UNIVERSITY OF EDUCATION, WINNEBA

EFFECT OF THE USE OF VISUAL AIDS ON FORM TWO PUPILS' PERFORMANCE ON BLOOD CIRCULATORY SYSTEM IN HUMANS AT DON BOSCO CATHOLIC JHS

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DECEMBER, 2017

DECLARATION

STUDENT'S DECLARATION

I, SOPHIA MAWUSI, declare that this thesis, 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.

SIGNATURE: ……

DATE: ……..……..…….

SUPERVISOR'S DECLARATION

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

NAME OF SUPERVISOR: PROF. VICTOR ANTWI

SIGNATURE: ……

DATE: ……

DEDICATION

To my lovely daughters, Benedicta Akosua and Pearl Abena Okore-Hanson and Gyan Okore-Hanson

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ABSTRACT

The purpose of the study was to determine the effect of using visual aids as an instructional tool in the teaching of circulatory systems in humans on the performance of Junior High School students. It further investigated the students‟ perception of motivation about their integrated science classroom learning environment under the visual aids and traditional teaching approaches. The study employed quasi experimental design. Purposive sampling technique was used to select the two schools for the study. The sample size comprised 81 students with 39 of them in the experimental group and the remaining 42 students in the control group. The experimental group was instructed using the visual aids method while the traditional lecture approach was used for the control group. Pre-test and post-test were carried out simultaneously on both groups using teacher-made achievement test. An independent sample t-test and paired sample t-test were used to analyse the scores of the achievement test. The findings indicated that students in the experimental groups achieved better results compared to those in the control group. Also, the results indicated that there was statistically significant difference in the Science achievement mean scores between the male and female students when taught with Visual aids as an instructional tool. It was also realised that students taught with visual aids were more motivational in learning the blood circulatory systems in human than the traditional method of teaching. It was recommended that teachers should incorporate the use of visual aids in the teaching of Science.

CHAPTER ONE

INTRODUCTION

1.0 Overview

This chapter consists of background to the study, statement of the problem, purpose of the study, objectives, research questions which serve as a guide for the study, hypotheses, significance of the study, delimitations of the study, organisation of the study.

1.1 Background to the study

The use of science permeates many fields of study such as astronomy and space science, biological and life Sciences, Chemistry, Earth Sciences, Marine Science and Oceanography, Meteorology and Physics. With respect to this, science is suggested to be among the crucial subjects for national development. Technological and economic developments in all countries depend on effective knowledge and use of science and mathematics. For that matter, the progress and improvement of science is linked to the prosperity of the state and this tells us that science should be highly esteemed as far as the development of the state is concerned. For this reason, most countries in the world including Ghana make science compulsory in the educational system in their pre-university schools. In Ghana, a student who fails in core science paper at the Basic School level, Basic education certificate examination (B.E.C.E.) or the Senior high school level, West African Secondary School Certificate Examination (W.A.S.S.C.E.) cannot progress to the next level of his/her education.

Due to these reasons, teaching and learning of science has improved substantially because of the accessibility of educational technology. Confirmations from literature show that when instructional technology is applied as supplementary approach in

teaching of science especially, Biology, the students were more attentive because the use of instructional technology stimulates interest and enhanced their motivational level. Use of instructional technology in Biology proves equally effective and beneficial for both low and high achievers. When the teacher teaches Biology through concrete examples and instructional technology to students; retention of the students is much better than that of students without instructional technology (Gillani, 2005).

Also, Rasul, Bukhsh and Batoo (2011) report that, audio-visual aids play important role in teaching and learning process. Aids make teaching and learning process effective, aids provide knowledge in-depth and detail and they bring change in class room environment. Mathew and Alidmat (2013) concluded that aids are often viewed to be an inspiration and provide motivation in classroom instruction and that effective use of audio-visual aids substitutes monotonous learning environments. Arora (2013) further concluded that there is a great impact of visual aids in the teaching-learning process, wherein students find the method of teaching very effective. So generally it is agreed that visual learning aids assist in the learning process and students find it easy to grasp the materials in classroom when visual learning aids are used.

In addition, the uses of visual aids encourage the body movement and it may strengthen the control (Jain, 2004). There is famous Chinese proverb “one sighted is worth, a hundred words” it is a fact that we take knowledge through our intellects. There is another maxim that” if we hear we forget, if we see we remember, and if we do something we know it” so it means that the use of visual aids makes teaching learning process more effective. As Kishore (2003) said “visual aids stimulated thinking and cognition.” The use of visual aids in teaching and learning process has multifarious values (Mohanty, 2001). Visual aids give chance to speakers to make a more professional and consistent performance. The teaching career is full with

limitless opportunities to enrich the academic survival of students, while some ideas and educational goals will be easy for students to hold, others will need you to think productively to ensure that important learning aims are met. Visual aids in teaching is one mode to enhance lesson plans and give students additional ways to process subject information (Kunari, 2006). Visual aids are devices present unit of knowledge through auditory of visual stimuli both with a view to aid learning. They concretize the information to be obtainable and help in making learning practical and real, active and vital. They supplement the work of the teacher and help in the research of the text books. The great educationist Comenius has well said that: The foundation of all learning consists in representing clearly to the senses and sensible objects so they can be appreciated easily (Singh, 2005).

However, use or non-use of learning aids was not the only problem in public Junior High Schools in Ghana; materials shortages, motivational inadequacy, poor learning environment couple with traditional approach of teaching abstract nature of some concepts in Biology especially, circulatory system in humans were some of the problems.

The reason may include lack of specialist science teachers and the perception that science is a difficult subject (Buabeng & Ntow, 2010; Fillmore, 2008; Isola, 2010). Other researchers (Paas, Renkl, & Sweller, 2004; Prow, 2003) have also reported that science is a difficult subject to learn where maximum effort is required and the resulting grade may not always reflect the effort that students have expended.

Studies have also revealed that the performance of students in science in most African countries was generally and consistently poor over the years (Oladajo, Olosunde, Ojebisi & Isola 2011; Osmosewo, 1999; Wambugu & Changeiywo, 2008). Tamakloe, Atta and Amedahe (2005) observed that it is not all those who teach students that are

considered in the traditional sense as teachers. In their opinion, the teacher is the one who understands what his or her students need to learn and their capabilities of learning. Thus the teacher must be able to judge just how much intervention students will require in their learning activities. The science teacher is therefore supposed to be one who would facilitate the learning process of learners. He/she ought to be a professional who will make use of any available resources to enhance teaching and learning.

While it is promising to see that several previous studies have demonstrated positive effects of visual instructional approach lessons on students‟ achievement, a search of literature indicates that many of these studies have not centred on visual instructional approach in teaching and learning circulatory system in humans, particularly in Ghana. Therefore, it is against this background that the study will be conducted to determine the effects of using visual aids as an instructional tool in teaching circulatory systems in humans on the performance of students.

1.2 Statement of the Problem

As it is known that visual aid are important teaching facilities and they are essential during teaching, they facilitate and make calm to study, teach and extent a theme easily. Visual aids may provide the chance to learn visually and are more effective and easy for human beings. During teaching with models and visual aids, students‟ put in effort to identify it, or recognize its functions and try to have its interpretation to understand its use (Bangkok, 2004). They compare it with their pre-concepts, adapting the new sensation and pursuing to recognize about it. But, most of the teachers do not use adequate visual aids as teaching materials. This may cause barriers to teaching and learning process and directly affect the learning outcomes. In the

Ghanaian educational system, it is compulsory that every Junior High School student study Integrated Science in addition to other core subjects such as Mathematics, English and Social Studies. Over the years, the performance of students in Integrated Science has, however, been very poor. Studies have revealed quite a number of reasons; one is that some concepts are very difficult to teach as well as for students to learn and understand (Bordens & Abbot, 2002; Bangkok, 2004). For instance, concepts of the circulatory system in human, which end up being neglected by teachers (Ertmer, 2003). Other studies have shown that difficulty of learning circulatory system in human is a common phenomenon, because the concept is abstract and the processes involved are not physically observable (deMarrais & Lapau, 2004). Therefore, their teaching and learning tools should be provided to make learning biological concepts easier and concrete. Hence, it is virtuous to stimulate the students or keep them active in the teaching and learning process by using visual aids.

Pupils from Don Bosco Catholic JHS Two, also have similar problems in formulating conceptual understanding in circulatory system in human. This problem could be attributed to the traditional lecture approach being used to teach the pupils. There is therefore the need to use modern approach when the use of visual aids to help improve pupils performance. It is by virtue of this that renders this study very significant to find out the effect of the use of visual aids on Don Bosco Catholic JHS Two pupils; performance in circulatory system in human.

1.3 Purpose

The purpose of this study is to determine the effect of using visual aids as an instructional tool in the teaching of circulatory systems in humans on the performance of Junior High School students.

1.4 Objectives of the study

Specifically, the objectives of the study are to:

a. compare the effectiveness of the visual aids approach of teaching and traditional approach of teaching circulatory systems in humans on the performance of students.
b. ascertain the difference in performance of female and male students taught circulatory system in humans using visual aids.
c. examine the students‟ perception of motivation about their Integrated Science classroom learning environment under the visual aids and traditional teaching approaches.

1.5 Research Questions

The following research questions were formulated to guide the study:

1. What is the effect of the use of visual aids on the performance of students in circulatory systems in humans?
2. Is there any difference in the performance of female and male students taught with the use of visual aids in circulatory systems in humans?
3. What are students‟ perceptions of motivation about their Integrated Science classroom learning environment under the visual aids teaching approach and traditional teaching approach?

