UNIVERSITY OF EDUCATION, WINNEBA

DEPARTMENT OF SCIENCE EDUCATION

EFFECTIVENESS OF AUDIO-VISUALS IN ENHANCING UNDERSTANDING OF CIRCULATORY SYSTEM

PROSPER APALIYA AGANGBA

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

DECEMBER 2016

DECLARATION

STUDENT'S DECLARATION

I, Prosper Apaliya Agangba, 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 it has not been submitted, either in part or whole, for another degree elsewhere.

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PROSPER APALIYA AGANGBA Date

SUPERVISOR'S DECLARATION

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

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DR. JOSEPH NANA ANNAN Date

(SUPERVISOR)

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Finally, while I appreciate the contribution of others that have not been mentioned in this research work, I take responsibility for any short coming.

DEDICATION

This dissertation is dedicated to the Almighty God for His mercy and guidance and for sparing my life from the beginning of my course work to the period of this research work. I thank Him very much because without God I cannot achieve this.

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ABSTRACT

The objective for this study was to determine the effectiveness of audio-visual method of teaching over traditionally-designed instruction on second year students of Awe Senior High Technical School in circulatory system. Three (3) research questions and two (2) null hypotheses were formulated to serve as guide for this study. Samples of two intact technical classes were placed into experimental and control groups. The study made use of a standardized achievement test items and a structured questionnaire as the instruments for data collection, the scores obtained were analysed using the t-test statistical method. Quasi-experimental non randomized design involving the pre-test and post-test was employed for the purpose of this study. The result obtained at pretest for both groups had a p-value of 0.13955 at 0.05 significance level therefore failed to reject the null hypothesis which stated that there was no significant difference between the two groups at pretest. Results obtained at posttest ***10−4*** which is less than 0.05 therefore, the null hypothesis which stated that there was no significant difference between experimental and control groups at posttest was rejected. The rejection was attributed to the use of audio-visuals on the experimental group. The findings revealed that the use of audio-visuals in teaching was most effective way of improving students' performance in the teaching and learning of circulatory system in Integrated Science.

CHAPTER ONE

INTRODUCTION

1.0 Overview

This chapter contains information on the background to the study, statement of problem, the purpose of the study, educational significance of the study, and the research questions to be addressed by the study. Also presented are the assumptions of the study.

1.1 Background of the study

It is very clear that the world that we live in is constantly being moved by the progress being made in science and technology especially in the developed countries of the world. A strong science and technology knowledge base therefore constitutes the currency for social and economic transformation of nations. Nations that have developed have utilized the opportunities offered by the current phenomenal increase in science and technology especially information and communication technology, biochemistry and material science. Such nations have scaled the poverty barrier and moved into the club of rich countries. Some of these countries including Singapore, South Korea and Malaysia, which in the 60s were at the same developmental level as Ghana have witnessed improvement in their economies through the development and application of science and technology (Anamuah-Mensah, 2004).

Since Ghana want to develop rapidly then there is the need for science, mathematics and technology to become the pivot of their education starting from the early childhood.

The recent education reform buttress this point as it was stated clearly in the executive summary of the President's Committee on Review of Educational Reforms in Ghana

October 2002, the key to the future socio-economic development of Ghana lies in the development of a large number of scientists, engineers, technologists, technicians and draftsmen to bring about technological innovations. To achieve this it is then imperative that science and science education must be given the number one priority.

Science is defined as a body of knowledge gained by observation and experiment (Otto & Towle, 1985). Science can then be explained simply as the search for explanation of what we observe in nature and knowledge we have discovered. However students perceived science to be so strange and too difficult and this perception cuts across all levels of education where science is taught. Due to this perception about science, student at every level of the education ladder try to avoid it when given the opportunity (Graham, 1976).

At the secondary stage the study of natural sciences is receiving and increasing emphasis day by day. The browning number of the students offering science group at high of higher secondary stage, and inclusion of integrated science as a compulsory subject of study justifies its great significance. Perhaps it is due to the impact of technological development taking place in the country and an ever increasing demand of skilled workers for feeding the various industries running or in making all over the country. Obviously such an important subject like science must receive the immediate attention of those entrusted with responsibility of teaching the subject at different levels (Shri & Badri, 2014).

In the light of responsibility an effort is made through this study to assess the effectiveness of using Audio-Visuals aids in understanding circulatory in mammals in Integrated science at the secondary level to make the teaching really purposive and useful. The importance of natural science have also been realized by the medallion

commission in the following words: “An understanding and appreciation of the fundamental principles of the natural and physical science is essential to effective living in the world of today.”

The realm of this modern education is to awaken the hidden curiosity and interest of the learner, nourishing his behaviours, attitudes and believes in order to develop basic and essential skills of lifelong learning and ability to think critically and to judge him and others in a more beneficial manner (Samreen et al.2012).

Students should be given confidence to ask, inquire, explore and be creative and initiators. Infect an inquisitive mind is the beginning to lifelong learning that surely leads to success. Before modern education was incorporated students was passive listener and teacher was autonomous body who knows what, when and how of education. But in recent years the superiority is shifted towards students. Use of audio-visual aids is preferred as they are considered as 85% of whole teaching and learning (Jadal, 2011). They keep the individual learner focused on what is being taught by the teacher in the classroom session.

It is apparent that the stakeholders of education such as Ministry Of Education, Ghana Education Service, Curriculum and Research Development Division (CRDD), Government etc, has the optimal responsibility to find solutions to the problem, the onus also lies on the teacher of the subject who have day to day interaction with students to device means of averting the problem by arousing the interest of the pupils in the subject thus embarking on the research “Assessing the effectiveness of audio-visuals in understanding circulatory system in integrated science. A case study of Awe Senior High Technical School”

1.2 Problem statement

It has been recognised by various researchers of science curriculum at various levels of education that, "scientific concept taught in abstract terms forces students to resort to rote learning without understanding" (Felder, 1993). Concepts in human digestion, circulation of blood in mammals, excretion, fertilization in human and flowering plant, flower formation are clear examples. This has led to poor performance of students in the biology aspect of integrated science at the Senior High School level as indicated by the chief examiner report West Africa Examination Council (WAEC, 2011).

This assertion by the WAEC biology chief examiners about integrated science students' performance is also shared by colleague teachers who teach integrated science and integrated science examiners.

The WAEC biology chief examiner attributes the low performance to student's failure to properly understand exams questions and providing correct answers. These students' failures can be traced to students' inability to grasp properly the fundamental concepts in science and teachers failure to communicate the fundamental concept via the appropriate method of teaching science, further discussion and analysis of the problem from fellow science teachers and science examiners revealed that major contributing factor is the use of inappropriate method of teaching science by teacher and inadequate classroom facilities.

Most science teachers including myself have adopted various methods of teaching and learning science in the hope of communicating effectively the core ideas and concept of science to the students. Common methods of teaching employed over the years are

the traditional or lecture method of teaching, inquiry method, collaborative method etc.

These methods even with the addition of charts and improvised teaching and learning materials are unable to proper explain concepts such as the process of photosynthesis, circulation of blood in mammals, digestion in mammals, transpiration in plant, fertilization process in plant, skeletal system etc.

To overcome some of the difficulties teachers and students face under this method as suggested by Davis (1993) and Mckeanchie (1994), is to use audio-visuals to enhance presentation and to captivate and sustain students. Also, adopt reasonable and adjustable pace that balances content coverage and student understanding.

1.3 Aim

The research is to find out whether the use of audio-visuals as a teaching method improves the teaching and learning of circulatory system in integrated science amongst students of Awe Senior High/Technical School.

1.4 Specific objectives of the study

1. To determine the knowledge students have about circulatory system in integrated science before the instructional strategies.
2. To compare the performance of students taught circulatory system at post-test using audio-visuals and those taught using traditional method of teaching.
3. To determine the perception of students about the use of audio-visuals in teaching.

1.5 Research questions

In order to ascertain the effectiveness of audio-visuals in understanding circulatory system in the selected Senior High School, the following questions were addressed in the study:

1. What is the knowledge students have about circulatory system in integrated science before the instructional strategies
2. Is there any difference in post-test scores between the experimental group students who learnt with audio-visuals and control group students who learnt with the traditional method of teaching?
3. What are students' perceptions about the use of audio-visual aids in learning the circulatory system?

1.6 Research Hypotheses

In line with the research questions, the following null hypotheses were raised for this study:

H_0: There is no significant difference between both groups (classes) on circulatory system at pretest

H_1: There would be significant difference between both groups (classes) on circulatory system at pretest.

H_0: There is no significant difference in between both groups (classes) on circulatory system at post-test.

H_1: There would be significant difference in between both groups (classes) on circulatory system at post-test.

1.7 Significance of the study

The researcher believes that the findings of this research work would go a long way to assist and guide fellow researchers, science teachers, science faculties and policy makers in science education in drawing curriculum and syllabus, to critically look at teaching and learning of science with audio-visuals as an essential requisite in the delivery of integrated science lessons.

It also seeks to encourage teachers to employ modern teaching methods and students to search and learn for themselves as the use other mediums such as the internet from educational videos, films and audio lectures apart from the text books.

This research could improve integrated science teaching and also overcome the difficulties science teachers encounter in teaching some biological concepts in integrated science.

1.8 Limitation

For meaningful deduction/conclusion to be made on the impact of audio-visuals in understanding biology aspects of integrated science at Awe Senior High Technical School, all topics in the syllabus must be treated with the audio-visual method but due to inadequate resources. This will limit the research to only the circulatory system in the syllabus.

1.9 Delimitation

The study was delimited to Awe Senior High Technical School (technical 2A& 2B classes) in upper east region because the researcher happens to be the subject teacher for both classes and he used these intact classes for the study. The research could not be extended beyond the confines of the school, for consideration of suitable sample only form two classes were used for the study.

Space and instruction time on a restricted time table could not allow for all classes in the school.

1.10 Organisation of the study

The study involved five (5) chapters with sub-headings in a systematic order. Its' first chapter explains the scope of the problem; it has aspects like background to the study, statement of the problem, research questions, limitations and delimitations.

Chapter two (2) is the literature review which requires the researcher to sort ideas from other related materials to the study. Chapter three (3) is on methodology which deals with how the study will be carried out and the instruments used during the intervention.

Chapter four (4) involves the results of findings. It deals with presentation and drawing comments about the study. The last chapter being chapter five (5) is summary, conclusions and recommendation.

CHAPTER TWO

LITERATURE REVIEW

2.0 Overview

This chapter examines and discusses the issues raised in the form of literature of related studies and also the theoretical framework related to essential aspects of the study.

2.1 What is science?

Science is defined as the use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process (The National Academy of Sciences, 2008).

The US Supreme Court in Daubert v. Merrell (1993) stated that science is not an encyclopaedic body of knowledge about the universe. Instead, it represents a process for proposing and refining theoretical explanations about the world that are subject to further testing and refinement. But, in order to qualify as 'scientific knowledge,' an inference or assertion must be derived by the scientific method. Proposed testimony must be supported by appropriate validation - 'good grounds,' based on what is known. In short, the requirement that an expert's testimony pertain to 'scientific knowledge' establishes a standard of evidentiary reliability.

What we call "science" is the human activity practiced by "scientists", who are often assembled in scientific communities, and whose results and pronouncements often conflict. The history of science is full of ups and downs, which have famously been likened to political revolutions. There are stated and unstated principles and rules by which scientists operate, primarily encoded in the "scientific method", which is in

principle based on empirical observation, logic, verification and falsification, but in practice affected by many other contingencies (Hohenberg, 2010).

