data collected was analysed using descriptive statistics of frequency counts

and percentages which allowed the researcher to use numerical values to represent scores in the sample.

Findings of research question one revealed a statistically significant difference between the two approaches. Students taught using the STAD approach reported significantly higher levels in academic performance than using the individual approach. Post-test result was statistically significant, suggesting that using (STAD) cooperative instructional approach had a significant effect on SHS 2 biology students' achievement in respiration in Presbyterian Girls SHS in Odumase- Krobo. The means of the STAD approach increased compared to that of the Individualized approach.

Findings of research question two indicated that the average score using individual approach for Pre-Test was 4.65, whereas students of taught using STAD approach for Post-Test was 6.40. The means of the STAD approach increased by 1.750 compared to that of the Individualized approach indicating that there was a significant difference in the two approaches.

Results of research question three showed that students in this study generally exhibited negative attitudes towards the individual learning approach. The results indicated a mean score on Perception of Importance (X = 1.86, SD = 0.89). This

implied that students had a negative attitude towards the individual learning approach.

5.2 Conclusions

The situations in the classroom needs to be planned and constructed in such a way that students get the opportunity to interact with each other. In this interaction, will form a community that allows them to understand the process of learning and understanding each other. The STAD approach of cooperative teaching will not be out of place in addition to its importance in education. In applying STAD in teaching has advantages such as students work together in achieving its objectives by upholding the norms of the group. Besides, it also has disadvantages such as require a longer time for the students.

Based on the results of the study, the study concluded that:

1. the Student Teams Achievement Division (STAD) is one method or approach in a simple and cooperative learning for teachers who are just beginning to use cooperative approach in the classroom, STAD also an effective method of cooperative learning. The main idea behind the model STAD is to motivate the students to encourage and help each other to master the skills presented by the teacher.

2. Students taught using the STAD approach reported significantly higher levels in academic performance than using the individual approach. Thus,

using STAD approach to teach social studies may be applied if social studies teachers develop positive attitudes towards its use and are given opportunities with appropriate resources and training.

5.3 Recommendations

Based on the results, the study recommended that:

1. Students have different personalization goals of needs therefore, there is the need to offer them personalised institution through the use of STAD so that they can make their own choices, own their learning, increase their intrinsic motivation and put in more effort.

2. Teachers and students viewed STAD learning strategy as a valuable learning pedagogy that support knowledge. Therefore, teachers should employ STAD as a system of cooperative learning in which students learn to be formed into groups representing the students with the skills and different genders to bring student's learning experience to a different level.

3. Technology will allow collaboration between teachers and students creating digital resources, presentations and projects together with other educators and students will make classroom activities resemble real world.

5.4 Suggestion for Further Studies

The experience of this study has highlighted my interests. Future research should explore using cooperative instructional approach to improve teaching and learning of photosynthesis.

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APPENDIX A (PRE-TEST)

1. The most common substrate of respiration is _____.

a. Fats
b. amino acids
c. Glucose
d. Sucrose

2. During respiration, the substrate is _____.

a. Reduced
b. Hydrogenated
c. Carbonated
d. Oxidized

3. The percentage of nitrogen in inhaled air is _____% and exhaled air is _____%.

a. 21 and 21
b. 21 and 78

c. 78 and 21
d. 78 and 78

4. The percentage of carbon dioxide in the inhaled air is _____% and exhaled air is ____%.

a. 0 .04 and 4
b. 4 and 0.04
c. 0 .04 and 0.04
d. 4 and 4

5. The process common to aerobic and anaerobic respiration is _____.
a. Oxidation
b. Glycolysis
c. Kreb's cycle
d. electron transport chain

6. In higher plants, the gaseous exchange takes place through _____.

a. Stomata
b. Lenticels
c. general surface of some cells
d. all the above

7. In microbes, the gaseous exchange takes place through _____.

a. Stomata
b. Lenticels
c. general surface
d. all the above

8. The energy rich compound generated as final product during respiration is _____.

a. NADH
b. FADH
c. ATP

d. ADP

9. The production of alcohol by yeast is called _____.

a. Brewing
b. Fermentation
c. Respiration
d. none of the above

10. Lime water turns milky in the presence of _____.

a. carbon dioxide
b. Oxygen
c. Water
d. none of the above

11. In grasshopper, gaseous exchange takes place through _____.

a. gills
b. spiracles
c. trachea
d. lungs

12. The source of oxygen for the aquatic animals is _____.

a. Atmosphere
b. Water
c. Soil
d. none of the above

13. Glycolysis takes place in _____.

a. Cytoplasm
b. mitochondrial matrix
c. mitochondrial cristae

d. outside the cell

14. Kreb's cycle operates in _____.

a. Cytoplasm
b. mitochondrial matrix
c. mitochondrial cristae
d. outside the cell