1.6 Hypotheses

To determine the effect of using Visual aids or conventional method as instructional tools in the teaching of circulatory systems in humans on the performance of students, the following hypotheses were raised:

H_{01}: There is no significant difference between the performance of students taught with visual aids method and those taught with traditional method in the circulatory systems in human.

H_{02}: There is no significant difference in the performance of female and male students taught circulatory systems in human using visual aids.

1.7 Significance of the Study

- The findings of this study will be a resource for policy makers, teachers and other stakeholders as to whether utilization of visual aids in the teaching of circulatory systems in human actually improves students‟ conceptual reasoning in circulatory systems or not.
- It will also generate relevant information that could inform curriculum developers on the ways to design the curriculum by integrating visual aids into the teaching and learning of science due to its impact in the study.
- Students would benefit from this study since they would be able to learn about various visual aids and use it to achieve better understanding of biological concepts in science.
- It would benefit Junior High School science teachers by giving them insight on how visual aids can be used to improve their teaching.

- Again, the findings of the study will provide information on how the use of visual aids as an instructional tool motivates students to learn circulatory system in humans.
- The study will also serve as a source of information for scholars and researchers who want to embark on similar study.
- Finally, the outcomes and recommendations of this research will create the much needed awareness and attention among science teachers to improve upon their teaching methodology and make science interesting to students.

1.8 Delimitations of the Study

The scope of the study two public Junior High Schools in the Efutu Municipality and one intact class in the second year of each school were used for the study. The main rationale for using the second year students in the study is that the topic is within the scope of the second year science curriculum. Again, the study was confined to blood circulatory systems in humans.

1.9 Limitations of the Study

From a total of 32 Junior High Schools in Efutu Municipality, only 2 schools were purposively selected for this study which clearly limited the scope of the current research. This implies that generalization cannot be extended beyond the schools where the study took place, but schools with similar features.

1.9 Organisation of the Rest of the Study

The rest of the study is organised as follows. Chapter two deals with the review of related literature. Chapter three is concerned with methodology for the study and focuses on research design, population, sample and sampling procedures. Chapter three also deals with instrument, data collection procedures and data analysis. Chapter

four presents the results and discussion of the findings of the study. Chapter five is the final chapter of the study. It gives the summary of the study and draws conclusions on the key findings of the study. It outlines recommendations from the study and suggests areas for further research.

CHAPTER TWO

LITERATURE

2.1 Introduction

This chapter is devoted to a review of the literature that pertains to the research. Its aim was to enable the researcher have a better understanding of the topic, identify where gaps existed in the research literature and most importantly generate relevant methods such as the design of the research questions to elicit responses from research participants. The focus was on the interaction concepts and themes as they relate to research and theory.

Some related empirical studies were also reviewed in order to understand much better the current concept under study. This helped the researcher gain knowledge by means of direct and indirect observation or experience of previous researches or studies. Some of the sub-headings reviewed were constructivism, constructivism view of learning, criticism of the constructivism theory of learning, and how constructivism is related to this study. Other sub-headings reviewed were the concept of teaching Biology in Junior High School, methods and strategies of teaching Biology, and attitude of students towards Biology.

2.1 Theoretical Framework of the Study

The theoretical framework is a collection of theories that support a research (Ofori & Dampson, 2011). Therefore, the theory supporting this study is constructivist‟s theory of teaching and learning of science. In constructivist learning theory, the learner is the source of meaning. This means that the knowledge previously subsists and the learner needs to discover it. With regards to this theory, learners do not just accept information inertly but continuously generate new knowledge established on previous

knowledge in concurrence with new understandings they had (Hmelo, Cindy, & Chinn, 2007).

The concept of constructivism has roots in classical antiquity, going back to Socrates‟ dialogues with his followers, in which he asked directed questions that led his students to realize for themselves the weaknesses in their thinking. The Socratic dialogue is still an important tool in the way constructivist educators assess their students‟ learning and plan new learning experiences. In the last century, Jean Piaget and John Dewey developed theories of childhood development and education, what is now referred to as Progressive Education, which led to the evolution of constructivism (Adey, Fairbrother, Wiliam, Johnson, & Jones, 1999). Piaget believed that humans learn through the construction of one logical structure after another. They concluded that the logic of children and their modes of thinking are initially entirely different from those of adults.

The implications of this theory and how he applied them have shaped the foundation for constructivist education. Dewey called for education to be grounded in real experience. According to Dewey (as cited in Adey, Fairbrother, Wiliam, Johnson, & Jones, 1999), if you have doubts about how learning happens, engage in sustained inquiry: study, ponder, consider alternative possibilities and arrive at your belief grounded in evidence. Inquiry is a key part of constructivist learning. Among the educators, philosophers, psychologists, and sociologists who have added new perspectives to constructivist learning theory and practice are Lev Vygotsky, Jerome Bruner and David Ausubel (Bandura, 1986). All these researchers have theorised one way or the other on constructivism.

2.2 Constructivist View of Learning

Constructivism is basically a theory, based on observation and scientific study about how people learn. It says that people construct their own understanding and knowledge of the world, through experiencing things and reflecting on those experiences (Grossfield, 1989). When we encounter something new, we have to reconcile it with our previous ideas and experience, maybe changing what we believe, or may be discarding the new information as irrelevant. To do this, we must ask questions, explore, and assess what we know. Cognitive constructivism holds that people actively construct their own knowledge, and that reality is determined by the experiences of the knower, rather than existing as an objective truth distinct from the individual (Jonassen, 1991).

Constructivism learning theory enhances students' logical and conceptual growth. The underlying concept within the constructivism learning theory is the role which experiences or connections with the adjoining atmosphere-play in student education. Two of the key concepts within the constructivism learning theory which create the construction of an individual's new knowledge are accommodation and assimilation (Allen, 1988). Allen examines that assimilating causes an individual to incorporate new experiences into the old experiences; while accommodation relates to re-framing the world and new experiences into the mental capacity already present. Individuals conceptualizes a particular fashion in which the world operates, and this causes the individual to develop new outlooks, rethink what were ones‟ misunderstandings, and evaluate what is important, ultimately altering their perceptions (Allinson & Hayes, 1996).

Constructivism transforms the student from a passive recipient of information to an active participant in the learning process (Bandura, 1986). Always guided by the teacher, students construct their knowledge actively rather than just mechanically ingesting knowledge from the teacher or the textbook. The constructivist view of learning in most general sense, usually means encouraging students to use active techniques to create more knowledge and then to reflect on and talk about what they are doing and how their understanding is changing. The teacher makes sure she understands the students‟ pre-existing conceptions, and guides the activity to address them and then build on them (Deci, 1992).

In Constructivism, students are encouraged to constantly assess how the activity is helping them gain understanding. By questioning themselves and their strategies; thus, in the constructivist classroom ideally become "expert learners.” This gives them ever-broadening tools to keep learning. With a well-planned classroom environment, the students learn how to learn. When they continuously reflect on their experiences, students find their ideas gaining in complexity and power, and they develop increasingly strong abilities to integrate new information (Dunn, Dunn & Price, 1989).

The Constructivism Learning Theory allows children to, at an early age or a later age, develop the skills and confidence to analyse the world around them, create solutions or support for developing issues, and then justify their words and actions, while encouraging those around them to do the same and respecting the differences in opinions for the contributions that they can make to the whole of the situation (Doucette, Kelleher, Murphy & Young, 1998). Classroom applications of

constructivism support the philosophy of learning which build a students‟ and teachers' understanding.

2.3 Criticism of the Constructivist Theory of Learning

Constructivism has been criticized on various grounds. Some of the charges that critics level against it is that it is elitist. Critics say that Constructivism and other "progressive" educational theories have been most successful with children from privileged backgrounds who are fortunate in having outstanding teachers, committed parents, and rich home environments (Brooks & Brooks, 1993). They argue that disadvantaged children, lacking such resources, benefit more from more explicit instruction. Critics say the collaborative aspects of constructivist classrooms tend to produce a tyranny of the majority, in which a few students' voices or interpretations dominate the group's conclusions, and dissenting students are forced to conform to the emerging consensus (Miller, 1994).

Also, there is little hard evidence that constructivist methods work. Critics say that constructivists, by rejecting evaluation through testing and other external criteria, have made themselves unaccountable for their students' progress. Critics also say that studies of various kinds of instruction in particular "project follow through", Long-term government initiative in U.S.A, have found that students in constructivist classrooms lag behind those in more traditional classrooms in basic skills. Despite these criticisms, constructivists counter that in studies where children were compared on higher-order thinking skills, constructivist students seemed to outperform their peers (Ellis & Hunt, 2004).

2.4 How Constructivism is related to this Study

The idea that each of us constructs our own knowledge has important implications for teachers and students. In this study and for that matter in the integrated science classroom, it is expected that all the proposals of the constructivist theory be applied. In the constructivism learning theory, instead of giving a lecture, the teachers function as facilitators whose role is to aid the student when it comes to their own understanding (Fischer & Fischer, 1979). This takes away focus from the teacher and lecture and puts it upon the student and their learning. Instead of telling, the teacher must begin asking. Instead of answering questions that only align with their curriculum, the facilitator in this case must create the situation that allows the students to come out with the conclusions on their own instead of being told.

Also, teachers must continually be in conversation with the students, creating the learning experience that is open to new directions depending upon the needs of the student as the learning progresses (Grasha & Riechmann, 1996). So, in this study it is expected that teachers teaching integrated science in the selected schools do this in their respective classrooms. Teachers teaching integrated science using the Constructivist Theory must pose questions and problems, guide students to help them find their own answers, using various techniques such as visual aids in the teaching process. For example, they may prompt students to formulate their own questions, allow multiple interpretations and expressions of learning and encourage group work and the use of peers as resources.