Science teaching in Ghana is still accomplished through 'talk and chalk' approach despite the exposure of science teachers to student- centred methods (Seweje, 1987). The emphasis has been on good performances in examinations, so the student memorises the scientific facts to pass the examination. In some cases, the students are encouraged to read passively from science textbooks when examination is so close and there is no time for student teacher discussion of the topic. Efebo (1996) came out with the findings that science teachers lack the appropriate strategies for teaching the subject. They therefore keep on giving notes to the students, which they copy without understanding.

Since science became one of the core subjects of the National Curriculum, the nature of science education changed and 'there has been a general acceptance that learning science involves more than simply knowing some facts and ideas about the natural world' (Millar & Osborne, 1998).

In this complex society of today where experiences are innumerable and varied it is not at all possible to present every situation in its original colors hence the opportunities for learning by actual experiences always are not at all possible. It is only through the use of proper audio-visual aids that the life situation can be trough in the class room by an enlightened teacher in their simplest form and representing the original to the highest point of similarity which is totally absent in the verbal or lecture method. In the presence of audio aids the attention is attracted interest roused and suitable atmosphere for proper understanding is automatically created, but in the existing traditional method greater efforts are to be made in order to achieve the fore

said essential requisite. Inspire of the best and sincere efforts on the side of the teacher the net effect as regards understanding or learning in general is quite negligible (Shri & Badri, 2014).

2.2 Classroom environment for science teaching and learning

A considerable time of a child in a school is spent in the classroom. The classroom and its environment is where children will learn the various skills deemed necessary and proper for them to achieve success in the global society. It is where they will gain an understanding of their existence in the world and the gifts that they have to offer it. The classroom helps students develop what they want their future to look like, as well as knowledge of the skills needed to reach those goals.

With the classroom being such an important place in the growth of a child it is important to understand the ways in which to affect this environment in order to receive maximum effectiveness in instruction. If schools really do play a large role in teaching the next generation how to be successful members of society then every precaution should be taken to make sure that the learning environment is one that helps students thrive.

Twenty-first century learning environments are envisioned as places where the learner is engaged in self-directed and co-operative learning activities, and the physical environment is planned so that it can be routinely re-organised to mediate learning (Partnership for 21st Century Skills, 2002).

Classroom management is a critical part of effective and successful instruction. Effective classroom management, which initiates with well-organized and efficient lesson planning preparation, helps a teacher to teach and students to learn. Students perform well in an optimistic classroom atmosphere and an environment in which they feel secure, safe, cared for and involved. From a student point of view, effective

and successful classroom management provides students with opportunities to socialize while learning interesting content. From a teacher point of view, effective classroom management involves preventive discipline and interesting instruction (Lang and Hebert, 1995).

An aspect of the classroom that is difficult to control but can play a large part in keeping students engaged is the classroom temperature. This can be a tricky facet to modify in the classroom since many schools use a central heating system. Too cold or too warm of a classroom can make students sluggish or inattentive. Also, poor circulation of air can create dust or air pollution that can affect students' allergies. A classroom with fresh, warm air can create an atmosphere conducive to learning (Hannah, 2013).

Some students may have needs that need to be met individually. There are ways to easily accommodate them as well without changing things for the rest of the class. If a student has a visual impairment the teacher can either make power points in larger font or print the PowerPoint off for the student to follow. If the student has a hearing impairment the teacher can wear a microphone or have the student sit closer to where the teacher will be speaking.

They can also allow the student to use a tape recorder so they can listen to the instructions again at home if needed. All of these can be done easily to benefit all of the students (Erin & Melissa, 2012).

2.3 Challenges facing teaching and learning science in schools

As cited from the ICSU report of 2011, Teachers play a key role in inspiring and mentoring future scientists, using constructivism and other recommended teaching

practices for effective student learning. Unfortunately, in many countries around the world, teachers are not well prepared to teach scientific subjects and indeed, may be more effective in driving students away from scientific disciplines than attracting them because of their lack of preparation. Some teachers lack a basic understanding of the mathematical and scientific concepts that will be the foundation for preparing the scientists of tomorrow. Quality professional development, continuing education and support for teachers are needed to prepare them to help students become scientifically literate, as well as to encourage those students that want to pursue scientific disciplines for their career. Furthermore, in some countries and at some grade levels, it is important to ensure that scientific content is presented in a way that considers cultural context, so that appreciation of the material is optimized for teachers, students and their families.

Inadequate numbers of well prepared and highly motivated science and technology teachers. At the moment almost 50% of teachers at the senior secondary level are not professionally trained. Most basic education teachers are ill-prepared to teach science and technology. Science teachers are poorly motivated and resourced resulting in appreciable numbers leaving the teaching profession for other occupations. Information available indicates that a sizeable percentage of students enrolled in Masters in Business Administration programmes at the University of Ghana are science and technology graduates (Entsua-Mensah, 2004).

Inadequate funding of the development of science and technology and science and technology education in the country; it is estimated that resource allocation to science and technology constitute only 0.3-0.5 per cent of GDP which is far below the decision taken by the signatories to the Lagos Plan of Action to spend at least 1.0% of

GDP. This has resulted in poor infrastructure including laboratory and workshop facilities for the teaching of science and technology in the schools (Anamuah-Mensah, 2004).

Okello and Kagoire (1996) say," The quality of education of a country largely depends on the quality of teachers." In other words, the quality of education is as good as the quality of teacher. Meanwhile if the quality of science teachers is poor, the quality of science education will be poor. What this means, therefore is that the quality of teachers will determine the effectiveness of teaching and learning science. Science teaching and learning needs adequately trained and motivated teachers in order to succeed but if we look at Ghana education system it lacks such teachers.

2.4 Concepts in science and conceptual change

All good teachers have always realized that one must start "where the student is." Since the 1960s, we have come to a completely new understanding of what this means. Back then, it was defined in terms of what the student lacked, and this was seen as a lack of science content knowledge, combined with age-related limitations in general cognitive capacities (e.g., the elementary school child is a concrete thinker not capable of abstract reasoning). Now we understand that the main barrier to learning the curricular materials we so painstakingly developed is not what the student lacks, but what the student has, namely, alternative conceptual frameworks for understanding the phenomena covered by the theories we are trying to teach (Carey, 2000).

Cognitive science heralds both good and bad news about the nature of human concepts and the process of conceptual change. The bad news is that conceptual change is extremely difficult to achieve, for reasons that have been understood at least

since the early writings of Kuhn (1962) and Feyerabend (1962). The good news is that all normally developing children have the capacity for conceptual change, and science educators and cognitive scientists, working collaboratively, are making very good progress at understanding how to foster conceptual change in the classroom (Carey, 2000).

Concepts are units of mental representation roughly equivalent to a single word, such as object, animal, alive, heat, weight, and matter. Theories of how people represent knowledge require concepts to fulfill many distinct functions, and there are currently no theories that successfully provide a picture of mental representations in which concepts discharge all the burdens placed on them (Carey, 2000).

Dale (1975) states learning or conceptual change is brought about from a state of dissatisfaction when an external experience is disturbed or conflicted between the existing ideas and the incoming ideas. Thus, the student sees the environment from the point of view of higher existing knowledge and mental thought patterns. Cobern (1996) explained that any individual is constantly assimilating new information that agrees with higher existing ideas. Nevertheless, when a disturbance or conflict between what the learners already know and the new information occurs, the new information may be rejected or modified before being accepted (Cobern, 1996). In other cases the old idea might be replaced or reorganized. According to Dale (1975), this process is called accommodation. It is the case when discrepant events or 'kounteo experiences" are used with the hope that the student will undergo a conceptual change or otherwise the conflict may remain unresolved (Gunstone, 1994). Accommodation in this case is brought about by equilibration and achieving a state of balance by either replacing the old idea with the new, or modifying the new idea for acceptance. Equilibration, which is a Piagetian term, means a compensation for an

external disturbance (Dale, 1975). The compensation is by having a changed of viewpoint due to alterations to existing knowledge and modification of existing mental structures to incorporate the new aspects (Dale, 1975).

However, not all that is presented to learners is accepted. Some students are resistant to conceptual change because of their various psychological or socio-cultural beliefs.

Hodson (1998) have interpreted this resistance by viewing such events from a Vygotskian perspective. This is an outlook that sees the group or social class as having a major role in shaping what its members learn or accept as user information.

Among the factors influencing learning or acceptance of a new concept is social pressure. This may come from other peers who hold a particular view. The peers could be those who occupy a special place in the student's personal life with respect to what Hodson (1998) calls the "student power" hierarchy. They create immense social pressure to conform, leading to a development and legitimization of a change of view. Sometimes the learner may hold membership of several social groups each of which has to follow and exerts social pressures to conform. In Hodson's view, the personal framework of understanding view of learning allows for the proliferation of meaning in response to entry into additional social groups.

Social and cultural group identities, such as gender, ethnicity, religion and politics also impact heavily on learning (Hodson, 1998). Aikenhead (1996) revealed in his study that each of these cultures or subcultures provides the learner with different "lenses" through which experiences are interpreted and understood. These different ways of seeing things can develop into what Claxton (1993) calls "stances" which tend to direct or guide individual students and their group activities or actions. In other words, stances constitute the ethics, the code of practice of the individual

members of a group and the group as a whole subscribe to. These stances become the frameworks that guide students' leaning behaviour. Sticking to these stances is like ensuring allegiance to the norms and practices that constitute them. It is because of this that students always work to hold together al1 the social groups they associate with. They do this by implicitly or sometimes explicitly swearing allegiance to the social groups. Some of the learners have been found to "act out" by supplying responses that depend on the prevailing circumstances (Hodson, 1998; Matthews, 1994).

2.5 Learning styles

Felder & Brent (2005), define learning styles as characteristic cognitive, affective, and psychological behaviours that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment. Learning styles do not encompass the ability to learn.

Even before learning styles was coined as a reputable and credible strategy in education, we all knew that we learn and interpret information presented to us differently. Some interpret information more effectively if presented in a verbal format. Whereas others interpret information more effectively when there are pictures and graphics involved. They are able to read more into an image rather than when being told the information.

Theories of learning styles suggest that individuals think and learn best in different ways. These are not differences of ability but rather preferences for processing certain types of information or for processing information in certain types of way. If accurate, learning styles theories could have important implications for instruction because

student achievement would be a product of the interaction of instruction and the student's style (Willingham, Hughes & Doboyi, 2015)

If a student possesses a particular learning style but is taught in a style that opposes the way the student learns, the student will appear bored and disinterested. It does not necessarily mean no learning will take place. There will be some or little acquisition of knowledge. The process of attaining this knowledge will take longer and it will be a difficult process for the student (Vanessa, 2011).

A method appropriate for most students may be ineffective for other students who could learn more easily with a different approach. Methods of teaching (e.g., graphic or verbal), ways of representing information, personality characteristics of teachers all affect learning and affect different learners differently (Mckeachie, 1995).

Learning styles are as individual as our characteristics. One author went as far as providing fingerprints as a benchmark by which learning styles should be compared. (Fuller, 2004).

In Talkers, Watcher and Doers, three main styles are identified and described.

They are the auditory learner, the visual learner and the kinesthetic learner. Many papers and books on improving learning abilities focus on these three types of styles.

Individuals are generalized and classified according to these three types of styles. The three styles are briefly discussed below

Auditory learners are learners who listen and learn. They digest information by simply listening. They are able to sit through long lectures easily and walk away from the lecture with valuable and important knowledge attained.

Visual learners are learners who learn by sight. They are able to visualize the solution to a problem. They see it in their head like a photograph and are then able to write it

down. They are not able to follow verbal instruction well and works best when there is a list of things to do rather than being told what to do.

Kinesthetic learners are learners who learn when their body is active. They need movement to digest information. They learn from touching and experiencing for themselves rather than being told a theory and made to understand it. They tend to misunderstand instructions when presented orally or visually.