15. Anaerobic respiration takes place _____.

a. in the cytoplasm
b. in the mitochondria
c. outside the cell
d. both a and b

16. Instant source of energy is _____.

a. Sucrose
b. Glucose
c. Fats
d. amino acids

17. The number of ATP molecules produced during aerobic and anaerobic respiration are _____ and _____ respectively.

a. 2 and 38
b. 0 and 2
c. 38 and 0
d. 38 and 2

18. Cramps are caused by heavy exercise resulting in the accumulation of _____.

a. carbon dioxide
b. lactic acid

c. Ethanol
d. Heat

19. Anaerobic respiration in the muscles does not produce _____.

a. lactic acid
b. Energy
c. carbon dioxide
d. both a and b

20. The product of glycolysis is _____.

a. carbon dioxide and water
b. pyruvic acid
c. acetyl CoA
d. none of the above

21. Lowering of diaphragm results in _____.

a. Inspiration
b. Expiration
c. it is not related to either
d. Digestion

22. The energy produced during respiration is stored in _____.

a. pyruvic acid
b. carbon dioxide
c. adenosine monophosphate
d. adenosine triphosphate

23. The breathing roots are the _____.

a. Rhizoids
b. Stomata
c. Pneumatophores
d. Lenticels

APPENDIX B (POST-TEST)

1. The surface area of the gills increase due to the presence of _____.

a. lamellae
b. alveoli
c. arches
d. slits

2. The direction of flow of water is _____ that of the flow of blood in the capillaries.

a. is in the same direction as
b. is opposite to
c. not connected to
d. none of the above

3. Production of sound in man is due to the presence of _____.

a. cartilage rings
b. Cilia
c. goblet cells
d. vocal cords

4. The number of spiracles in a grasshopper are _____.

a. 10
b. 20
c. 6
d. 8

5. Conversion of milk to curds is due to _____.

a. Spoilage
b. Fermentation
c. Boiling
d. Heating

6. The process complementary to respiration is _____.

a. Circulation
b. Photosynthesis
c. Osmoregulation
d. none of the above

7. Respiratory surface should be _____.

a. Permeable
b. Thin
c. richly supplied with blood vessels
d. all the above

8. The part of the respiratory tract that is responsible for keeping it healthy is _____.

a. Trachea
b. Bronchi

c. nasal cavity
d. all the above

9. Hiccups can be best described as _____.

a. forceful sudden expiration
b. jerky incomplete inspiration
c. vibration of the soft palate during breathing while sleeping
d. sign of somebody remembering you

10. Snoring can be best described as _____.

a. forceful sudden expiration
b. jerky incomplete inspiration
c. vibration of the soft palate during breathing while sleeping
d. sound sleep

11. Sneezing can be best described as _____.

a. forceful sudden expiration
b. jerky incomplete inspiration
c. vibration of the soft palate during breathing while sleeping
d. something you should never do when someone is going out

12. Respiration in addition to producing energy also carry out the function of _____.

a. producing the major part of body heat
b. manufacturing food
c. maintaining water levels
d. all the above

13. Which of the following are the stages of respiration in the correct order?

a. gaseous transport, breathing, tissue respiration and cellular respiration
b. breathing, gaseous transport, tissue respiration and cellular respiration

c. breathing, gaseous transport, cellular respiration and tissue respiration
d. breathing, tissue respiration, cellular respiration and gaseous transport

14. Epiglottis guards the entrance of _____.

a. pharynx
b. wind pipe
c. bronchus
d. lungs

15. The expired air differs from the inspired air in the following respects:

a. it contains more carbon dioxide
b. it contains less oxygen
c. it contains more water vapour
d. all the above

16. A commonly known organism that carries out anaerobic respiration is _____.

a. earthworm
b. amoeba
c. yeast
d. fish

17. Which structure separates thorax from abdomen?

a. lungs
b. heart
c. diaphragm
d. rib cage

18. Which metallic element is present in haemoglobin?

a. Magnesium
b. Sodium

c. Iron
d. Calcium

19. Which muscles are responsible for expiration?

a. external intercostal
b. internal intercostal
c. a and abdominal
d. b and abdominal

20. Which area of the brain controls the respiratory movements?

a. cerebrum
b. cerebellum
c. medulla
d. medusa

21. The instrument used to measure the volume of respired gases is _____.

a. Respiroscope
b. Spirometer
c. Barometer
d. Thermometer

22. Maximum carbon dioxide concentration will be in the _____.

a. inspired air
b. expired air
c. dead space air
d. all will be same

APPENDIX C – MARKING SCHEME

Pre -Test

1. **Answer:** c
2. **Answer:** d
3. **Answer:** d
4. **Answer:** a
5. **Answer:** b
6. **Answer:** d
7. **Answer:** c
8. **Answer:** c
9. **Answer:** b
10. **Answer:** a
11. **Answer:** b
12. **Answer:** b
13. **Answer:** a

14. **Answer:** b
15. **Answer:** a
16. **Answer:** b
17. **Answer:** d
18. **Answer:** b
19. **Answer:** c
20. **Answer:** b
21. **Answer:** a
22. **Answer:** d
23. **Answer:** c