Notwithstanding, teachers must challenge the student by making them effective critical thinkers and not being merely a "teacher" but also a mentor, a consultant, and a coach (Handal & Bobis, 2006). Instead of having the students relying on someone else's information and accepting it as truth, students should be exposed to data,

primary sources, and the ability to interact with other students so that they can learn from the incorporation of their experiences (Hou, 2007). Furthermore, the constructivism approach can also be applied in the classroom through the following ways as put forward by Brooks and Brooks as guiding principles.

The first principle focuses on teachers posing problems that are or will be relevant to the students. It would be wonderful, and easy for teachers, if all students came to every class with the question of burning interest relevant to the topics that particular lesson was to cover, which they could not wait to address. Interest and relevance can be created and students drawn in if teachers are adept at creatively setting up and mediating interesting problems for students to ponder. Teachers create cognitive conflict by presenting students with an interesting problem, one that students can make testable predictions about, discuss among themselves, elaborate upon to develop further knowledge, and see as relevant in some way (Mayer, 1992; Greenberg, 1990).

The second principle concentrates on structure learning around essential concepts. Teachers encourage students to make meaning by breaking whole into parts. Students must avoid starting with the pans to build a "whole." For example, considering the world of a terrarium might help students construct knowledge.

The teaching of bio1ogy as part of integrated science in Junior High School is a branch of natural science which is devoted to the study of life and the activities of all living things from bacteria to high plants and animals (Miller & Levine, 1991). Miller and Levine further noted that the survival of humans nevertheless depends greatly on the knowledge and understanding of the structure and functions of organisms and how they interact with one another and the environment. This invariably leads to the necessity of conservation of living things and other natural resources.

Junior science education is too important to be left out entirely in a developing country like Ghana. According to Dr. Kwame Nkrumah as cited in McWilliams and Kwamena-Poh (1975), the whole educational system must be geared toward producing a scientifically-technically minded people. McWilliams & Kwamena-Poh further wrote that science and technology must be an instrument for accelerating economic growth and scientifically literate population capable of contributing to creativity and innovativeness. To them, this was the answer poverty and low-productivity. I indeed support their statement, in that, science and technology had been the pillars on which every successful economy in the world is built. In the past, to get anybody outside the country was only through the post. What do we see now? Within a twinkle of an eye one can in and around the world and even through internet one can even see the person he/she is talking to on the screen of a computer or cellular phone. All these came as a result of science and technology. The survival of humans and the development of nations would ever depend more and more on science and technology (Reiss, 2006).

The argument here is that, if science can be seen in this light of improving then the teaching of the subject and for the sake of this study Biology should be given the necessary attention so that students' learning can be easy and attractive. Consequently, Alberts (as cited in Reiss, 2006) commented that biologists should first look for ways to strengthen the teaching of science in their own communities. Therefore, one can say that scientists have been far too reluctant to make the connections with educators that are necessary for the scientific enterprise to continue to thrive. Everyone must realize that he/she can offer educators something that is often beyond their reach; more importantly, the Ministry of Education must provide teachers with the necessary

resources. Additionally, well to do schools, for example can loan a microscope and other important materials, invite a class to their laboratory, and they will love it.

According to Anderson (2007), students hold different conceptions and that it is the teacher's responsibility to be aware of students' conceptions and to teach in ways that are likely to facilitate conceptual change on the part of the students. Many teaching studies in recent years have attempted to take into account research on students' conceptions of natural phenomena. A number of different features have begun to emerge from these studies as characteristic components of what can be called conceptual change teaching (Hewson & Hewson, 2008).

Teachers can build conceptual structures in which they incorporate classroom events, instructional concepts, socially accepted behaviours, and explanatory patterns. These structures include, possibly implicitly on one hand, their rationale for teaching and their view of knowledge, learning, and science, their disciplinary knowledge, and on the other hand the ways in which they teach, along with detailed specific information on content, students, school procedures, etc. I call this a conception of teaching science (Hewson & Hewson, 2008.). It seems obvious that teachers' knowledge, skills, and attitudes are likely to be very different in kind, serving different purposes, and not necessarily being coherent. In order to identify the characteristics of a conception of teaching science appropriate for conceptual change teaching, Hewson and Hewson (2008) concluded in their study that science teachers should know the phenomena, the methods, and the concepts, principles, and theories that constitute the science they are teaching, and also, they should know what conceptions their students hold about the units to be taught, and the extent to which they are scientifically acceptable. They further recommend that teachers should be aware of the role played by students' existing knowledge in understanding new material, they must be

convinced of 'the need to use conceptual change teaching strategies particularly when students' existing conceptions conflict with those being taught, and also they should be able to plan and perform teaching actions that give effect to these strategies.

2.5 Methods and Strategies of Teaching Biology

The sequence in which the syllabus is presented does not imply any particular order of teaching. According to the 2008 teaching syllabus for integrated science, the teaching of science should be student-centred and activity oriented. The teacher acts as a facilitator. But is this the case now in our various classrooms in Ghana here? To me, students need to construct their own knowledge so that the knowledge they get become theirs, like their own property. I am in agreement with (Chen, 2008) who stressed that the use of the constructivist learning model takes the emphasis away from the teachers' effort to transmit knowledge as a discrete entity towards assisting learners to construct meaning by relating new experiences to establish understandings. In this model, learners are viewed as actively developing thinking rather than passively receiving knowledge. New learning is highly dependent on prior learning and so teachers must explore pupils' current understanding in order to support further development (Appleton, 2009). Teaching strategies should promote the aims and objectives of the syllabus (Conti & Wellborn, 2009).

2.6 Current Trends in Teaching Learning Practice

Previous to the last century, teaching was considered as a rigid, formal and stereotyped process of transmitting knowledge. Education was taken as a bipolar process with teachers at the giving end and students at the receiving end. Teachers were considered to be the only source of knowledge, maybe through manuscripts or printed materials. Schools were the knowledge shops and teachers are the information

managers. Emphasis was laid on rigid discipline, blind memorization and hard reinforcement. Verbalism was enforced and no visual aids or materials were utilized in the field of education. In recent times, 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 (Karthick, 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).

Teaching methods in recent times have been moved from predominantly teacher oriented and controlled approach to student interactive system. Such a system requires a number of changes in the instructional procedure and the materials used for effective teaching. In a formal education system, the use of 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).

Development in the field of science and technology resulted in an increased availability of teaching aids which are known as visual aids or techniques. Advances in technology have brought instructional aids especially the projected and electronic materials to the forefront as the most radical tools of globalisation and social development which have affected the classroom teaching-learning situation positively. They are the important landmarks in knowledge transfer. Unfortunately, the employment of visual techniques as an integral part of instructional technology is very limited in Ghana as compared to the Western countries where it is being used extensively with great effect. 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. Without the knowledgeable teacher, instructional materials cannot create change and progress in the teaching learning process. It begins to make impact only when the teacher begins to make use of it and allows it to make over its values. Therefore, teachers have to be properly motivated and made interested in the use of such materials. Teachers have to be trained and oriented in the adequate use and maintenance of the materials. It is often found that these devices or media have been hurriedly introduced and used without sufficient planning and forethought.

Visual literacy in the classroom has become increasingly important since more and more information and entertainment is accessed through technology. Development in the area of visual literacy has focused on the growth and expansion of educational

programs that stimulate students‟ abilities as well as enhancement of students‟ reading and writing skills through the use of visual literacy strategies.

Visual aids have an effect on student emotions and assist in comprehension and at the same time students should be guided through the process of learning to recognize and respond to the visual. 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).

The growing use of educational technology in today‟s schools has helped to release the teacher from the routine role of information giving but it enabled them to devote more time and effort to the tasks of planning, arranging and evaluating learning experiences, guiding and counseling students. The various technological media are used to communicate the factual information accurately and efficiently than the teacher. So today students acquire knowledge through the various media. Another noticeable trend is the creation of multi-media learning environments in the classroom which involve the use of a variety of interrelated learning experiences. This implies “the selection and use of appropriate sequences of interlinked of audio visual or instructional media learning experiences which reinforce and strengthen the progress of the learner (Singh, 2005).

2.7 Teaching Methods and Aids

Teaching Methods

Teaching methods are the basic approach by which the teacher has transferred the knowledge to the students. The preparation of teaching methods depends on the

students‟ age, developmental level, previous knowledge, their needs, subject-matter content, objective of the lesson, the available people, space and material resources, and physical set up of the classroom (Nisha, 2006).

Reiser and Dempsey (2007) define teaching methods as “the elements included in teaching for the purpose of supporting the achievement of the learning objective”. The teaching methods allow learners to draw upon cognitive processes of learning through assisting learners in "paying attention to relevant materials, mentally organizing it into a coherent representation and mentally relating it to prior knowledge”. Teaching method includes practice, problems or exercises, negative or positive feedback, visuals, educational games, and simulations. Instructional methods fall into two categories such as teacher-centred approaches and student- centred approaches.

Teacher-centered approaches include instruction where the teacher's role is to present the information that is to be learned and to direct the learning process to students. The teacher identifies the lesson objectives and takes the primary responsibility for guiding the instruction by giving explanation of the information and modeling. This is followed by student practice. Methods that fall into the teacher- centred approaches include demonstration, lecture, lecture-recitation, and lesson method.

Learner- centred approaches involve instruction where the teacher is a facilitator (or guide) as the learners construct their own understandings. Our educational system is generally based on the teacher centred approach in which the individual student has little freedom regarding what he learns and how he learns it. However, it is observed that there is a slow but steady increase in the use of student- centred learning within the traditional system. This trend is certain in making teaching learning process more practicable by making available new and more effective methods and media (Singh, 2005).