For Felder and Henriques (1995), the criterion for classifying learners is their perceptual behaviour. They make two categories: sensing and intuitive learners. 'Sensing' learners are concrete and methodical; they are good at memorising facts and doing hands-on work and are more comfortable with following rules and standard procedures. On the other hand, 'intuitive' learners tend to be abstract and imaginative; they like innovation and dislike repetition. As to the ways in which learners prefer input information to be presented, they can be either visual or verbal learners. Visual learners are those who prefer to receive in the form of pictures, diagrams, films and demonstrations while verbal learners prefer words as a medium for information transfer. Moreover, with respect to the ways of knowledge can be processed, learners can be put into two categories, namely 'active' and 'reflective'. An active learner, as suggested by the name, is someone who prefers to be actively involved in examining and employing knowledge with others. He does so in group discussions and interactions with others. Reflective learners tend to employ their introspection. Active learners benefit the most in dialogue, role-play and team work learning activities while reflective learners are more inclined to ponder on perceived information.

2.6 Cognitive theoretical perspective on learning

Constructivism is a term that has been widely used in educational research over the past 30 years and presents a variety of different meanings. Therefore, it is necessary to begin by defining my interpretation and use of the term constructivism.

Constructivism is a theory about how students learn that focuses on the productive role of learners' existing ideas and their interpretation of the reality they experience (Cobb, 1990; Smith, Disessa, and Rochelle, 1993; Steffe, 1991; Steffe and Thompson, 2000; von Glasersfeld, 1995). Originating from Piagetian roots, learning from this perspective is the reorganization of cognitive structures or accommodation: when a new conceptual structure is formed or an existing structure is reorganized or modified to account for an experience that does not conform to previously constructed structures (Steffe, 1991; Steffe and Thompson, 2000; von Glasersfeld, 1995).

From this perspective, cognition is viewed as "an instrument of adaptation, the purpose of which is the construction of viable conceptual structures" (von Glasersfeld, 1995). When confronted with a new situation, a learner will either assimilate or accommodate the new information to maintain cognitive equilibrium. If the experience can be explained or understood within the learner's existing cognitive structure, then the learner maintains her cognitive structure: assimilation. If, however, the experience contradicts the learner's cognitive structure, this results in disequilibrium (perturbation). The desire to maintain cognitive equilibrium drives the learner to reorganize her existing cognitive structure or generate a new one: accommodation.

Since learning from this perspective derives from a need to maintain cognitive equilibrium, many researchers suggest that instruction should provide an experiential

basis for cognitive conflict such that the complex and gradual process of cognitive change can take place (Chinn and Brewer, 1993; Hammer, 1994; Minstrell, 2001; Posner, Strike, Hewson, and Gertzog, 1982; Smith, diSessa, and Roschelle, 1993).

This assumption posits that if a learner's cognitive structure cannot account for an experience (for anomalous information) then the learner will likely modify his or her cognitive structure. To effect this cognitive change, however, the learner must view the information as contrasting with existing knowledge.

The constructivist theoretical assumptions about learning and cognition include viewing learners as active builders of knowledge, and learning as fundamentally interpretive in nature.

2.7 Social Theoretical Perspective on Learning

Educational researchers from a social perspective believe that learning and understanding are inherently social and cultural activities (Brown, Collins &Duguid, 1989; Cobb & Yackel, 1996; Gilbert & Yerrick, 2001; John-Steiner & Mahn, 1996). Cognition and learning can be examined as situated in a broad social institution, a cultural setting, or through interpersonal interactions. In each of these settings, there are various ways to theorize about the relationship between the social context and the individual's knowledge construction. In this section, I briefly address the differences between three of these social learning perspectives: the sociocultural perspective, the emergent perspective, and social constructivism.

Vygotsky's Sociocultural Perspective. From the sociocultural perspective, education and learning are viewed as situated in a larger social and cultural structure.

Vygotsky believed that each human mind was unique and affected by "social, historical, cultural, and material processes" (John-Steiner and Mahn, 1996, p.196).

From this perspective, the link between the community and individual processes is a direct one. Ideas, thoughts, and knowledge occur first on a social plane and are then internalized into the psychological plane (Cobb and Yackel, 1996; John-Steiner and Mahn, 1996). "Any higher mental function," Vygotsky (1978) argued, "was external and social before it was internal" (p. 197). Vygotsky used dialectics to make sense of the contradiction between individual and social processes: the individual constructs the social and, at the same time, is constructed by the social (Confrey, 1994; John-Steiner and Mahn, 1996). Sociocultural research focuses on how this "co-construction of knowledge" (social meanings and individual meanings) is internalized.

For sociocultural theorists, collaboration is an essential component for facilitating internalization because thought and speech are intertwined (Confrey, 1994; John-Steiner and Mahn, 1996; Lemke, 2001). Language and thought are internal processes in a constant state of change depending on the social context. The people present, the situation, and the previous words that have been said influence one's decision to speak and the words one uses (Sfard and Kieran, 2001). All these factors affect what thoughts the individual generates.

2.8 Emergent Perspective

Students construct their knowledge in the context of participating in a classroom community (Cobb & Yackel, 1996).

From this perspective, there exists a reflexive relationship between mathematical practices (from the sociocultural perspective) and individual conceptions (from the

psychological perspective). Here, the link between the community and individual processes is indirect. To coordinate the interactionist perspective on communal classroom practices with the psychological constructivist perspective on individual activity, Cobb and Yackel (1996) developed a framework that analyses social norms, socio-mathematical norms, and mathematical practice within a classroom environment.

Socio-mathematical norms are norms specific to mathematical activity and include those actions and ideas that develop as one constructs a conceptual understanding of mathematics. For example, "what counts as different mathematical solutions, a sophisticated mathematical solution, an efficient mathematical solution, and an acceptable mathematical explanation" are all socio-mathematical norms (Cobb and Yackel, 1996, p. 178).

Applying this construct to science education, one socio-scientific norm that might develop is the ability to analyze data in such a way that explanations are based on what is observed, and conclusions are based on evidence and logical argument. The development of this socio-scientific norm would require that, when possible, the teacher allow the observational evidence to be seen as the validator of ideas rather than the teacher.

2.9 Social Constructivism perspective

From the perspective of social constructivism, the situation or context is seen to afford or constrain the mental models the learner constructs. The learner is studied as an individual within a particular setting, and the mental processes of the individual are connected to the social setting. From a social constructivist perspective, "interpersonal interaction patterns and classroom routines and norms are carefully examined"

(Confrey, 1994, p. 41). Brousseau (1997) describes the study of teaching situations to identify phenomena that result from the communication of knowledge as didactical research. From such studies, Brousseau (1997) developed the theory of didactical situations to describe the complex dynamics that arise within the mathematics classroom due to the transposition of knowledge.

This theory is based on the perspective that learning is both an individual and social activity and the development of a micro-scientific community in the classroom is necessary for the communication of knowledge in didactical situations. Although Brousseau acknowledges that students construct their knowledge, he also believes that teaching should guarantee the socialization of students' conceptions.

Brousseau (1997) explains that during this socialization process, a system of reciprocal obligation forms in which the teacher and the student determine who will have the "responsibility for managing and, in some way or other, be responsible to the other person for" (p. 31). As the teacher and students interact together in the classroom, negotiation of expectations occurs. This negotiation results in a relationship that forms between the teacher and the students—a "didactical contract"

2.10 Behaviourism perspective

The empiricist, or associationist, mindset provided the framework for many learning theories during the first half of this century, and it was against this background that behaviorism became the leading psychological viewpoint (Schunk, 1991).

The behaviourist definition of learning states that learning results in a change in behaviour, to ascertain whether learning has transpired we should abandon the

examination of inaccessible and unobservable mental events in favour of directly observable behaviours (Surgenor, 2010).

Cheetham and Chivers (2001) argue that no review of the literature on learning theories could be complete without reference to the seminal work of Pavlov. Pavlov's (1927) work on classical conditioning or the linking of a stimulus, which reliably elicits a specific behavioural response, can be viewed as seminal because it provided the foundation for modern developmental psychology. Pavlov also clearly demonstrated that animals could be conditioned to behave in a required way by subjecting them to otherwise neutral stimuli and thus 'conditioned – response' was discovered. Watson (1913, 1930) and Skinner (1938) then applied these principles to human behaviour. Significantly they added in additional reinforcement elements following the desired response, which demonstrated that 'operant responses', i.e. those that related to more complex everyday behaviour, could be achieved (Peel, 2005).

Although both learner and environmental factors are considered important by behaviorists, environmental conditions receive the greatest emphasis. Behaviorists assess the learners to determine at what point to begin instruction as well as to determine which reinforcers are most effective for a particular student. The most critical factor, however, is the arrangement of stimuli and consequences within the environment (Ertmer and Newby, 1993).

Behaviorists attempt to prescribe strategies that are most useful for building and strengthening stimulus-response associations (Winn, 1990).

Many of the basic assumptions and characteristics of behaviorism are embedded in current instructional design practices. Behaviorism was used as the basis for designing many of the early audio-visual materials and gave rise to many related teaching strategies, such as Skinner's teaching machines and programmed texts. More recent examples include principles utilized within computer-assisted instruction (CAI) and mastery learning (Ertmer and Newby, 1993).

2.11 Some Effective Teaching Strategies in science classroom

Teaching strategies shape the learning environment. As part of the lesson design, an effective teacher selects a particular teaching strategy or set of strategies to engage students in learning. There are teaching strategies that can be transferred from one subject to the next. There are also strategies that are more specific to a subject area (Hudson, 2007).

Ronsini (2000) states that, cooperative learning is a successful teaching strategy in which small teams, each with students of different levels of ability use a variety of learning activities to improve their understanding of a subject. Each member of a team is responsible not only for learning what is taught but also for helping team mates to learn, thus creating an atmosphere of achievement (Ronsini, 2000). Cooperative learning is a mode of learning in which students work in small groups to achieve a purpose. Here there is an emphasis on the importance of group work, students in a group help each other in learning the content, but achievement is judged individually.

Odili (1990) states that the class in cooperative learning is divided into groups, and each group has specific work to do in which group rewards and individual accountability within the group are essential.

According to Slavin (1987), the two major theoretical perspectives related to cooperative learning are motivational and cognitive. Slavin (1987) further noticed that the motivational theories of cooperative learning emphasize the student's incentive to do academic work, while the cognitive theories emphasize the effects of working together. Motivational theories related to cooperative learning focus on reward and goals structures (Slavin, 1987). One of the elements of cooperative learning is positive interdependence, where students perceive that their success or failure lies within their working together as a group (Johnson, Johnson & Holubec, 1986). From a motivational perspective, cooperative goal structure creates a situation in which the only way group members can attain their personals goals is when the group is successful (Slavin, 1990). Therefore, in order to attain their personal goals, students are likely to encourage members within the group to do whatever will help the group to succeed and to help one another with a group task.

Johnson, Johnson and Holubec's (1986) theory identified the three types of cooperative learning groups as formal, informal and base. According to them, the formal group ensures that students are actively involved in the intellectual work of organizing materials, explaining it, summarizing it, and integrating it into existing conceptual structures. Informal cooperative learning group task from a few minutes to a whole class period .and the teachers uses them during direct teaching to focus student's attention on the materials to be learnt. A base cooperative learning group task extends for at least a year. It provides students with long-term committed relationship. The formal cooperative learning group as used in this study.

According to Johnson and Johnson (1999), competitive learning is one in which students' work against each other to achieve a good grade. They further state that it exits when one students' goal is achieved and all other students fail to reach the goal.

They further state that competitive learning can be between individuals or between groups (Johnson & Johnson, 1999). Competitive learning is most appropriate when students need to view learned materials (Johnson, Johnson & Holubec, 1986).