Post -Test

1. **Answer:** a
2. **Answer:** b
3. **Answer:** d
4. **Answer:** b
5. **Answer:** b
6. **Answer:** b
7. **Answer:** d
8. **Answer:** 4
9. **Answer:** b
10. **Answer:** 3
11. **Answer:** a
12. **Answer:** a
13. **Answer:** b
14. **Answer:** b

15. **Answer:** d
16. **Answer:** c
17. **Answer:** c
18. **Answer:** c
19. **Answer:** d
20. **Answer:** c
21. **Answer:** b
22. **Answer:** b

APPENDIX D

Week 1 Intervention 1

Week ending: 11th November, 2016

Day: Wednesday 9th November 2016

Duration: 30 minutes

Time: 9:00 am – 9:30 am

Topic: Cellular Respiration

TLM: Animations and pictures

Objectives:

At the end of the lesson/activities,

1. Students must be able to explain the term **cellular respiration**
2. Students must be able to explain the equation for cellular respiration.

Activities:

1. Teacher brainstormed students to come out with the explanation of cellular respiration
2. Teacher discusses the equation for cellular respiration with students.
3. Teacher discusses the importance of cellular respiration with students.
4. Student explain the term cellular respiration.
5. Student state the importance of cellular respiration.
6. Student state and explain the equation for cellular respiration

Week 2 Intervention 2

Week ending: 18th November, 2016

Day: Wednesday 16th November 2016

Duration: 30 minutes

Time: 9:00 am – 9:30 am

Topic: Cellular Respiration

TLM: Animations and pictures

Objectives:

At the end of the lesson/activities,

1. Students will be able to explain the meaning of aerobic and anaerobic respiration
2. Students will be able to give at least two differences between aerobic and anaerobic respiration.

Activities:

1. Teacher discusses the meaning of aerobic and anaerobic respiration
2. Teacher brainstormed students to come out with the differences between aerobic and anaerobic respiration.
3. Student explain the term aerobic and anaerobic respiration.
4. Student state two differences between aerobic and anaerobic respiration.

Week 3 Intervention 3

Week ending: 25th November, 2016

Day: Wednesday 23rd November 2016

Duration: 30 minutes

Time: 9:00 am – 9:30 am

Objectives:

At the end of the lesson/activities,

1. Students will be able to explain the term Glycolysis
2. Students will be able to explain the meaning of Krebs Cycle/ Acid Cycle.

Activities:

1. Teacher discusses the meaning of Glycolysis.
2. Teacher discusses the meaning of Krebs Cycle/ Acid Cycle.
3. Student explain the term Glycolysis.
4. Student come out with the meaning of Krebs Cycle/ Acid Cycle.

APPENDIX E- OBSERVATIONAL GUIDE

Key: Strongly Agree (SA) = 5; Agree (A) = 4; Uncertain (U) =3; Disagree (D) =2;

Strongly Disagree (SD) =1

Items	SA	A	U	D	SD
Students were asking questions to show their level of understanding					

Students contributed massively towards the lesson					
Students were able to understand concepts					
Students were able to apply concepts taught.					
Students could explain concepts taught to their colleagues.					

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DECLARATION

STUDENT'S DECLARATION

I, Efua Ataa Boamah declare that this dissertation, with the exception of quotations and references contained in published works which have all been identified and duly acknowledged, is entirely my 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 dissertation as laid down by the University of Education, Winneba.

NAME OF SUPERVISOR: Prof. Yaw Ameyaw

SIGNATURE: …….....…….

DATE: …….....….

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DEDICATION

This dissertation is dedicated to my lovely husband, Mr. Kojo Addo and my children; Aba Addo, Adwoa Addo and Kobina Addo.

ABSTRACT

The purpose of this study was to assess the use of cooperative instructional approach to improve the teaching and learning of respiration among SHS form 2 Home Economics Students of Presbyterian Girls SHS in Odumase- Krobo as against individual learning in Odumase Krobo. Seventy-two (72) Home Economics students were sampled using the purposive sampling techniques. Teacher-made-test (pre-test and post-tests) and observational guide were used to collect data. The instrument was validated through content validation procedures and yielded a reliability of Cronbach Alpha coefficient of 0.63. Three (3) research questions guided the study. Descriptive statistics of Frequency counts and percentages were employed for all the research questions. Findings obtained from research question one revealed that students taught using the STAD approach (M= 6.40, SD=1.49) reported significantly higher levels in academic performance than those using the individual approach (M= 4.65, SD=1.74). Findings obtained from the research question two revealed a statistically significant difference between the two approaches. Results obtained on research question three also showed that students in this study generally exhibited negative attitudes towards the individual learning approach. Based on the outcome of the results, the study recommends that, there is the need to offer them personalised institution through the use of STAD so that students can make their own choices, own their learning, increase their intrinsic motivation and put in more effort. Also, teachers should employ STAD as a system of cooperative learning in which students learn to be formed into groups representing the students with the skills and different genders to bring student's learning experience to a different level.