Jones (2007) defined the student centred classroom as a place where needs of students are considered and students are encouraged to participate in the learning process at all times. It is not a place where students make random decisions about what they want to learn. The teacher becomes a member of the team as a participant in the learning process and functions as a facilitator who guides, manages activities and directs. Learner centred approaches assumed that only when students are active participants, learning that takes place will be deep, enduring and enjoyable. Moreover, this would help in transfer of learned concepts and abilities to contexts beyond classroom.

Dupin-Bryant (2004) defines learner centred teaching style as "a style of instruction that is responsive, collaborative, problem centred and democratic in which both students and instructor decide how, what and when learning occurs". Learner-centered teaching methods shift the focus of activity from the teacher to the learners. These methods include active learning, in which students solve problems, answer questions, formulate questions of their own, discuss, explain, debate, or brainstorm during class. There are a number of methods in this category including discussion, debate, simulation/games, role playing, case study method, cooperative learning, discovery learning inquiry and learning individualized instruction.

Teaching Aids

Teaching aids are print and non-print items that are designed to impart information to students in the educational process. Instructional materials include items such as kits, textbooks, magazines, newspapers, pictures, recordings, slides, transparencies, videos, video discs, workbooks, and including electronic media but not limited to music, movies, radio, software, CD-ROMs, and online services. Instructional material plays a very important role in the teaching-learning process and enhances the memory level of the students. At present, education has spread wide and the entirely oral teaching

cannot be the key to successful pedagogy. Therefore, the teacher has to use instructional materials to make the teaching-learning process interesting. The use of instructional material can enhance the learning achievement (Nicholls, 2000 and Raw, 2003).

The Psychology of Using Teaching Aids

There is an old saying which reads

1. I hear, I forget;

2. I see, I remember;

3. I do, I understand.

I Hear, I Forget

The traditional teacher depended too much on verbal exposition. The pupil hears and forgets. Further, unless the individual has a pragmatic imagination it will be difficult for the individual to visualize objects and events, however the verbal description is. It is highly possible that concepts formed will depend upon the nature of background experience of the individual.

I See, I Remember

As a sensory organ, the eye is very highly developed when compared to the other sensory organs. It is quite natural that the knowledge gained through the sense of sight is more accurate and permanent. Hence, what one sees, one remembers. More than 80 percent of our knowledge is gained through our eyes.

I Do, I Understand

When one is engaged in any practical activity, involving physical work (doing practical work in the laboratory, workshop or in the field) all the senses are used to perceive. Knowledge is through all the senses. This is learning by direct experience.

The outcome is pragmatic. A lot of self-activity is involved. It is an ideal method of making the pupil acquires complete knowledge (Kumar, 2000).

Adekeye (2008) summarized instructional aids available for instruction into four major categories: Visual aid-these include pictures, maps, charts, graphs, diagrams, chalkboard, sketches, atlas and painting; Audio visual aids-television, computer programs, film strips, video recording and projectors; Auditory aids-audio recordings, radios, records or cassette tapes, music and Printed materials-Encyclopedias, textbooks, magazines, journals, newspapers, pamphlets, government records and publications almanacs, biographic, editorial cartoons and case studies.

2.8 The use of Visual Aids in the Teaching of Science/Biology

The use of audio-visual aids in education has been found to be an effective way of communicating ideas and concepts to students (Le Doux, 1996; Ouellette, 2004). Literature has also established that audio-visual-aided instruction has greatly improved the performance of students in science especially those with special needs and slow learner‟s abilities (Aremu, 1992; Mitchell & Surprise, 1994; Okwo, 1994; Osokoya, 2007). However, many teachers in Junior High Schools (JHS) in Ghana do not use audio-visual aids when teaching science. Although there are a few notable exceptions, others either feel these materials are inappropriate for instruction or use them poorly. Some teachers find it quite complex to use audio-visual aids to complement the traditional lecture method while others perceive the use of it as waste of time.

With respect to instruction, students‟ achievement and attitude towards learning, research has not only proven the efficacy of technology related materials but has also found this results to be overwhelmingly positive (Dabbagh, 2001). Teaching and

learning with audio-visual resources play an important role in the teaching-learning process. Students often benefit from the visual/sound appeal of audio-visual material because it tends to focus their attention on the topic. When teachers present materials in various manners such as providing students with both a summary statement and a chart on a given topic, the visual material enhances the written materials. King (1990) indicated that audio-visual resources, wisely selected and intelligently used, arouse and develop intense and beneficial interest and so motivate students to learn; and properly motivated learning means improved attitudes, permanency of impression and rich experience and ultimately more wholesome living.

Since most students consider science as an abstract subject, the use of audio-visual resources should be a requirement for every science teacher if the aim of the teacher is to guide the student to master concepts in the subject (science). Quellette (2004) sums up tenaciously that words may easily be forgotten but mental pictures will long be remembered. 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. 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 therefore important to prepare illustrative materials and short demonstrations or other visual materials which are effective means of helping students to understand and thereby facilitating learning.

CHAPTER THREE

METHODOLOGY

3.0 Overview

This chapter covers the research design, population, sample and sampling procedure, instrument, data collection procedure, description of treatment/interventions and data analysis.

3.1 Research Design

Research design is a master plan that specifies the methods and procedures for collecting and analysing needed information. A pre-test and post-test non-equivalent quasi-experimental design was used for the study since the subjects were not to be assigned randomly to the experimental and control groups (Cohen, Manion, & Morrison, 2000). In a typical school situation, classes cannot be disrupted or reorganised for the researcher to conduct her study, therefore in such a case, it is better to use groups that are already organised or intact (Ary, Jacobs, & Razavieh, 2002). Even though this design suits this study, it has some weaknesses. The major weakness lies in its inferiority to randomized experiments in terms of internal validity. Hence some extraneous factors such as age, ability, maturation and previous learning experiences were not controlled in this study. Another weakness of this design which is a threat to internal validity is the interaction between the control and the experimental groups notably when both groups are on same school premises. However, this weakness was reduced in this study since both groups were about 20km apart.

The quantitative data was used for the study. Scores of students‟ achievement test for pretest and posttest constituted the quantitative data as well as the questionnaire on

students‟ perception towards the use of visual aids in teaching and learning Biology. The achievement tests which were pre-test and post-test were administered to both the control and experimental groups. The experimental group received treatment using the visual aids in the form of video on how blood is and how it flows in humans while the control group received treatment using the traditional method. Both groups however covered the same content in blood circulatory system in human under circulatory system in human.

In this study, the achievement of the students was the dependent variable while the teaching approaches (visual aids method and the traditional method) were the independent variables. The independent variable was manipulated in order to affect the dependent variable.

3.2 Population

A population is a body of people or collection of items under consideration for statistical purposes. It is a group of elements or cases, whether individuals, objects, or events that conform to specific criteria to which we intend to generalize the results of the research (Ofori & Dampson, 2011). The target population for this study was all second year Junior High Schools (JHS2) students of 2016/2017 academic year in the 32 Junior High Schools in Efutu Municipality of Ghana. The accessible population consisted of a set of second year students of School A and School B in East and West circuit respectively in the Efutu Municipality. The distance between the two was considered long enough to prevent any interactions between the students who participated in the study. Also, the reason for choosing the two schools from the same category was to ensure that all other factors that might affect the result of this study, except the performance in the teacher-made achievement test would be held constant.

3.3 Sample and Sampling Procedure

The sample comprised two Junior High Schools (JHS) 2 in Efutu Munpality. Out of the 32 JHSs, a purposive sampling technique was used to select two schools (School A and School B) for the purpose of this study. Creswell (2009) stated that purposive sampling is employed because of the special characteristics of the school in facilitating the purpose of the research. In purposive sampling the units of the sample are selected not by a random procedure, but they are intentionally picked for the study because of their distinctive characteristics. In all, one intact class was selected for the research in each school for study from JHS 2 class by using purposive sampling technique.

The reason for selecting the intact class from each school was that all the lessons were taught during the instructional time. Also, the intact class was used for study so that the contents treated would be beneficial to the entire class. Further, the usage of the entire class was to avoid disturbance during the school session. The form two classes were used because the topic treated in the study was among the form two topics in the Integrated Science syllabus for JHS and the school would not allow the researcher to teach or reteach this topic in the other forms. The sample size consisted of 81 students of which 42 were in the control group and 39 were in the experimental group. The control group was made up of 24 boys and 18 girls and the experimental group was made up of 19 boys and 20 girls. After the initial Biology achievement test (pre-test) which was administered, the outcome of the test disclosed that both the students in the control and experiment group were comparable in aptitudes before the treatment was administered. The two schools selected were about 20km apart this reduced the interaction between the control and experimental groups.

3.4 Research Instruments

Instrument is the general term that researchers use for a measurement device (test, questionnaire, interview etc.). According to Biddix (2009), instruments are grouped into two main categories: researcher-completed instruments and subject-completed instruments. The researcher-completed instruments are those instruments that researchers administer. Examples include rating scales, interview guide and observation checklist. The subject-completed instruments are those that are completed by participants. Examples are questionnaire, self-checklist, and achievement/aptitude test.

The two main instruments employed in this study were teacher-made achievement test and questionnaire. Aside these two main instruments which were used to collect data from the students to answer the research question and hypotheses, lesson plan and class work were used to guide teaching instruments and classroom management.

3.4.1 Teacher-made Achievement Test

The teacher-made achievement test is the written assessment not commercially produced or standardised. The items on the teacher-made achievement test were constructed based on the lesson taught and learning objectives in the JHS science syllabus. The purpose of this instrument was to provide a measurement of achievement. The teacher-made achievement test was preferred in this study to other type‟s tests for the following reasons: it reflects instruction and curriculum; it is sensitive to student‟s ability and needs; it provides immediate feedback about student progress; and finally, it can be made to reflect small changes in knowledge (O‟Malley, 2010).