Akinbobola (2006) emphasized that, the mode of delivery for physics lessons at senior secondary school in Ghana is by expository. The expository method is teacher-centered, student-peripheral teaching approach in which the teacher delivers a pre-planned lesson to the students with or without the use of instructional materials. However, the modern expository method involves more that talking and reading about science for it allows some interaction between the teacher and the students in terms of asking and being asked questions on the topic of discussion. Also, the current educational system in Ghana is based upon competition among the schools. According to Akinbobola (2004), in Ghana and with the present educational system, competition is valued over cooperative learning strategies.

Hence, cooperative learning being a new strategy for science teaching in Ghana has not been frequently used by teachers (Akinbobola, 2004).

2.12 Current Trends in Teaching Learning Practice

Prior to the last century, teaching was considered as a rigid, formal and stereotyped process of transmitting knowledge. Emphasis was laid on rigid discipline, blind memorization and hard reinforcement. Verbalism was enforced and no audio-visual aids or materials were utilized in the field of education. Recently, learning has assumed more importance than teaching.

It has been rightly observed by the International Commission on the Development of Education that there has been a change in the learning process which is tending to

displace the teaching process. Multimedia systems have to now acquire more significance and educational technology has been popularly used for effectiveness (Karthik, 2005).

The new era makes the educationists to realize that in education 'learning' is now important than 'teaching'. The former is concerned with pupils whereas the latter is concerned with pupils and teachers. The traditional concept of teacher as the only source of knowledge has been changed due to the advancement of science and technology. The traditional classroom with one teacher teaching students was mainly one way of communication is no longer effective in modern times due to dynamic nature of society. The change should be brought in teaching learning situation. So there is a need to introduce modern teaching learning process through improved means of educational technology (Kumar, 2004).

In a formal education system, the use of audio-visual aids is useful for the classroom teaching. Undoubtedly, the instructional and pedagogical skills of the teacher, and the readiness of the students play significant role to make the classroom teaching effective. In the present period of educational technology, teacher should not depend upon any single method of teaching (Kaur, 2010).

The limited employment of audio-visual techniques in india and developing countries may be attributed to the inadequate appreciation of the impacts of the techniques, lack of commitment to improved instructional methods, and lack of support from the authorities. It therefore implies a thorough understanding on the part of the teachers and school authorities towards the relative merits of technological aids and its application to achieve the best result (Natarajan, 2005).

Ema and Ajayi (2004) opined that the application of such technological aids can be facilitated only when teachers understand its applicability and acquire the needed skills for the use of intricate mechanical equipment.

The new generation of teachers should become more and more aware of the change, and prepare themselves to supplement the present teaching activity with new techniques.

Thus, in a changing world of higher education, the teacher ceases to be a "lecturer" but transforms into an "agent of change" (Gangwer, 2009).

2.13 Concepts and definitions of audio- visual aids

Teaching aids arouse the interest of learners and help the teachers to explain the concepts easily. Undoubtedly, audio-visual aids are those instructional aids which are used in the classroom to encourage teaching learning process. As Singh (2005) defines: "Any device which by sight and sound increase the individuals' experience beyond that acquired through read described as an audio-visual aids" Audio- Visual aids are those instructional devices which are used in the classroom to encourage learning and make it easier and interesting. The materials like charts, maps, models, film strip, projectors, radio, television etc. called instructional aids. (Rather, 2004).

According to Webster's Encyclopedia Unabridged Dictionary of English, Audio-Visual Aids as "training or educational materials directed at both the senses of hearing and the sense of sight, films, recordings, photographs, etc. used in classroom instructions, library collections or the likes". The term has also been defined by (Dike, 1993) as those materials which do not depend solely upon reading to convey meaning. They may present information through the sense of hearing as in audio resources; sight as in visual resources or through a combination of senses. Indeed, the variety of

such resources is a striking characteristic. According to (Anzaku, 2011) "the term audio-visual material is commonly used to refer to those instructional materials that may be used to convey meaning without complete dependence upon verbal symbols or language"

Thus, according to Anzaku a text book or a reference material does not fall within this grouping of instructional materials but an illustration in a book does. Some audio-visual components are in the nature of process and experience for example, dramatizing an event or a procedure or making diorama. Some of the audio-visual materials like the motion pictures require the use of equipment to release their latent value. Some do not need equipment at all like an exhibit or a study print. This term designates in common usage both material things as well as processes such as field trips. Anzaku further states that audio-visual materials include materials and equipment alike that materials are considered to be system or body of content of potential value when put to work while equipment or instructions often referred to as hardware, components are the means of presenting such content.

Shri and Badri (2014) also asserts that audio-visual instruction simply means a supplementary device for making learning objective real and effective. Experiences provide with the help of audiovisual aids are generally interesting full of life and provide a clear vision leading to perfect understandability and adaptability in life. Audio-visual aids are not self-contained teaching devices. They are not in the field of learning to replace anything books teachers of audiovisual aids can be found only when the separate entity is completely of audio-visual aids can be found only then their separate is completely merged and they join hands with the existing techniques. They are good only because they make the learning.

2.14 Types of audiovisual materials

There are different ways of classifying audiovisual materials. As listed by (Fayemi, 1991) together with the necessary related equipment for putting them to work in the classroom, audio-visual materials include the following:

Realia in social and physical environment: These materials, situations, and the people have to be visited, studied, observed, reacted to and worked with, right in their natural environment. The study of realia may then demand field trips, demonstration, experiments and other direct experiences as processes for getting the meaning. They may come into the class in display cases or attached on bulletin boards.

Dramatic performances (portrayal of people, events, and procedures) dolls and puppets are produced for use as dramatic models.

Models, Mock-ups, Globes and Relief Maps**:** These can be purchased or produced by the teachers and students jointly. Exhibits and dioramas made up of models can be borrowed, purchased or constructed.

Television programmes: This requires television receivers and antenna systems. They can be produced jointly by students and teacher as learning experiences.

Motion pictures: Projection equipment for accommodation either optical and/or magnetic sound tracks or projection screens are required. Still pictures projection materials include transparencies and micro-projector materials (microscopic slides and microscopic slides and microscopic objects).

Study prints and pictorial illustrations

Radio and Audio programmes, as found in tapes or disk recordings and radio broadcast.

Graphic materials such as maps, graphs, cartoons, diagrams and charts.

Dike (1993) grouped audio-visual materials into: Audio resources such as records, tapes and cassettes, and radio broadcasts. Visual resources including models, real objects, three dimensional displays, the chalkboard, bulletin board, adhesives, graphs, diagrams, charts, maps, cartons, posters and pictures and projected forms like transparencies, slides, filmstrips and films. Audio-visual combinations e.g. sound film and filmstrips, slides-tape decks, television programmes, videotapes and dramatization. Others such as educational programmes or games, programmed instructions, demonstration and field trips. From the above we can see that A/V resources are divided into audio-visual and a combination of audio and visual resources and others which are class with audio-visual resources which can either be in a projected or non-projected forms.

2.15 The importance and functions of audio-visual materials

The shortest route to provide direct experiences clarity of thought interest and activity all at one and the same time is the extensive use of Audio-Visual aids in teaching.

"Seeing and hearing looking and learning are major ways by which human being learn. Many media have been developed and are widely used------the A/V aids are powerful testimony of mankind's desire to learn and to learn well."(Shri & Badri, 2014).

Audio-visual aids are specifically made instructional aids which are powerfully meant for education as well as giving information and entertainment. Rowtree (1994) sums up the value of audio-visual aids as:

1. Those materials that fill such gaps which are created by the use of traditional teaching methods where teachers sparingly use the instructional materials
2. Audio-visual materials help people to share expert knowledge which reaches a lot of people simultaneously.

3. They are very good materials for the preservation of records and documents.
4. They enrich learning and teaching
5. They allow students to learn at their own rate
6. They encourage integration in individuals and group learning

He further groups the audio-visual aids as:

i. Manipulative Equipment: They are elements and tools of training.

ii. Facilitative System: Any teacher who uses this system has the purpose to help learners cultivate and fulfill expectation of their own.

iii. Operational Value System: In this concept, teaching has to be done in line with the existing culture of a people for over and conformity. Again, there is the overlap of meaning and activities of teaching as indoctrinating, conditioning, instructing and training, which are native to the learners. Therefore, audio-visual materials carry them as real life experiences and pass on to the learners as direct experiences.

iv. Education Process: It is a model of teaching. It contains programmes that are full of intellectual activities. The material contains; discussions, commentaries, tutorials, games, simulations and other such activities selected and guided by the teacher in line with the set educational objectives or goals.

v. Entertaining Device: It is specially designed to carry along entertainment in form of music, dances and other lively activities to ward off boredom and conditions the students to absorb more knowledge.

2.16 The advantages of audio-visual aids

There are three primary modalities through which people take in information: visual, auditory and tactile. Silverman (2006) relates these three modalities to how students process information, deriving three basic learning styles: visual-spatial, auditory sequential and tactile-kinesthetic. Visual-spatial learners take in new information through visualization of the whole concept and think in holistic, often three-dimensional, images.

Auditory-sequential learners, by contrast, think in words, processed auditorally, and generally learn in a sequential, step-by-step process. Finally, tactile-kinesthetic learner stake in information through physical touch and sensation, and they benefit from demonstration or application more than from verbal explanations.

Gopal (2010) states that the Audio-Visual Aids provides significant gains in informal learning, retention and recall, rethinking and reasoning, activity, interest, imagination, personal growth and development. Swank (2011) stressing the effectiveness of visual materials in learning estimates that about 40% of our concepts are based upon visual experience, 25% upon auditory, 17% on tactile, 15% upon miscellaneous organic sensation and 3% upon taste smell. With the above assertion, it becomes clearer why audio-visual materials are important in the teaching and learning processes. This is because they bring the different senses contributions together to get 100% clarity. Gopal (2010) stressed that audio-visual materials help the teacher to overcome physical difficulties of presenting subject matter. That is to say with audio-visual materials, the barrier of communication and distance is broken. The culture and climatic conditions of other countries can be brought into the classroom with the aid of slides, films, filmstrips and projectors. This is important because according to Dike (1993:87) “once the phenomenon is visualized, the picture and knowledge becomes

very clear and permanent". Agreeing to this assertion, a 20th century Chinese philosopher stated that "one picture is worth a thousand words".

Natoli (2011:102) once again adds that "audio-visual materials are rich opportunities for students to develop communication skill while actively engaged in solving meaningful problems". In other words, students certainly like it more and learn better if they are engaged in important and appealing activities. For example, involving students in bulletin board display will enhance their choice of colour and aid their understanding of the concept in question or when they join the teacher in dramatization of an event or a process.

According to Katherine (2009) "learning takes place effectively when the teacher sets out to provide learning situation in which a child will learn because of his natural reactions of the provided materials". During the process of learning, the teacher has to provide the learning situation to satisfy the natural reaction of the learner and this is through the use of instructional aids. The attention of the learner is caught and his interest is also won and he is ready to learn. Fawcett (1994) also contributing on the role of audio-visual materials in stimulating interest stated that "A friendly, accepting group climate is important in any learning situations especially those materials that require students to reveal their ignorance and confront their fellow students". When there is a climate of acceptance for learning, then learning is stimulated.

Lestage (1959) stressed that audio-visual materials provide a means of individualizing instruction. This he said is possible through programmed learning and tapes which enable the learner to learn at his pace and also to work on his own.

Moreover, according to Dike (1993) the machine frees the teacher to work with individual students, since he or she is not now required to carry out routine drills. Production of resources by students is another way of individualizing instruction.

These audio-visual resources serves, because the information can be gotten from the good use of perceptual instructional materials especially those provided from our locality. When they are used in the class, their familiarity gives a background for understanding the information. McNaught (2007) also observes that audio-visual materials are very useful teaching and instructional as well as promotional aids. He further stressed that where consistency of presentation is desirable and audio-visual materials are useful. They provide experiences not easily secured in other ways and hence contribute to the depth and variety of learning. Audio-visual resources can play a major role of making learning permanent, Gopal (2010) stresses that "audio-visual methods do seem to facilitate the acquisition, the retention and the recall of lessons learnedbecause they seem to evoke the maximum response of the whole organism to the situations in which learning is done. And perceptual materials readily associate themselves with the unique experiential background of each individual. Natoli (2011) stresses that audio-visual materials are important in the teaching and learning processes because "Having seen something, most people remember, for whatever that thing was, it conjures up an image at a mere mention and can be talked about freely. Dike (1993) also explains that students forget because of lack of interest and opportunities to use the knowledge they have gained later on. Audio-visual resources can therefore contribute to the clarity of information presented by allowing students to visualize what is learned.

This overall classroom environment becomes conducive to creative discipline. At the same time, it is important to take into account that the Audio-Visual Aids do not play role up to disseminate the information, data, facts and clues but also they influence the mentality, psychology, grasping level of the students in the classroom. On the other

hand, they greatly motivate and inspire the teachers to adopt the latest creative and innovative aids.

2.17 Traditional method of teaching versus Audio-visual method

The most common method of teaching for students is the traditional method. Though small group learning is the best way for teaching, still we prefer traditional method as we have a large numbers of students. Hence, it is immensely important that teaching should be as effective as possible. A learner's learning style, whether visual, auditory or kinesthetic, is usually resistant to change. Hence it is likely that mismatches exist between the learning styles of students and the teaching styles of teachers (Parvin, et al, 2010).

The traditional method of teaching of teaching and learning also referred to as the teacher-centered approach is a method where the teacher is the focus, acting as the authoritative expert. The teacher is the main source of knowledge and the focal point of all the activity. Teaching is merely to transmit information and to help the students to master facts for examination purpose, through lectures, explanations and illustrations. In such teaching environment, students are passive learners and they regurgitate content. This type of teaching style allows for minimal teacher-student interaction (Erinosho, 2008; Sonmez, 1986).

The main teaching skill involved in the traditional method is lecturing. Lecturing involves oral presentations of material to student by teacher. The advantage of using this approach is that it allows much information to be communicated quickly to students (Erinosho, 2008).

In traditional method of teaching and learning the classroom situation is one that the teachers stand in front of the students, giving explanations, informing and instructing. They usually use chalk to write something on the blackboard. Students seat in rows and a chalkboard in front. The teacher stands in front of the class and gives a lecture. Students sit passively in the classroom and listen. To avoid the boredom the lecturer introduces a series of questioning (Joshi, 2012).

Audiovisual methods in teaching can improve classroom instruction and student understanding. Today, technology offers many possibilities for the teacher reported that wants to capitalize on the appetite of a new generation of multimedia presentations. Lesson plans on the use of the media must be consistent with the objectives of the program and not go wrong.

In the words of audio-visual instructions simply mean the presentation of knowledge to be gained through the seeing experience whereas according to Roberta visual education is a method of imparting information which is based upon the psychological (Shri & Badri, 2014).

Among the few things that we are knowing about ICTs, is the interaction that we do with them where they only do not provide information, so they modify and restructure our cognitive structure for many different mobilization symbolic systems which is core in the audio-visual method. Its effects are not only quantitative of increasingly informative offers, but they are only quantitative for the treatment and usefulness that they have.

Facing to the education suggest that ICTs convert in a significative tool for the formation of cognitive skills, and to facilitate to join the skills and attitudes of the people and the information showing through different cods. In order to create new

educational technologies, the media has been developing strategies which are ICTs (informatics and communicative technologies) in order to create student who have critical, emotional and entrepreneurs criteria to defend themselves of many challenges that educative, social and economic world give us.

At present, the most common ways of teaching in Ghanaian senior high/ technical schools is the traditional 'chalk and talk' methods though some incorporate audio-visuals aids in their teaching such as using PowerPoint (PPT)presentations, utilizing the transparency and overhead projector (TOHP). There is no conclusive study stating the superiority of one method over the other. Garg et al. (2004) have observed that students want the teachers to include audiovisual aids during the lectures, but it is not certain whether it increases their understanding or performance in the examinations.

Bartsch and Cobern (2003) noted that students preferred lectures with PPT over the use of TOHP, but that in some instances the content of the PPT presentation distracted students and they performed less well on tests compared with another group given lectures using chalkboard. One extensive study comparing PowerPoint and TOHP observed no difference in student performance in tests (Szabo and Hastings, 2000) while in another study there was marked improvement in examination results when PPT replaced the use of TOHP (Lowry, 1999).

So there is a mixture of views based on the recent studies and it is not clear whether the use of a particular teaching method is superior to others. Therefore, this study was undertaken to find out students' performance in understanding the circulatory system integrated science using audio-visuals compared with the traditional chalkboard method of teaching.

2.18 The role of the teacher in designing audio-visuals

According to encyclopedia Britannica (1984:298) "design is from the Latin word "designara" which means to "mark out". It is the process of developing plans and schemes of action whether in mind or set forth as a drawing model."

Herold and Pomeroy (1992:17) opine that design as a visual thinking of a higher order than verbal thinking. The word design has many depths of meaning and that only philosophical method will strip off all the meaning to provide a coherent and comprehensive view.

Nkuuhe et al (1995) suggest that before one can produce any instructional materials including printed media, one should plan carefully. Take into consideration the objectives one intend to achieve, the target audience, whether prints are the most appropriate media. They state further whether printed media will be used alone or in combination with other media. Planning in the production of printed media will have to be more elaborate than that of display media such as the chalkboard, posters and transparencies. There are three stages in this planning: pre-design, design and post-design.

Kemp and Dayton (1985) propose that one has to make a checklist for this preliminary planning before instructional material is produced. Similarly, the researcher agrees that preliminary sketches should be made when designing any instructional media or teaching learning materials. These designs will help the artist to choose the best design that will serve as a guide to complete the finish artifacts.

According to Amenuke et al (1991), design refers to planning, that is, organization of elements of art into visual forms. Inferring from the above definition, design can also

be described as a plan of work of art or simply, a plan. This plan will guide the artist in executing the final work.

García-Barbosa & Mascazine (2002) asserts that "The use of media is determined by an instructor's objectives. Researchers have found that the use of media can motivate students to learn."

CHAPTER THREE

METHODOLOGY

3.0 Overview

This chapter discusses the research methodology that was employed in the study. This includes the research design used in the study, the target population of study, sample techniques, research instrument, research procedure, intervention programme, data collection procedure and data analysis.

3.1 Research Design

Two groups pretest posttest, quasi-experimental (non-randomized control group) design was used to examine the impact of the performance of students on circulatory system. With two similar technical classes 2A & 2B intact classes in which one was experimental group and the class control group, there was no sub sampling. This meant that all students within sampled classes participated in the research with the exception of students who were absent during the research period.

3.2 Population of Sample

The population of the Awe SHTS was one thousand and five hundred (1500) students and had seventy five (75) teachers on the staff. The target population was the second year technical students who offer integrated science in the school and were fifty each in a class.

3.3 Sample Technique

Purposive sampling technique was used to select the class for the study. Purposive sampling which is a non-probability sampling was used because it allowed the researcher to choose the subjects on purpose of study or because they possess the information the researcher needs or they possess specialist knowledge of the research issue, or capacity and willingness to participate in the research (Creswell, 2005).

3.4 Sample and Sample Size

Data gathering is crucial in research, as the data is meant to contribute to a better understanding of a theoretical framework (Bernard, 2002). It then becomes imperative that selecting the manner of obtaining data and from whom the data will be acquired be done with sound judgment, especially since no amount of analysis can make up for improperly collected data (Bernard et al. 1986).

The sample for the study was two intact technical classes which were selected from nine other integrated science classes, which were at different levels (i. e. SHS 1, 2 & 3). Since they were intact classes, the entire subjects were involved in the research. The sample chosen was the second year integrated science students. They were fifty students per class. These classes were chosen because they had been taught a lot of topics and concepts and so were reading wide in order to complete their course. At that stage of their education, different teaching methods had been introduced to them. The sample size of 100 was used to enable the researcher work effectively within the limited period.

3.5 The study area

The study was conducted in Awe Senior High/Technical School. The school is located on the outskirts of Navrongo Township. Navrongo is a town in the Kassena/Nankana Municipality of the Upper East Region of Ghana. The Kassena/Nankana Municipality has six (6) government Senior High Schools, two of them are single sex schools and the rest are co-education with one being an integrated school.The Municipality is a savannah area and is characterized by high dryness.

Awe SHTS is rated a 'C' school according to the Ghana Education Service classification. It offers the following courses: Elective Science, Home Economics, Agriculture, General Arts, Visual Arts and Technical (building construction and wood work). There are nine classes at each level and only two out of the nine classes was considered.

3.6 Variables for the study

The independent variable in this study was two (2) weeks teaching instructional programme that was administered to the two classes.

The dependent variable in this study was the student's scores obtained in the traditional method of teaching and the audio-visual method of teaching on the topic circulatory system.

3.7 Instrumentation

A close-ended objective test item was the instrument used to collect data on the performance of the students on circulation system at pretest and posttest. The closed ended questions was appropriate for this study since it allowed respondents to choose

between options provided by the researcher and have increasingly become popular compared with open-ended questions (smith, 1987).

Questionnaire is widely used for data collection in educational research when information is to be obtained from a larger number of subjects (Babbie & Rubin, 1989)

A structured questionnaire was used to ascertain the subjects' perception, assimilation and preference on the use of audio-visuals method as compared to the traditional method of teaching.

3.8 Procedure for Implementation of the Instructional Programme

The instructional programme was implemented through teacher centered and audio-visual centered. The samples were subjected to different treatment for two weeks each.

The Technical 2A class was given a pretest and taken through lessons on circulation system using teacher-centered instructional approach. This was where the teacher transmitted information via the traditional method of teaching or the lecture method with little or no teaching and learning material involved. After using the teacher-centered approach for two weeks, a class test (posttest) was conducted to assess the performance of the students on the lesson taught. The class test which consisted of 20 test items of objective questions with multiple answers. The student response was collected, marked and recorded.

The Technical 2B class was also be given a pretest and for two weeks, taught using audio-visuals. This is where the teacher transmits the same information via the audio-visual aids. A set of educational films, pictures, charts displays, videos from a

computer through a projector and beamed onto a white screen with the volume transmitted through audible speakers. After the two weeks, a class test (posttest) was conducted to assess the performance of the subjects on the lesson taught.

3.9 Validity of the Instrument

Validity has been defined by "the extent to which a test measures what it claims to measure" (Gregory, 1992). Any measure can be called as "valid" if it measures what it is supposed to measure.

To ensure test items validity, they were given to a supervisor for thorough examination in order to ensure that they measured the total content area (content validity) of the study. To ensure internal validity, peer reviews by experienced science teachers were employed. Fellow graduate students at the Department of Science Education, University of Education, Winneba were given the items to study it and comment on it.

3.10 Reliability of the instrument

Reliability concerns with the extent to which a questionnaire, test or any measurable procedure produces the same results on a repeated trials. That is, it is the consistency of score over time.

To ensure the reliability of the research instrument, a pilot test was carried out on a sample of SHS 2 integrated science students at Navrongo SHS. Data from the pilot test was statistically analyzed and determined the reliability of the test instruments using cronbach alpha reliability coefficients and was calculated to be 0.72.

3.11 Data Collection Procedure

The test items and a questionnaire were administered personally by the researcher to the form two integrated science technical classes' students of Awe Senior High/Technical School after seeking permission from the headmaster and the head of department of science.

The mode used for administering the test items was the investigator-administered mode.