On the other hand, teacher-made achievement test has been criticised that it may not reflect content standards; it has little variety in types of assessment used; it is informal

or unstandardized; and it has concerns about validity and reliability. In this study, the following measures were taken to address these concerns. The principles of test construction provided by Etsey (2008) and O'Malley (2010) were followed strictly to construct the test; table of specification was prepared and used for the construction of the test items; content and face validity were ascertained by supervisors of this study; and finally, the instrument was pilot tested to ascertain its validity and reliability.

The teacher-made achievement test comprised fifteen (15) multiple choice test-items and four (4) essay test questions (Appendix B). The reason for using the objective test was to allow extensively coverage of subject content. The essay test was also used to check students who obtained high score through guessing.

Two instruments were used for the data collection in this study. Biology Achievement Test (BAT) and questionnaire on students' perception towards visual aids in teaching and learning blood circulatory system.

3.4.2 Biology Achievement Tests (BAT)

The Biology achievement test was categorized into multiple choice question and essay type questions which was used as the pre-test and post-test for both the control and experimental groups. The pre-test consists of 15 multiple choice questions and four easy type of questions which were based on integrated science syllabus objectives 3.4.1, 3.4.2 and 3.4.3 (Ministry of Education, 2007). The questions covered all the contents treated. Student from each group was given 45 minutes to complete the test. See Appendix C for the pre-test and the marking scheme for scoring the test. The pre-test was done to determine the initial entry points and compare difference between experimental and control group before treatment. Again, the pre-test was used to ascertain the amount of knowledge the students have on circulatory system in

humans and to determine the homogeneity or the heterogeneity of the control and experimental groups. Students have had lessons on circulatory system in humans in their first year in integrated science. Also, post- test also consists of 15 multiple choice questions and essay type of questions that have a slightly different with the questions in the pre-test, however the questions measured the same difficulties level of students. See Appendix D for the post-test and the marking scheme for scoring the test. Post-test was used to measure the students‟ achievement after the treatment

The post-test was administered after the treatment has been given. The achievement of the post-test was compared between the experimental and the control groups.

3.4.3 Questionnaire

After implementing the design (visual aids teaching), a questionnaire (science classroom learning environment inventory) was administered to measure the perception of students on their science learning environment (Appendix B). Therefore, this data was used to answer research question 3.

The Science Classroom Learning Environment Inventory (SCLEI) was developed based upon the five scales of what is happening in this classroom (WIHIC) questionnaire developed by Fraser, Mcrobbie and Fisher (1996). The scales used in developing the Science Classroom Learning Environment Inventory (SCLEI) were student cohesiveness, teacher support, involvement, co-operation and equity. The Science Classroom Learning Environment Inventory (SCLEI) had five subscales in all with each subscale having eight items bringing the total number of items on the Science Classroom Learning Environment Inventory (SCLEI) to forty.

Again, a value of 5 indicated that the classroom practice being measured takes place almost on a regular basis while a value of 1 was interpreted as Junior High School

pupils perceiving the classroom practice to hardly take place. Since the items on the WIHIC scale were developed based on a culturally different context of the respective countries in which they were used, some of the items on it were modified by the researcher to reflect the Ghanaian cultural context and make the items on it more understandable to the respondents. For instance, an original item on the WIHIC instrument was "my science teacher takes interest in me" which could be interpreted in the Ghanaian cultural context as a teacher having an amorous relationship with a pupil was modified to read "my science teacher maintains a healthy pupil-teacher relationship with me even after his/her lesson has ended". The finial modified version of the questionnaire was constructed using a four-point Likert-type response scale to indicate the degree to which pupils agreed with each statement made: (1) Never; (2) sometimes; (3) Often (4); Always. Again, the total number of items in the modified questionnaire was fifteen (15). A detailed description of the five modified WIHIC Subscales are presented in Table 3.1.

Table 3.1: Description and Sample item for each sub scale in the modified WIHIC

Subscale	Description	Sample Item
Student Cohesiveness	Extent, to which s should know, is friendly to, and supportive of each other.	I am friend to members in my science class.
Teacher Support	Extent to which teacher helps, relate to and show interest in their students	My science teacher listens to and accepts my comments on how he/she teaches
Involvement	Extent to which Students	My ideas and suggestions

Subscale	Description	Sample Item
	have attentive interest, participate in discussions and explain their solutions	are used during science classroom discussions
Co-operation	Extent to which students are prepared to help each other rather than compete with each other selfishly	In my science class there is high competition among us which leads to selfishness.
Equity	Extent to which Students view the treatment they receive from the teacher to be equitable	My science teacher treats me the same way he/she treat other Students in this class.

Because of time constraints and category of respondents involved in the study, the researcher assessed the perception of the students based on Students cohesiveness and Co-operation and teacher support.

Table 3.2: Categories (questions) of the various dimensions and the number of questions in that dimension.

Categories	Items	No. of items
Pupil cohesiveness and co-operation	1,2,3,4,11,12,13,14,15	9
Teacher support	5,6,7,8,9,10	6

The items were rated on a scale of 1 - 4 (1 = Never, 2 = Sometimes, 3 = Often, 4 = Always) to indicate how often the students experienced the situations described in the statements during their science lessons.

3.5 Piloting the instruments

Piloting determines whether questions and directions are clear to respondents/subjects and whether they understand what is required from them. Piloting is done to determine the feasibility of using a particular research instrument in a major study. It provides an opportunity to try out the instructions for completion of the instrument, especially if it is being used for the first time. Piloting entails a trial administration of a newly developed instrument in order to identify flaws and time requirements (Shilubane, 2010).

The test items and the questionnaire were vetted by the researcher‟s supervisor and piloted before the data collection began. Trial-test the instrument (tests) was done at one of the Junior High Schools in Winneba, the school was chosen because is of the same characteristics as ones sampled for the study. In this study the purpose of tail-test the test was to test its reliability and content validity, and to identify and rectify problem areas in the questions.

Validity is a measure of the extent to which research conclusions effectively represent empirical reality or whether construct devised by researchers accurately represent or measure categories of human experience" (LeCompton & Preissle, 1993, p. 323). It is a demonstration that a particular research instrument in fact measures what it purports to measure (Durrheim & Wassenaar, 1999,pp 57-71).

In order to validate the research instruments, the researcher consulted the integrated science syllabus as well as some prescribed integrated science textbooks for senior high school students. The purpose was to gain insight into what learners are expected to learn so that she (The researcher) developed her instruments accordingly.

To further ensure that the content chosen was within the prescribed domain of the study for the senior high school students concerned, test items were being given to some JHS tutors to cross check whether the test items are standard.

Reliability on the other hand refers to the extent to which a measuring instrument i.e. a questionnaire and a test yield the same results on repeated applications (Williams, 2014). It means the degree of dependability of a measuring instrument. In this study, the split-half method was used to check the reliability of the instruments, because it is a "more efficient way of testing reliability" and was less time consuming (Durrheim, & Wassenaar, 1999, p 90).

The spilt-half method requires the construction of a single test consisting of a number of items. These items are then divided or split into two parallel halves (usually, making use of the even-odd item criterion). Participants‟ scores from these halves were correlated using the Spearman-Brown formula used in reliability testing. Twenty-five (25) students from one of the Junior High Schools in Winneba were used for the piloting. Table 3.3 shows the results of the reliability test.

Table 3.3: Reliability Test of the Research Instruments (Test and Questionnaire)

Instrument	No. of Item	Spearman-Brown Value	Reliability Level
Science Classroom Environment Inventory Instrument	25	0.731	Acceptable
Test items	14	0.710	Acceptable

3.6 Description of Treatments/Interventions

The Visual Aids approach was applied to the experimental group whereas a traditional method of instruction was applied to the control group throughout this study. These approached are described in this section.

3.6.1 Experimental design: Visual Aids approach to teaching Blood Circulatory System in Humans

The Visual Aids approach refers to the teaching approach involving the use visual supports, teacher-led demonstrations and students‟ hands-on activities using computer. Lessons of the experimental group was held in the classroom using projector to explore how blood flow in the human system. This means that the treatment in the experimental group was affected by collaborative learning unlike the control group where all the lessons was taught using teacher-centred approach. Lesson plan was designed to help ensure that classroom instruction followed the curriculum aims and objectives of the topic (Circulatory System in Humans) treated. The lesson plan for this study indicated the lesson objectives, duration of the lesson, contents to be treated, teacher or learner activities, assessments and remarks are shown below.

WEEK 1

Lesson: Description and Composition of the human blood.

Objectives: Learners will be able to describe the human blood and its composition

Mode of lesson delivery: Brief video show, chart illustrations and class discussion

Table 3.4: Composition of human blood

Question / Activity	*Expected answer to questions*
- Use of a short video on blood, showing the blood circulating in the ateries and veins of the human body	- Blood circulates in the ateries and veins because of its fluid-like nature.
- Why the red colour of blood	- Blood is red because it contains a red pigment called haemoglobin.
- Examples of animals (lower / higher) that have their blood to be red	-Eg. Humans, dogs, goat, chicken, elephant
- In crabs and snails, their blood colour is blue, why?	- In crabs and snails their blood is blue in colour because it contains copper.
- The composition of human blood are;	- Blood plasma - Blood cells / corpuscles

Learners' Response: Learners participation was very encouraging since the video show and chart illustrations were interesting and explanatory.

WEEK 2

Lesson: Blood Plasma

Objectives: Learner will be able to list and describe the blood plasma and its component.