This mode of administration ensured 100% collection of the test item response. Also respondents were not allowed to communicate among themselves to ensure that responses were not affected by other respondent's views. The questionnaire was administered to only the experimental group at posttest. This was done so to allow students respond according their feeling about the approach. It was also the basis for subsequent data analysis. Again for respondents to be candid about their responses they were made aware of the fact that the test was for academic purpose only and that the information they were providing would be kept strictly confidential and that no name was to be written on the test items.

3.12 Data Analysis

The data collected was examined for consistency and accuracy by reading through all the responses that were provided by the respondents.

The statistical analysis of the test (pretest and posttest) was carried out first. The descriptive statistics such as means, mean difference, standard deviation, percentages and t-test of both experimental and control groups were computed by computer statistical product service solutions (SPSS) version 20.0 programme. These

descriptive statistics were used to summarize the general trends in student performance. The purpose of descriptive statistics is not only to describe the data from the study but also to help find pattern within the data described and to inform inferential statistics as well. Coding schemes were developed to organize the data into meaningful and manageable categories.

The raw data entries were done by the researcher in order to ensure accuracy of entry of the data.

CHAPTER FOUR

RESULTS, FINDINGS AND DISCUSSION

4.0 Overview

This chapter presents the results findings and discussions of this study to provide an understanding of the effects of the use of audio-visuals in understanding circulatory system in integrated science. The results and discussion were presented in the order of the research questions and the null hypothesis. The guiding research questions of this study were to determine whether the students of awe senior high school would perform well academically in circulatory system or not when they are taught using audio-visuals.

The primary source for data about circulatory system was academic performance in the pretest and posttest scores for both students instructed by using audio-visuals and traditional teaching method. The student t-test analyses of the collected data were performed alongside with the discussion. Additional qualitative data were collected as well to help explain the nature of quantitative results and to also determine the perception and attitudes of students towards the use of audio-visuals in teaching. All of the data from this study were intended to complement one another in order to provide evidence for the interpretation of effect of audio-visuals on the students' understanding and perception on the concept. Findings of the study are discussed in the light of available literature.

4.1 Presentation of results and findings of the study according to research questions and hypothesis

4.1.4 Analysis with respect to Research Question One.

Research question 1: What is the knowledge students have about circulatory system in integrated science before the instructional strategies?

Students marks at pretest for both control and experiment group

The tables below were obtained when a 20 test question items on circulatory systems in integrated science was administered to two classes (control and experimental). Each mark was given a weight of 5% which implies that a total score of 20 is 100%. The data contains the raw scores in class intervals of converted percentile marks on a WAEC and GES standard and their corresponding frequencies, and means and standard deviations.

Table 1. Group Frequency distribution of students in control group at pretest

Expected Performance Scale by GES & WAEC (Marks %)	Grade	Frequency	Percentage (%)
0-39	F9	33	66
40-49	E8	10	20
50-54	D7	4	8
55-59	C6	0	0
60-64	C5	2	4
65-69	C4	1	2
70-74	B3	0	0
75-79	B2	0	0
80-100	A1	0	0
Total		**50**	**100**

One student had the best grade which was 'C4' thus representing 2% of the sample. Two (2) students had 'c5' representing 4%, then grade 'D7' with frequency of 4 representing 8%, followed by grade 'E8' with a frequency of 10 representing 20% and finally grade 'F9' which recorded the highest frequency of 33 representing 66% thus more than half of the sample failed in the pretest (Table 1).

Table 2. Students mean value of pretest in control group

	Mean	Number of students	Standard Deviation	Standard Error
Pretest	33.1	50	12.813	1.8120

Table 2 shows some statistical tendencies of the pretest. The mean gave 33.1 while the standard deviation was 12.813. So the mean score of the test result shows the knowledge the students possess before the use of the traditional method of teaching.

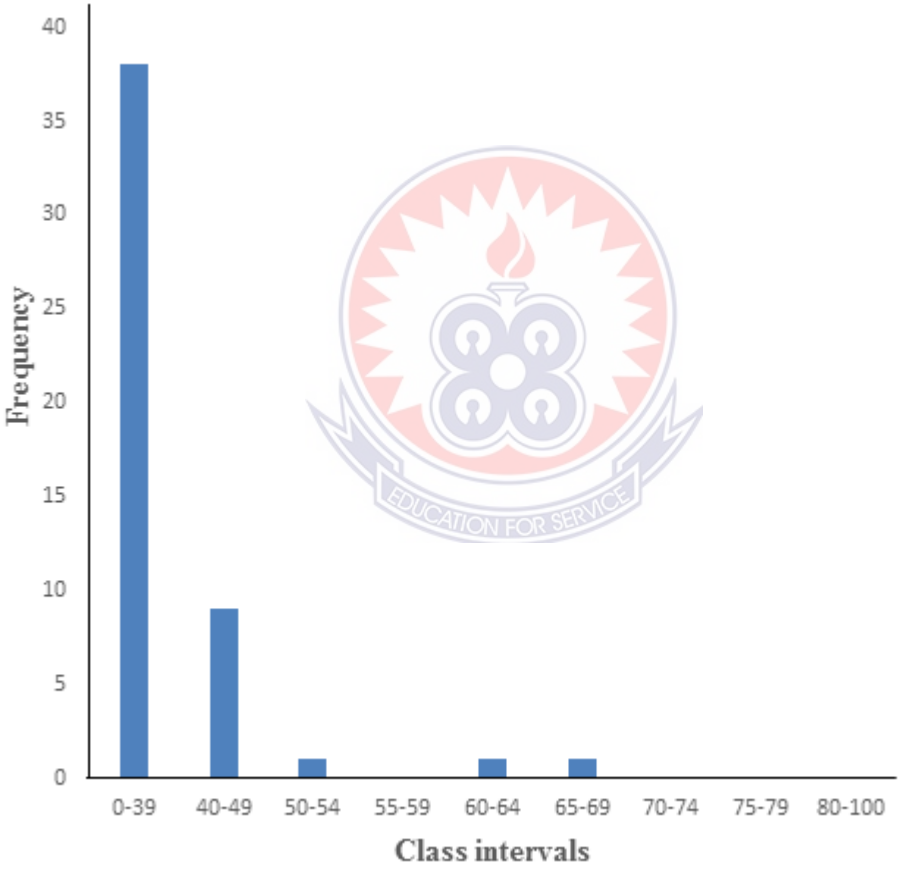

Figure 1: A bar chart showing the marks obtained at by students in the experimental group at pretest.

The results at pretest from the experimental group showed that with class interval of 0-39, the frequency is 38 which is the mode for the distribution. It also indicates that

many students had grade F9 in the experimental group that the control group at pretest (fig. 1).

Table 3. Students mean value of pretest in experiment group

	Mean	Number of students	Standard Deviation	Standard Error
Pre-test	29.3	50	12.698	1.796

Table 3 shows some statistical tendencies of the pretest. The mean gave 29.3 while the standard deviation was 12.698. So the mean score of the test result shows the knowledge the students possess before the use of audio-visuals in teaching.

T-test analysis of pretest

The results in Table 5 below indicated the data analysis between control and experimental groups of the pretest mean scores differences.

Table 4. Significant difference between control group and experimental group of the pretest of students before treatment

Group Test	Means	Tabulated value	Degree of freedom	P(2-Tailed)	Mean Difference
Control	33.1				
		1.4895	98	0.13955	3.8
Experimental	29.3				

Significance at 0.05; $p < 0.05$

The control group had a mean score of 33.1 as compared to the experimental group of 29.3. The mean difference is 3.8 between the two groups (Table 4).

The research hypothesis derived from research question one, which states that there would be significant difference in between both groups (classes) on circulatory system at pretest is answered by considering results from Tables 1, 2, 3 and 4 which indicated the overall scores from the pretest for both control group and experimental group. The control group had a mean score of 33.1, SD of 12.81 and SE of 1.81. The experimental group had a mean score of 29.3, SD of 12.70 and SE of 1.80. Results from the T-test analysis shown in Table 4 gives as Mean difference of 3.8, T-value of 1.49 and a P-value of 0.14 at a 95% significance level. Since the P-value (0.14) is greater than 0.05 we reject the hypothesis and accept the null hypothesis which implies that there is no significant difference between the control and experiment before treatment.

4.1.5 Analysis with respect to Research Question Two.

Research question 2: Is there any difference in post-test scores between the experimental group students who learnt with audio-visuals and control group students who learnt with the traditional method of teaching?

Students marks at posttest for both control and experiment group

The grades of the students were assigned remarks according to the GES and WAEC standard. Each raw score was also giving a weight of 5%. The remarks obtained by students during the posttest are as follows:

Table 5. Group Frequency distribution of students in control group at posttest

Marks (%)	Grade	Remarks	Frequency	Percentage (%)
0-39	F9	Fail	5	10
40-54	E8-D7	Pass	12	24
55-69	C6-C4	credit	20	40
70-74	B3	Good	1	2
75-79	B2	Very Good	5	10
80-100	A1	Excellent	7	14
Total			**50**	**100**

Four (4) of the students failed representing 10% of the sample. Also twelve (12) students obtained the grade 'D7-E8' representing 24% of the sample.

The grade 'C4-C6' recorded the highest frequency of 20 representing 40% with a remark of ‘credit’, The table also shows that the grade 'B3' has a frequency 1 representing 2%, followed by grade 'B2' which had a frequency of 5 representing 10%. The best remark obtained by students was ‘excellent’ which had a frequency of 7 representing 14% of the sample (Table 5).

The results showed that majority of the students would have had passed according to the GES and WAEC grading system but also implications from Table 5 shows that more than one-third of the sample performed poorly on the WAEC rated scale.

Table 6. Students mean value of posttest in control group

	Mean	Number of students	Standard Deviation	Standard Error
Posttest	58.8	50	16.98	2.40

Table 6 shows some statistical tendencies of the posttest. The mean gave 58.8 while the standard deviation was 16.980. So the mean score of the test result shows the knowledge the students was above average or improved after they were taught using the traditional method.

According to Hatim (2011), he elaborates that enhanced learning and increased performance is not only found in the social constructivist classroom but the traditional lecture classroom can also enhance learning and increase students' performance once there is appropriate content and design of teaching or learning. Cullen et al (2004) findings also revealed in their study that there was a positive influence in students' research abilities when the traditional instructional strategy was employed.

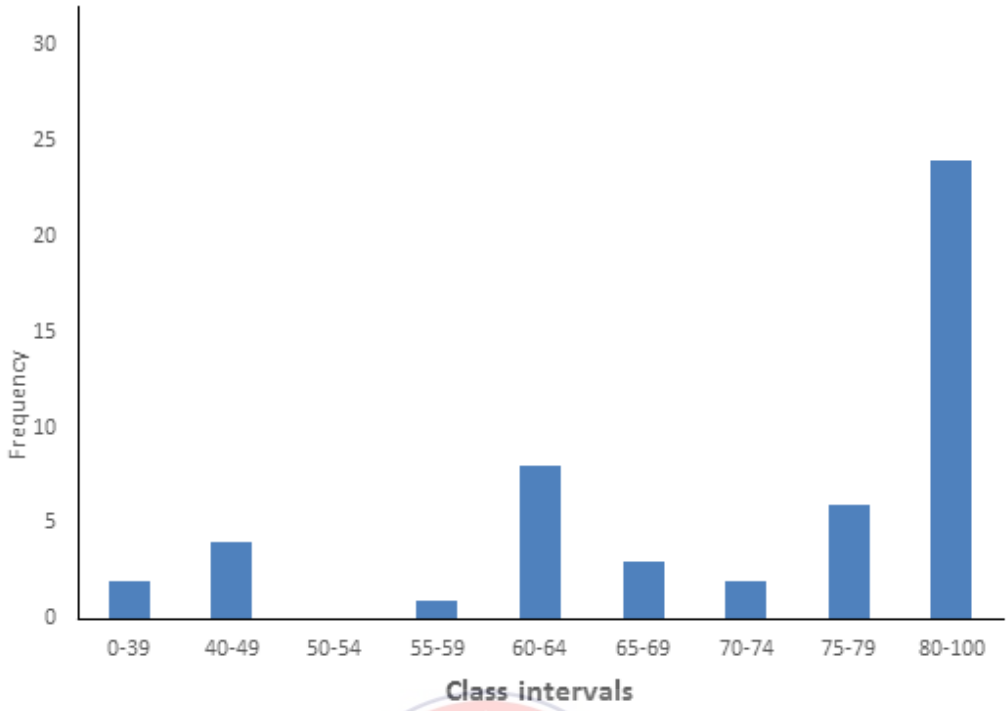

Figure 2: A bar chart showing the marks obtained by students in the experimental group at post-test.

Students who had marks more than 80% has the highest frequency of 24 which is A1 with reference to WAEC grading system. Few students also had marks less than 40% (fig. 2).

Table 7. Students mean value of posttest in experiment group

	Mean	Number of students	Standard Deviation	Standard Error
Posttest	72.5	50	18.218	2.576

Table 7 shows some statistical tendencies of the posttest. The mean gave 72.5 while the standard deviation was 18.218. So the mean score of the test result shows the knowledge the students had significantly improved after they were taught using audio-visuals.

T-test analysis of posttest

With the administration of the test items, the researcher was interested in finding out whether the use audio-visuals in teaching had more effect on the performance of the students as against the traditional method of teaching. Therefore T – test analysis was performed on the mean scores for experimental group and control group at post-test. This was done to determine whether significant difference exist between the mean scores.

Table 8. Two sample t-test with equal variances of significant differences between control group and experimental group of the posttest

Group Test	Means	Tabulated value	Degree of freedom	P(2-Tailed)	Mean Difference
Control	58.8				
		3.88986	98	0.000183	13.7
Experimental	72.5				

Significance at 0.05; $p < 0.05$

From the research hypothesis, which is that there would be significant difference in between both groups (classes) on circulatory system at post-test, results from tables 5, 6, 7 and 8 indicated the overall scores from the posttest for both control group and experimental group. The control group had a mean score of 58.8, SD of 16.98 and SE of 2.40. The experimental group had a mean score of 72.5, SD of 18.22 and SE of 2.58. Results from the T-test analysis shown in Table 8 gives as a Mean difference of 13.7, T-value of 3.89 and a P-value of 0.000183 at a 95% significance level. As a rule of thumb, the P-value (0.000183) is less than 0.05 so we accept the hypothesis and reject the null hypothesis which implies that there is no significant difference between

the control and experiment after using audio-visuals in teaching the experimental group and using the Traditional method in teaching the control group.

4.1.6 Analysis with respect to Research Question Three.

Research question 3: What are students' perceptions about the use of audio-visual aids in learning the circulatory system?

To answer the question posed that 'What are students' perceptions about the use of audio-visual aids in learning the circulatory system?' a five-point likert scale ranging from 'strongly agree to strongly disagree was used. The responses of the students were analysed by a descriptive statistical analysis such as frequency and percentage. All responses of individual students in the experimental group about the use of audio-visuals in understanding circulatory system were analysed. Table 9 below shows the results of the number of students (50) on the level of their views on each item in the questionnaire.

Table 9: The distribution of sex and ages of respondents to determine their perceptions of the use of audio-visuals.

	AGE			
SEX	16yrs and below	17-19yrs	20yrs and above	**Total**
Male	2	13	25	40
Female	1	3	6	10
Total	3	16	31	50

It is observed that most of the students who responded to the questionnaire are males which could be attributed to low-preference for technical courses by female students in second cycle schools (Table 9).

Table 10. Perception of students about using audio-visuals

Count in percentages (%)					
	Strongly Agree	Agree	Not sure	Disagree	Strongly Disagree
Audio-visuals improved my understanding in circulatory system	24	54	20	2	_
The use of audio-visuals reduces forgetfulness in examination	22	38	34	6	_
I learn better when teachers teach without audio-visuals	2	6	20	54	18
I always enjoy the lesson when our teacher uses audio-visuals	46	50	4	_	_
I will be glad if we use audio-visuals for all integrated science lessons.	50	40	10	_	_
Audio-visuals motivated me to learn	32	42	20	4	2

From the Table 10 above, in item 1, students were to respond to whether audio-visuals improved their understanding of the concepts in circulatory system or not. According to the students' response, 24% strongly agreed, 54% of them agreed it did, 20% of them not sure, 2% disagreed and none of them strongly disagreed. In terms of whether the use of audio-visuals reduces forgetfulness in examination or not, it is observed

that, 22% strongly agreed, 38% of them agreed it did, 34% of them not sure, 6% disagreed and none of them strongly disagreed.

The next item was to find out whether students learn better when teachers teach without audio-visuals or different instructional approaches, 2% strongly agreed, 6% of them agreed, 20% not sure, 54% disagreed and 18% of them strongly disagreed. It therefore suggests that prefer the use of audio-visuals.

From item 4, students were to respond to whether the always enjoy their lessons when teachers uses audio-visuals or not. The observations from the Table 10 showed that 46% strongly agreed, 50% of them agreed, 4% of them not sure, none of them disagreed and also strongly disagreed. In terms of whether audio-visuals should be used for all Integrated Science lessons, 50% strongly agreed, 40% of them agreed, 10% of them not sure, none of them disagreed and also strongly disagreed.

On whether audio-visuals motivated them to learn or not it was observed that 32% strongly agreed, 42% of them agreed, 20% of them not sure, 4% disagreed and 2% of them strongly disagreed. The responses from the students revealed generally that the use of audio-visuals have improved their understanding of the circulatory system and should be integrated in instructional strategies to enhance the learning of some science concepts.

These results are also similar to Saima and co who also used a likert scale to determine the effectiveness of audio visuals in teaching. Audio visual aids are effective tool that “invest the past with an air of reality.” A.V aids provide the learners with realistic experience, which capture their attention and help in the understanding of the historical phenomena (Saima et al, 2011).

Using A.V aids in teaching is one way to enhance lesson plans and give students additional ways to process subject information (Kunari, 2006).

CHAPTER FIVE

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

5.0 Overview

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

5.1 Summary of Findings

The purpose of the study was to find out if there was any difference in the application of the traditional method in teaching circulatory system and that of audio-visual method of teaching circulatory system in Integrated Science. Test items of 20 were administered at pretest for both control and experimental groups and post-test to find out the performance of students on the two methods of teaching being applied. Intervention activities were when the samples were taught for two weeks with both traditional method of teaching and an audio-visual method of teaching.

Two intact technical classes of fifty each of the form two students from Awe SHTS from the Kasena Nankana Municipality in the Upper East Region of Ghana was the sample used for the research. Results from pre intervention test and post intervention test intervention activity were collected, marked, recorded, analysed and discussed.

The statistical analysis of the results of the pretest of the experimental and the control groups (Tables 1, 2, 3 and 4) shows that there was no statistically significant difference in the performance between the two groups at the beginning of the study. This reveals that the experimental and control were comparable on their understanding of the circulatory system but the statistical analysis of the post-test of

the control and experimental groups (Tables 5, 6, 7 and 8) showed that there was statistical significant difference in the performance between the experimental group and the control group. The experimental group performed far better than the control group in the post-test with a mean difference of 13.7%. There was a significant improvement in the performance of students in the experimental group over the control group after the intervention. This means students who were taught by using audio-visuals could interpret and comprehend more the circulatory system in the study than those who were taught by the traditional method of teaching.

The effectiveness of using audio-visuals was also confirmed from the questionnaire administered to the students about their perception about the approach of teaching. The students indicated that the intervention improved their abilities to understand the concept (Table 10). Considering the results, it means that students have positive attitudes towards the use of audio-visuals to teach circulatory system.

5.2 Conclusion

The use of audio-visuals in teaching produced a significant improvement in students' understanding of circulatory system as compared to the traditional instructional approach. Students' abilities to interpret and comprehend the concept were hugged when they were taught using audio-visuals.

Results from this study also indicated that majority of the students enjoyed the interactive lessons with audio-visuals and thus, they were motivated more to participate actively in the lessons therefore they preferred audio-visual instructional strategy to traditional strategy of instruction.

Finally, it was concluded that the use of audio-visuals in teaching was most effective way of improving student's performance in the teaching and learning of circulatory system in Integrated Science.

5.3 Recommendations

From the study, the following guidelines are recommended to schools and teachers who would like to include audio-visuals in the teaching and learning of Integrated Science

- Science teachers should be encouraged to employ the use of audio-visuals in the delivery of their lesson so that students can perform better.
- Science teachers are encouraged to improvise in the absence of real material to make their science lesson practically oriented. The ministry of education through GES and Ghana Association of Science Teachers should periodically organise workshops, in-service training frequently for science teacher on the practical use of audio-visuals in their teaching.
- Science teachers are encouraged to get personal training on the use of audio-visuals that could enhance their teaching.
- Head of institutions should encourage their science teachers to employ the use of audio-visuals in the delivery of their lesson.

5.4 Areas for Further Research

Reflecting on the findings of this study, the following recommendations are made for further research with respect to the use of audio-visuals on Integrated Science teaching:

- The attitudes of SHS science teachers to the use of audio-visual method of teaching in delivering their lesson.
- Use of audio-visuals by science teachers and students in improving their teaching and learning of Integrated Science.
- A study should be carried out to determine the knowledge and perceptions of science teachers on the use of audio-visuals.