Mode of lesson delivery: Video show on the component of blood plasma

Table 3.5: Description of blood plasma

Question / Activity	*Expected Answer to Question*
- Description of blood plasma	- Blood plasma is a straw-colored liquid. - It contains mostly water and a variety of dissolved substances which are transported from one part of the body to another.
:- The dissolved substances include	• Blood protein • Dissolved food (glucose, amino acid and fat droplets) • Mineral salts in the form of ions eg. Sodium ion (Na^+), Chlorine ion (Cl^-), Potassium ion (K^+) and Calcium ion (Ca^{2+}). • Hormones like insulin, testosterone and progesterone. • Gases like oxygen and carbon dioxide • Waste substances like urea.
- The components were explained alongside the slide-show. - Class discussion was held afterwards to test pupils understanding.	

Learners' Responses: Learners responded excitedly in class discussion and came out with their own findings.

WEEK 3

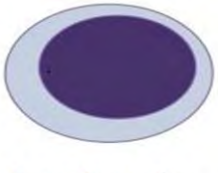
Lesson: Blood cells, shapes and functions

Objectives: Learners will be able to list the three types of blood cell, draw them in shapes and outline their functions.

Mode of lesson delivery: Short video show, illustrations on chart, classroom discussion.

Table 3.6: Shapes and functions of blood cells

Question / Activity	***Expected Answer to Question***
- A video show describing all the three types of blood cells.	• Red blood cells (Erythrocytes) • White blood cells (Leucocytes) • Platelets (Thrombocytes)
- Red blood cells	• They are round disc, concave on two sides • They are very small and numerous • They do not have a nucleus • They contain haemoglobin which gives the red colour to the blood. • Haemoglobin transports oxygen from the lungs to the cells. • Red blood cells are made in the red bone marrow.
Functions of Red blood cells	• Red blood cells transport oxygen from the lungs to the cells and carbon dioxide from the cells to the lungs.

Question / Activity	*Expected Answer to Question*
Various shapes / view of the red blood cell	
- White blood cells	• They are larger than red blood cells but are small in number. • They have nucleus but no haemoglobin • There are two main types of white blood cells: phagocytes and lymphocytes.
What do the phagocytes do?	• The phagocytes function by surrounding and ingesting any bacteria that may enter the body.
What do the lymphocytes do?	• The lymphocytes function by producing antibodies to fight diseases.
- Functions of white blood cells	• White blood cells are produced in the red bone marrow and lymph nodes.
-Shapes of phagocytes and lymphocytes	• Their function is to defend the body against disease.  lymphocyte  phagocyte (a neutrophil)

Question / Activity	*Expected Answer to Question*
- Blood Platelets	• Blood platelets are tiny or minute fragments of cells. • They do not have a nucleus • They circulate inactivated in the blood. • They are produced in the red bone marrow.
- Function of blood platelets	• Blood platelets help in blood clotting
- shape of blood platelets	 Platelet (thrombocyte)

Learners Responses: Learners, in turns, individually summarized the functions of the blood cells.

WEEK 4

Lesson: Blood clotting, importance of blood clotting and functions of blood.

Objectives: Learners will be able to explain the process of blood clotting and its importance.

Mode of lesson delivery: **-** Video show on blood clotting and functions of blood

- Summary of blood clotting and functions of blood on a flow chart.

Table 3.7: Blood clotting and its importance and functions of blood

Question / Activity	*Expected Answer to Question*
- Use of video show to explain how blood formation occurs and its importance to humans and animals.	• Whenever there is a cut on the skin, blood oozes out. • The platelets on exposure to the air become activated and form a clump, adhering to each other at the sites of the cut. • They secret chemicals that convert a blood protein, fibrinogen to fibrin. • The fibrin forms a mesh of fibres at the cut or damaged site. • A clot then forms when platelets, together with red and white blood cells become trapped in the fibres. • Blood clotting begins within seconds of injury. •
- Importance of blood clotting to humans	• It prevents excessive bleeding • It prevents the entry of micro-organisms into the body.
- Functions of blood	• Blood performs a lot of functions which are concerned with ***a) Transport*** Eg. Blood transport hormones from the glands which secrete them into their site of action.

Question / Activity	*Expected Answer to Question*
	b) Protection Eg. Blood helps the body defend itself against diseases. For example white blood cells feed on and destroy any bacteria that may enter the body. ***c) Regulation*** Eg. Bood helps to maintain the level of water in the body.

Learners Responses: Learners actively participated in classroom discussion and gave a lot of instances where blood clotting has saved lives.

3.6.2 Control Design: Traditional Approach

This term is used in this study to refer to teaching using chalk and board for teachers; pen and paper for students. Also, teachers use other methods such as demonstration using examples, lecture methods, question-answer methods, among others. Thus, the researcher gave the input orally or wrote on the board and the learners strictly followed the instruction the teacher gave, and active participation of the students were not encouraged. The students were not given any hands-on activities to help them explore the concept of circulatory system. In other words, instruction was not in line with the constructivism approach but mainly in lecture format and, therefore, instruction was teacher-centred. Exploring various circulatory system in humans through this method of teaching can be very stressful and time consuming. A lot of time is wasted on unwarranted accuracy. These routine activities do not need a large amount of concentration. Despite the drawbacks of the traditional approach, it is cheap and does not require much rigorous advanced lesson preparation on the part of both the teacher and the learner. It can also be conducted anywhere. It is good for both

audio learners and reflective learners because such learners do better through listening. The descriptions of the lesson using the traditional teaching method are described below;

WEEK 1

Lesson: Description and Composition of the human blood.

Objectives: Learner will be able to describe blood and its composition.

Mode of lesson delivery: Lecturing and board summary

Approach to lesson

Impart knowledge to pupils using lecture method to explain to them how blood circulates in the arteries and veins, why blood is red and give examples of organisms that have their blood to be red.

Teacher summarizes on board the composition of the human blood.

Learners' Response: Since lesson was teacher-centered, learner participation was low but copied board summary into their books.

WEEK 2

Lesson: Blood Plasma

Objectives: Learner will be able to list and describe the blood plasma and its component

Mode of lesson delivery: Lecturing with board summary

Approach to lesson

Lecture to pupils on the component of blood plasma.

Teacher summarizes notes on the components of blood plasma on board for pupils to copy.

Learners' Response: Since lesson was teacher-centered, learner participation was low but copied board summary into their books.

WEEK 3

Lesson: Blood cells, Shapes and Functions.

Objectives: Learner will be able to list, draw and state functions of blood cells.

Mode of lesson delivery: Teacher-centeredness and board summary

Approach to lesson

Teacher copy notes on blood cells, their shapes and functions of the blood cells on board for pupils to copy into their books.

Teacher explains the notes to the pupils using a lecture method

Learners' Response: Objectives for lesson was partially achieved since pupil"s explanations to oral questions were not satisfactory.

WEEK 4

Lesson: Blood clotting, Importance of blood clotting

Objectives: Learners will be able to explain the process of blood clotting and its importance to human

Mode of lesson delivery: Lecturing and board summary

Approach to lesson

Lecture pupils on how blood clots in the lesson.

It is important to humans and animals

Learners' Response: Pupil"s participation in lesson was low

However, the main differences between the two approaches of teaching and learning of Circulatory system are shown in the Table 3.1.

Table 3.8 Differences in the two approaches of teaching blood circulatory systems

Visual Aids Approach	Traditional Approach
i. The lessons were taught using computer and projector	i. The lessons were held at normal traditional classroom
ii. Students create their own version of knowledge by active participation in learning activities	ii. Students learn mainly from teachers‟ explanations
iii. Teachers focus more on conceptual understanding	iii. Teachers focus more on procedural understanding
iv. Teachers engage learners in situations that might bring about contradictions and then encourage discussions	iv. Learning activities provided are focused on memorization of skills and procedures by doing repetitive practice

3.7 Data Collection Procedure

Letters of introduction from the Department of Science Education of the Faculty of Science Education were sent to the headmasters of schools where the research took place. I met the headmasters of the respective schools and explained the rationale of the study to them. I was then introduced to the teachers of JHS 2 integrated science by the assistant heads of the schools. This was followed by interaction with the JHS 2 integrated science teachers to know from them the in their respective class. It was revealed that the method mostly adopted by these teachers for teaching was the

traditional method of teaching where the lesson is introduced followed by expository explanation. Students also had to write copious notes given by the teacher. After going through the note books of the students, it was realized that they all had the same notes indicating they had their notes from their teachers. I took time to observe the teachers teach, but this was done with their consent; this helped to know how to exactly teach the control group. I also took time to familiarize with the students as well. The rapport which was created between the teachers and the students created a congenial atmosphere throughout the period of data collection. During the familiarization, the experimental group was introduced to circulatory system through the use visual aids in the form of video. This topic was chosen because it was treated in the second year of JHS 2 and this served as revision for them. The Researcher gave students various exercises to make them understand the lesson well. The control group was also taught the same topic.

At the end of the familiarization, a pre-test on the Biology Achievement Test (BAT) was administered to both the control and experimental groups. The test comprised items on the topics blood circulatory system in humans.

The pre-test was to ascertain the homogeneity of the experiment and control groups, and also to know the level knowledge each group has on blood circulatory system in humans before the intervention is given.

Time allocation for the pretest was 45 minutes. Students were encouraged to do independent work. The class teachers helped in the sitting arrangement and the supervision of students. Another rater who is also a integrated science teacher and I marked the pretest. After the pretest, the treatment followed. Students in both the control and the experimental groups were taught within two weeks. I, being a qualified Biology teacher taught both groups. Researcher bias, which is often

associated with this type of design, was thought to be a risk worth taking. The treatment covered four days for each group during which each class met for 80 minutes for each day. The experimental group had science on Monday 10:30 – 11:50 and on Wednesday 11:50 – 1:10 while the control group had science on Tuesday 7:40 – 9: 00 and on Thursday 1:10 – 2:30. The flexibility of the time Table made it possible for commuting between both schools by the researcher easier. I went to the experimental school first followed by the control group the following day. I alternated between both schools based on the Time Table. Hence I visited each school two times in a week for four weeks. The first week was for familiarization, the other two weeks was for teaching the topics and the last week was for administration of the achievement post-tests, and questionnaire. Both the control and the experimental group were taught the same content, had the same instructional objectives, same lesson duration and class assignment. Both groups were taught on the units of circulatory system in humans. Topic under circulatory system in humans treated was blood circulatory system in humans.

However, students in the control group were taught using the traditional method. The traditional method involves teaching topics in a regular science class where teaching and learning activities are mainly teacher-centred. The researcher prepared his notes and did most of the talking during the teaching process. Students occasionally asked questions and the researcher answered their question. The researcher explained concepts to students followed by writing main ideas on the board for students to copy. Each lesson ended with summary. After each lesson was taught, students were given assignments.

After the interventions to both the experimental and the control group were given the same Biology Achievement Test (BAT) administered in the pre-test, as the following

week. After the post-test, the experimental group was given the questionnaires to respond to reflecting their science classroom learning environment.

3.8 Data Analysis Procedure

Descriptive statistics such as means, standard deviations, percentages, tables and Box plot were used to describe the general performance of students in both groups in the pre-test and post-test with the help of Statistical Package for Social Sciences (SPSS) version 21. Box plot was used to give pictorial representation of the performance of the students in the achievement tests.

Independent samples t-test was used to compare the means of Biology achievement scores between the control and experimental groups in the pre-test scores and between the gender in the control and experimental group as well as between the gender in the control group before the intervention to know their entry level of the Biology achievements. Again, the paired-sample t-test was used to test the last two hypotheses. The paired samples t-test was used to find whether the performance of students within each group improved or not while the effect size (eta statistic square) was used to determine the magnitude of improvement in each group.

The purpose was to determine whether there were statistically significant different between each students scores in the pre-test and post-test

In addition, an eta statistic squared was used to determine the magnitude of the difference (effect size) between means of the scores. This is because the difference might occur by chance. According to Pallant (2001), the criterion for interpreting eta squared values are 0.0 = small effect, 0.06 = moderate effect and 0.14 = large effect.

Test of the Assumptions of the t-tests

The *t*-tests are parametric tests and therefore there are some assumptions that need to be met before they are used to analysis any quantitative data. The data that were collected in this study warranted the use of paired samples *t*-test, and independent sample *t*-test. The reason being that the scores from the achievement test were treated as having interval scale and continuous. Again, the distributions of the data were approximately normal (see Appendix E). The normality of the data will be checked using Q-Q plot as part of the descriptive statistics.

Another assumption that need to be met before the independent t-tests were used, was homogeneity of variance, will also be checked.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.0 Introduction

This chapter presents statistical analyses of the data with a focus on the research questions and hypotheses introduced in Chapter One. The chapter discusses the results of the study and interprets the findings in reference to the literature reviewed in chapter two.

4.1 Demographic Characteristics of Participants

Table 4.1 presents demographic characteristics of the participants in the study

Table 4.1: Gender of the participants

Gender	Control Group		Experimental Group		Total	
	N	%	N	%	N	%
Boys	24	29.6	19	23.5	43	53.1
Girls	18	22.3	20	24.7	38	46.9
Total	42	51.9	39	48.1	81	100.0

Source: Field work, 2017

Results from Table 4.1 reveal the demographic characteristics of the participants in the study. The Table shows that out of 43 participants, 53.1% of the students were boys while 46.9% of them were girls. This implies that majority of the respondents selected for the study were boys.

4.2 Research Question One

What is the effect of the use visual aids on the performance of students in circulatory systems in humans?

H_{0c}: There is no significant difference between the performance of students taught with visual aids method and those taught with traditional method in in circulatory systems in human.

4.2.1 Analysis of Performance of the Students Taught with Visual Aid Teaching Approach

Research Question 1 was tested at significance level of 5% using paired sample *t* test generated from SPSS. The analysis of the effect of the Visual aids teaching approach on students‟ performance is presented in Table 4.2 and Table 4.3.

Table 4.2: Descriptive statistics of students Taught with Visual Aids Teaching Approach (N = 39)

	Minimum	Maximum	Mean	Std. Deviation
Pre-test	12	29	19.18	4.22
Post-test	20	42	31.79	6.04

Source: Fieldwork, 2017

Table 4.2 relates the pre-test and post-test results of the students within the experimental group. In the experimental group the results showed an improvement in students understanding of circulatory systems in human in the post-test. The minimum score students obtained in the pre-test was 12, while the maximum score was 29 out 45. However, in the post-test, the minimum score was 20, while the maximum score

was 42. The mean score of students in the pre-test was 19.18, while that of the post-test was 31.79, an increase of 12.61. This is an indication that in the post-test, every students‟ performance had increased in the experimental group. These improvements might be due to the use of the Visual aids approach of teaching circulatory systems in human.

Table 4.3: Comparison of Pre-test Scores and Post-Test Scores by the Experimental Group

	Mean	Std. Deviation	Std. Error Mean	*t*	*df*	Sig.	Eta square
Pre-test – Post-test	12.62	6.97	1.12	11.30	38	.0001	0.77

t-value significant at $p < .05$

A paired samples t-test was conducted to compare the pre-test and post test scores for the students taught with visual aids teaching approach (experimental group). The paired sample t-test was examined to find out if the mean score difference (M = 12.62, SD = 6.97) between the posttest and pre-test of the experimental group was statistically significant. This was done to evaluate the effect of visual aids on students‟ achievement in circulatory systems in human. The results from Table 4.3 indicated a statistically significant increase in the students‟ achievement from the pre-test (M = 9.40, SD = 6.42) to the post-test (M = 28.36, SD = 6.304), t (38) = 11.30, p < 0.0001. The eta squared statistics (0.77) indicated large effect size. This means that 77% of the variance in the scores of the achievement tests thus pre-test and post-test of the experimental group was explained by the use of the new teaching method (Visual aids) for teaching circulatory systems in human. Also, the results implied that after the students had gone through the intervention, they improved massively in their understanding and achievement of the concept on circulatory systems in human. Thus,

Visual aids as an instructional tool had a positive impact on the students‟ achievement in circulatory systems in human. This shows that there was a significant improvement in the scores of the experimental group before and after the treatment.

4.2.2 Analysis of Performance of the Students Taught with Traditional Teaching Approach

Hypothesis 2 was tested at significance level 5% using paired sample *t* test generated from SPSS. The hypothesis states that "the traditional method as instructional tool has no effect on the performance of students in in circulatory systems in human".

The analysis of the effect of the traditional teaching approach on students‟ performance is presented in Table 4.4

Table 4.4: Descriptive statistics of students Taught with Traditional Teaching approach (Control Group)

	N	Minimum	Maximum	Mean	Std. Deviation
Pre-test	42	13	29	18.71	4.15
Post-test	42	17	40	26.29	5.11

Source: Field work, 2017.

Table 4.4 compares the pre-test and post-test results of the students within the control group. The minimum score students obtained in the pre-test was 13, while the maximum score was 29 out of 45. However, in the post-test, the minimum score was 17, while the maximum score was 40. The mean score of students in the pre-test was 18.71, while that of the post-test was 26.29, an increase of 7.58. This is an indication that in the post-test, every student‟s performance slightly increased in the control group.

Table 4.5: Paired Samples Test of the Students Taught with Traditional teaching approach

	Mean	Std. Deviation	Std. Error Mean	*t*	*df*	Sig.	Eta square
Pre-test – Post-test	7.57	5.86	0.90	8.38	41	.0001	0.63

Source: Field work, 2017.

A paired samples t-test was examined to compare the pre-test and post test scores for the students taught with traditional teaching approach (control group). The result as presented in Table 4.5 reveals that the mean score difference between the posttest and pre-test of the control group was 7.57 with corresponding standard deviation of 5.86. The paired sample t-test was examined to find out if the mean score difference between the posttest and pre-test of the control group was statistically significant. This was done to assess the effect of traditional method on students‟ achievement in circulatory systems in human. The results from Table 4.5 indicated that there was statistically significant increase in the students‟ achievement from the pre-test (M = 18.71, SD = 4.15) to the post-test (M = 26.29, SD = 5.11), t (41) = 8.38, p = 0.0001 < 0.05. In addition, the eta square statistics (0.63) discovered that traditional teaching approach also has a large effect on students‟ performance in circulatory systems in human. This indicated that there was a significant improvement in the scores of the control group before and after the treatment. From this result, it can be seen that students also gained from traditional teaching approach of learning circulatory systems in human. This outcome is an indication that a well-structured traditional approach of teaching can also improve students‟ performance in learning circulatory systems in human.

4.2.3 Comparing the Performance of the Students Taught with Visual Aids Approach and Those Taught with Traditional Approach

Hypothesis 1 was tested using independent sample t-test at significance level of 5%. The hypothesis states that "there is no significant difference between the performance of students taught with Visual aids approach and those taught with traditional approach".

Table 4.6 shows the result of the test of differences between the two groups using independent sample t-test.

Table 4.6: Independent Sample t-test of Control and Experimental Groups for the Pre-test Scores

	N	Mean	Std. Deviation	*df*	t-value	p-value
Control	42	19.18	4.22	79	.50	.62
Experimental	39	18.71	4.15			

Source: Field work, 2017.