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APPENDIX A

PRETEST 30 MINS

1. The major component of human blood is …….

   A. plasma. B. platelets. C. red cells. D. white cells.

2. An important function of white blood cells is to

   A. buffer blood. B. carry oxygen.

   C. fight infection. D. carry carbon dioxide

3. What is the organ that pumps blood all throughout the human body?

   A. The lungs B. The heart

   C. The kidneys D. The blood vessels and capillaries

4. Which of the following is a function of red blood cells?

   A. clot blood B. carry oxygen

   C. fight infection D. regulate osmotic pressure

5. Blood pressure will be at its highest when

   A. atria relax. B. atria contracts.

   C. ventricles relax. D. ventricles contract.

6. The blood vessel that carries blood from the lungs to the heart is the

   A. coronary vein. B. coronary artery.

   C. pulmonary vein. D. pulmonary artery

7. The **main** function of the valves in the heart is to

   A. prevent back-flow of blood.

   B. divide the heart into four chambers.

   C. control the volume of blood leaving the heart.

   D. control the volume of blood entering the heart.

8. The function of an artery is to

   A. transport blood toward the heart.

   B. transport blood away from the heart.

   C. connect the right and left atria directly.

   D. carry carbon dioxide to the tissue cells.

9. A blood vessel that transports blood out of a capillary bed is a(n)

   A. vein. B. artery. C. venule. D. arteriole.

10. The most muscular chamber of the heart is the

    A. left atrium. B. right atrium.

    C. left ventricle. D. right ventricle.

11. Blood vessels that allow diffusion of gases through their thin walls are the

    A. arteries. B. venules. C. arterioles. D. capillaries

12. The watery part of the blood is called…. A. Veins B. Platelets

    C. Plasma D. Capillaries

13. Chambers of the heart

    A. Atria or auricles and ventricles B. Veins and arteries

    C. Adenoids and tonsils D. Tarsal and carpals

14. These blood vessels take deoxygenated blood to the heart and oxygenated blood from lungs.

    A. Veins B. Capillaries C. Arteries D. Lymph

15. Hypertension would be indicated by a blood pressure reading of

    A. 100 / 80 B. 120 / 50 C. 120 / 80 D. 150 / 110

16. Which of the following would describe the path of the blood in the pulmonary circuit?

    A. Right ventricle → pulmonary trunk → pulmonary vein → left atrium.

B. Left ventricle → pulmonary vein → pulmonary trunk → right atrium.

C. Right ventricle → pulmonary vein → pulmonary artery →left atrium.

D. Right atrium→ pulmonary trunk → aorta →vena cava → right atrium.

17. Which of the following correctly matches structure with function?

A. platelets — provide immunity

B. plasma proteins — carry oxygen

C. red blood cells — carry carbon dioxide

D. white blood cells — initiate blood clotting

18. All of the following are components of plasma **except**

A. salts. B. water. C. proteins. D. platelets.

19. Blood which lacks platelets would not be able to

A. clot. B. carry oxygen.

C. fight infections. D. transport nutrients.

20. Which type of blood vessel has thick walls in order to withstand high pressure?

A. vein B. artery C. arteriole D. capillary

APPENDIX B

POST-TEST 30 MINS

1. What is the circulatory system? A. The body's breathing system
   B. The body's system of nerves C. The body's food-processing system
   D. The body's blood-transporting system
2. The organ that pumps oxygenated blood to the body and deoxygenated blood to the lungs. A. Brain B. Liver
   C. Heart D. Kidney
3. The major component of human blood is ……. A. plasma. B. platelets.
   C. red cells. D. white cells.
4. An important function of white blood cells is to
   A. buffer blood. B. carry oxygen. C. fight infection.
   D. carry carbon dioxide
5. Where is Red blood cells produced? A. Bone marrow B. Liver
   C. Pancreas D. Spleen
6. Blood pressure will be at its highest when
   A. atria relax. B. atria contracts.
   C. ventricles relax. D. ventricles contract.
7. The blood vessel that carries oxygenated blood from the lungs to the heart is the A. coronary vein. B. coronary artery.
   C. pulmonary vein. D. pulmonary artery
8. The **main** function of the valves in the heart is to
   A. prevent back-flow of blood.
   B. divide the heart into four chambers.

C. control the volume of blood leaving the heart.

D. control the volume of blood entering the heart.

9. The function of an artery is to

A. transport blood toward the heart.

B. transport blood away from the heart.

C. connect the right and left atria directly.

D. carry carbon dioxide to the tissue cells.

10. A blood vessel that transports blood out of a capillary bed is a(n)

A. vein. B. artery. C. venule. D. arteriole.

11. The most muscular chamber of the heart is the

A. left atrium. B. right atrium.

C. left ventricle. D. right ventricle.

12. Blood vessels that allow diffusion of gases through their thin walls are the

A. arteries. B. venules. C. arterioles. D. capillaries

13. Which type of blood vessel has thick walls in order to withstand high pressure?

A. vein B. artery C. arteriole D. capillary

14. Chambers of the heart A. Atria and ventricles B. Veins and arteries

C. Adenoids and tonsils D. Tarsal and carpals

15. These blood vessels take deoxygenated blood to the heart and oxygenated blood from lungs. A. Veins B. Capillaries C. Arteries D. Lymph

16. Hypertension would be indicated by a blood pressure reading of

A. 100 / 80 B. 120 / 50 C. 120 / 80 D. 150 / 110

17. Which of the following would describe the path of the blood in the pulmonary circuit?

    A. Right ventricle → pulmonary trunk → pulmonary vein → left atrium.

    B. Left ventricle → pulmonary vein → pulmonary trunk → right atrium.

    C. Right ventricle → pulmonary vein → pulmonary artery →left atrium.

    D. Right atrium→ pulmonary trunk → aorta →vena cava → right atrium.

18. Which of the following **best** describes a vein?

    A. Thin-walled, elastic, and equipped with valves.

    B. Thick-walled, elastic, and equipped with valves.

    C. Thin walled, muscular, and supplied with nerves.

    D. Thick-walled, muscular, and supplied with nerves.

19. Plasma is composed **mostly** of

    A. Salt. B. Water. C. Protein. D. Hormones.

20. These tiny blood cells clot the blood when a person gets cut.

    A. Red B. White C. Platelets D. Lymph

APPENDIX C

UNIVERSITY OF EDUCATION, WINNEBA

DEPARTMENT OF SCIENCE EDUCATION

RESEARCH QUESTIONNAIRE FOR STUDENTS OF THE EXPERIMENT GROUP

This questionnaire seeks information about the effectiveness of audio-visuals in understanding circulatory system. All information given is purely for academic and research purposes and therefore remains confidential. Kindly respond to all questions as accurate as possible to you.

√ the box for appropriate answers or write the appropriate response.

RESPONDANT ID NUMBER……..

1. Sex: Male [ ] Female [ ]
2. Age: 20 years and above [ ] 17-19 years [ ] 16 and below [ ]

Question items	responses				
	Strongly Agree	Agree	Not sure	Disagree	Strongly Disagree
3. Audio-visuals improved my understanding in circulatory system					
4. Audio-visuals motivated me to learn					
5. I learn better when teachers teach without audio-visuals					
6. The use of audio-visuals reduces forgetfulness in examination					
7. I always enjoy the lesson when our teacher uses audio-visuals					
8. I will be glad if we use audio-visuals for all integrated science lessons.					

APPENDIX D

MARKING SCHEME FOR PRETEST

1. A
2. C
3. B
4. B
5. D
6. C
7. A
8. B
9. C
10. C
11. D
12. C
13. A
14. A
15. D
16. A
17. C
18. D
19. A
20. B

APPENDIX E

MARKING SCHEME OF POST-TEST

1. D
2. C
3. A
4. C
5. A
6. D
7. C
8. A
9. B
10. C
11. C
12. D
13. B
14. A
15. A
16. D
17. A
18. A
19. B
20. C

APPENDIX F

Atintono Roger Milla. N. 19/05/2016

Tech 2B

05/20

PRETEST ON CIRCULATORY SYSTEM

1. The major component of human blood is ..... (A) plasma. B. platelets. C. red cells. D. white cells.
2. An important function of white blood cells is to
   A. buffer blood. (B) carry oxygen. C. fight infection. D. carry carbon dioxide
3. What is the organ that pumps blood all throughout the human body?
   A. The lungs B. The heart C. The kidneys (D) The blood vessels and capillaries
4. Which of the following is a function of red blood cells?
   A. clot blood B. carry oxygen C. fight infection (D) regulate osmotic pressure
5. Blood pressure will be at its highest when
   A. atria relax. B. atria contracts. (C) ventricles relax. D. ventricles contract.
6. The blood vessel that carries blood from the lungs to the heart is the
   A. coronary vein. B. coronary artery. (C) pulmonary vein. D. pulmonary artery
7. The **main** function of the valves in the heart is to
   A. prevent back-flow of blood. B. divide the heart into four chambers.
   C. control the volume of blood leaving the heart. (D) control the volume of blood entering the heart.
8. The function of an artery is to A. transport blood toward the heart. B. transport blood away from the heart.
   C. connect the right and left atria directly. (D) carry carbon dioxide to the tissue cells.
9. A blood vessel that transports blood out of a capillary bed is a(n) (A) vein. B. artery. C. venule. D. arteriole.
10. The most muscular chamber of the heart is the
    A. left atrium. (B) right atrium. C. left ventricle. D. right ventricle.
11. Blood vessels that allow diffusion of gases through their thin walls are the
    A. arteries. B. venules. C. arterioles. (D) capillaries.
12. The watery part of the blood is called.... A. Veins (B) Platelets C. Plasma D. Capillaries
13. Chambers of the heart (A) Atria or auricles and ventricles B. Veins and arteries
    C. Adenoids and tonsils D. Tarsal and carpals
14. These blood vessels take deoxygenated blood to the heart and oxygenated blood from lungs.
    A. Veins B. Capillaries (C) Arteries D. Lymph
15. Hypertension would be indicated by a blood pressure reading of
    (A) 100 / 80 B. 120 / 50 C. 120 / 80 D. 150 / 110
16. Which of the following would describe the path of the blood in the pulmonary circuit?
    A. Right ventricle → pulmonary trunk → pulmonary vein → left atrium.
    (B) Left ventricle → pulmonary vein → pulmonary trunk → right atrium.
    C. Right ventricle → pulmonary vein → pulmonary artery →left atrium.
    D. Right atrium→ pulmonary trunk → aorta →vena cava → right atrium.
17. Which of the following correctly matches structure with function?
    (A) platelets — provide immunity B. plasma proteins — carry oxygen
    C. red blood cells — carry carbon dioxide D. white blood cells — initiate blood clotting
18. All of the following are components of plasma **except** A. salts. B. water. C. proteins. (D) platelets.
19. Blood which lacks platelets would not be able to
    A. clot. B. carry oxygen. C. fight infections. (D) transport nutrients.
20. Which type of blood vessel has thick walls in order to withstand high pressure?
    A. vein B. artery (C) arteriole D. capillary

AYIFIU Solomon
TECH 2A

06/20

PRETEST ON CIRCULATORY SYSTEM

1. The major component of human blood is ……. A. plasma. B. platelets. C. red cells. D. white cells.
2. An important function of white blood cells is to
   A. buffer blood. B. carry oxygen. C. fight infection. D. carry carbon dioxide
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   A. clot blood B. carry oxygen C. fight infection D. regulate osmotic pressure
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   A. atria relax. B. atria contracts. C. ventricles relax. D. ventricles contract.
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   C. control the volume of blood leaving the heart. D. control the volume of blood entering the heart.
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13. Chambers of the heart A. Atria or auricles and ventricles B. Veins and arteries
    C. Adenoids and tonsils D. Tarsal and carpals
14. These blood vessels take deoxygenated blood to the heart and oxygenated blood from lungs.
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19. Blood which lacks platelets would not be able to
    A. clot. B. carry oxygen. C. fight infections. D. transport nutrients.
20. Which type of blood vessel has thick walls in order to withstand high pressure?
    A. vein B. artery C. arteriole D. capillary

PWADAM AUGUSTINE
TECH TWO A

19th MAY 2015

07/20

PRETEST ON CIRCULATORY SYSTEM

1. The major component of human blood is ..... A. plasma. B. platelets. C. red cells. D. white cells.
2. An important function of white blood cells is to
   A. buffer blood. B. carry oxygen. C. fight infection. D. carry carbon dioxide
3. What is the organ that pumps blood all throughout the human body?
   A. The lungs B. The heart C. The kidneys D. The blood vessels and capillaries
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9. A blood vessel that transports blood out of a capillary bed is a(n) A. vein. B. artery. C. venule. D. arteriole.
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11. Blood vessels that allow diffusion of gases through their thin walls are the
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12. The watery part of the blood is called.... A. Veins B. Platelets C. Plasma D. Capillaries
13. Chambers of the heart A. Atria or auricles and ventricles B. Veins and arteries
    C. Adenoids and tonsils D. Tarsal and carpals
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19. Blood which lacks platelets would not be able to
    A. clot. B. carry oxygen. C. fight infections. D. transport nutrients.
20. Which type of blood vessel has thick walls in order to withstand high pressure?
    A. vein B. artery C. arteriole D. capillary

Name : Atujenga Bright
Technical 2B

08/20

PRETEST ON CIRCULATORY SYSTEM

1. The major component of human blood is ..... A. plasma. B. platelets. C. red cells. D. white cells.
2. An important function of white blood cells is to
   A. buffer blood. B. carry oxygen. C. fight infection. D. carry carbon dioxide
3. What is the organ that pumps blood all throughout the human body?
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    A. platelets — provide immunity B. plasma proteins — carry oxygen
    C. red blood cells — carry carbon dioxide D. white blood cells — initiate blood clotting
18. All of the following are components of plasma **except** A. salts. B. water. C. proteins. D. platelets.
19. Blood which lacks platelets would not be able to
    A. clot. B. carry oxygen. C. fight infections. D. transport nutrients.
20. Which type of blood vessel has thick walls in order to withstand high pressure?
    A. vein B. artery C. arteriole D. capillary