The results of this test (Table 4.6) revealed that there was no statistically significant difference in mean scores between the control group (M = 19.18, SD = 4.22) and experimental group (M = 18.71, SD = 4.15) conditions; t (79) = .50, p = .62 > 0.05, demonstrating that the difference in the mean score of the two groups was not statistically significant. These results suggest that both the control group and the experimental group were almost at the same level of conceptual understanding before the start of the treatment.

Table 4.7 shows the independent sample t-test that was conducted to compare the mean scores of the experimental and control groups in the post-test.

Table 4.7: Independent Sample t-test of Control and Experimental Groups for the Post-test Scores

	N	Mean	Std. Deviation	*df*	t-value	p-value	Eta Square
Control	42	26.29	5.12	79	4.44	.0001	0.20
Experimental	39	31.79	6.04				

Source: Field work, 2017.

The results showed that in the post-test, there was statistically significant difference between the mean scores for experimental group (M = 31.79, SD = 6.04) and control group (M = 26.29, SD = 5.12); t (79) = 4.44, p = 0.0001 < 0.05. The results showed that the experimental group achieved better in the post-test than the control group. This was not due to chance since there was a significant difference between the scores of the experimental and control groups. The magnitude of the difference in the means was moderate (eta squared = 0.20). From the analysis we reject the null hypothesis that "there is no significant difference in the mean achievement of learners taught circulatory systems in human using visual aids materials and learners taught circulatory systems in human using traditional lecture approach. It was then concluded that the use of visual aids achievement, significantly, notwithstanding the magnitude of the difference was moderate. From the study, it was observed that learners were excited working with the materials, sharing ideas with their peers in the group and interacting freely with each other.

4.3 Discussion of Results of the Research Question One

The Hypothesis 1 was to find out whether there was statistically significant difference between achievements mean scores of students taught circulatory systems in human using visual aids as an instructional tool and those taught using traditional method of teaching. The outcome from the study portrayed that there was statistically significant difference in the achievement mean scores between the experimental group and that of the control group. This finding implied that the experimental group performed better than the control group in the circulatory systems in human achievement test. This means that when students are taught using visual aids as an instructional tool in circulatory system in humans, their performance would improve drastically more than students taught using traditional method in most of Ghanaian classrooms.

These findings from Hypothesis One is in line with the findings of Gillani (2005) who summarized that when instructional technology was applied as supplementary approach in teaching of Integrated Science; the students of the experimental group were more attentive because the used of instructional technology stimulated interest and enhanced the motivational level of students. Use of instructional technology in Integrated Science proves equally effective and beneficial for both low and high achievers. When the teacher teaches Integrated Science through concrete examples and instructional technology to experimental group; retention of the students is much better than that of the control group.

Also, this result is in agreement with Ameyaw and Agbotse (2016) who conducted Computer-Assisted Instruction (CAI) as an alternative instructional tool for improving the teaching and learning of blood circulation in humans. They found out from their study a statistically significant increase in the achievements or performance of the students that received the computer based lesson. In addition, the research revealed

that the use of ICT in the teaching and learning increased the academic successes of the students, and also changed the concept from abstract to concrete making it easier for the students to understand. In a nutshell, the findings from the study show that students taught with Visual aids method performed better than those taught with traditional method. Also, the students taught with Visual aids were able to answer questions on circulatory systems in human that require application. Finally, having observed the great prospects that Visual aids has as a teaching and learning resources in this study, it would be appropriate to use it more often in teaching and learning of science in Ghanaian classrooms as this could be the solution to the poor performance in science at Basic Education Certificate Examination.

4.4 Research Question Two

Is there any difference in the performance of female and male students taught with the use of visual aids in Circulatory systems in humans?

In answering the second research question, a comparison of the prettest and posttest scores between males and females in the experimental group was tested and presented in Table 4.5.

4.4.1 Gender Performance of Students on Circulatory systems in human

The data in Table 4.5 shows the independent sample t-test of the pre-test scores of males and females in the experimental groups.

Table 4.8: Comparison of Pre-test Scores between Males and Females in the Experimental Group

Gender	N	Mean	Std. Dev.	*Df*	t-value	*p*-value
Male	19	18.58	3.89			
				37	.86	.39
Female	20	19.75	4.53			

Source: Fieldwork, 2017

Table 4.8 shows the results of the independent-samples t-test conducted to compare the mean scores of the males and females in the experimental groups on the pre-test. The finding from Table 4.8 indicates that there was no statistically significant difference between the mean scores of males (M = 18.58, SD = 3.89) and females in experimental group (M = 19.75, SD = 4.53); t (37) = 0.86, p = .39. Though the result in Table 4.5 showed that females achieved better in the pre-test than the corresponding male counterparts, the result indicated that the difference in means was due to chance since there was no evidence to suggest that significant differences existed between males and females in the experimental group. These results suggest that both the male and female students‟ performance on the pre-test in experimental group were almost same before the treatment was administered.

The data in Table 4.8 shows the independent sample t-test of the pre-test scores of males and females in the control groups.

Table 4.9: Comparison of Pre-test Scores between Males and Females in the Control Group

Gender	N	Mean	Std. Dev.	*df*	t-value	*p*-value
Male	24	18.63	4.60			
				40	.159	.87
Female	18	18.83	3.59			

Source: Fieldwork, 2017

The results in Table 4.9 was an independent-samples t-test that was examined to compare the mean scores of the males and females in the control group on the pre-test. The result showed that in the pre-test, there was no statistically significant difference between the mean scores of males (M = 18.63, SD = 4.60) and females in experimental group (M = 18.83, SD = 3.59); t (40) = .159, p = .87. However, the result in Table 4.6 showed that females attained better understanding of circulatory systems in human in the pre-test than the corresponding male counterparts, the result indicated that the difference in means was due to chance since there was no confirmation to propose that significant differences existed between males and females in the control group. It was therefore concluded that the closeness of these means seems to suggest that both the male and female students‟ performance on the pre-test in control were to extent similar in abilities before the treatment was administered.

4.4.2 The effect of teaching methods on mean achievement of male and female students

Regarding gender differences in Integrated Science achievement test in the experimental group, the research the research question 2 which sought to find out the difference in the mean achievement of male and female JHS students who were taught circulatory systems in human using Visual aids was turned into a null hypothesis.

"There is no significant difference in the mean achievement of male and female students who are taught circulatory systems in human using Visual aids" was tested as shown in Table 4.10.

Table 4.10 shows the results of the means, standard deviations and the independent sample t-test of the post-test scores of males and females in the experimental group.

Table 4.10: Comparison of Post-test Scores between Males and Females in the Experimental Group

Gender	N	Mean	Std. Dev.	*df*	t-value	*p*-value
Male	19	29.05	5.78			
				37	3.05	0.004
Female	20	34.40	5.15			

Source: Fieldwork, 2017

The data in Table 4.10 was an independent-samples t-test examined to find out the difference in the mean scores of the males and females in the experimental groups on the post-test. The result indicated that there was statistically significant difference between the mean scores of males (M = 29.05, SD = 5.78) and females in experimental group (M = 34.40, SD = 5.15); t (37) = 3.05, p = 0.004. This implies that

females achieved better in the post-test than the corresponding male counterparts, because the result indicated that the difference in means was not due to chance since there was enough evidence to conclude that significant differences existed between males and females in the experimental group.

Table 4.11 reveals the results of the means, standard deviations and the independent sample t-test of the post-test scores of males and females in the control group.

Table 4.11: Comparison of Post-test Scores between Males and Females in the Control Group

Gender	N	Mean	Std. Dev.	*Df*	*t*-value	*p*-value
Male	24	26.38	5.89			
				40	.129	.898
Female	18	26.17	4.02			

Source: Fieldwork, 2017

Table 4.11 presents the results of the independent-samples t-test performed on the post-test scores to compare the mean scores of males and females in the control group. As can be seen in Table 4.11, comparison of the mean scores suggest that the males achieved slightly better (M = 26.38) than their counterparts‟ females in the control (M = 26.17). To test whether the difference in mean scores between the females and males in the control groups was statistically significant, independent-samples t-test was performed. The results of this test (Table 4.11) revealed that there was no statistically significant difference in mean scores between the male (M = 26.38, SD = 5.89) and female (M = 26.17, SD = 4.02); t (40) = .129, p = .898 > 0.05.

This is an indication that instruction without the use of visual aids had no effect on gender.

4.5 Discussion of Results on research question 2

The research question 2 explored whether there is a difference in performance of female and male students taught circulatory systems in human using visual aids. The findings show that there was statistically significant difference in the Integrated Science achievement mean scores between the male and the female students in the experimental and control group. This indicated that teaching method (visual aids approach) had effect on the achievement of students based on gender in the experimental group. This implies that female‟ students benefited from the use of visual aids instruction than the male students though males and females in each group were taught by the same method. Thus experimental group were taught with visual aids. The finding did not support Onasanya and Omosewo (2010) who found out that improvised instructional materials in the comparison of the male mean scores of experimental and control groups were the same with regard to academic ability. In addition to this, the studies by Ogunleye (2002) show that science achievement depends on gender. Nevertheless, Nwosu (2001) found that students‟ acquisition of science process skills is not gender specific. Also, the studies by Ogunleye and Babajide (2011); Agommuoh and Nzewi, (2003) lend credence to non-significant gender effect in science achievement. In addition, influence of gender on students‟ conceptual change has been equally investigated. However, Madu (2004), and Agomuoh (2010) found that gender influences students‟ conceptual shift in favour of the male.

In summary, it was established that female students performed better on the achievement test than their male counterpart using visual aids.

Research Question Three

What are students‟ perceptions of motivation about their Integrated Science classroom learning environment under the visual aids and traditional teaching approach?

In addition to the test scores, students in both groups answered a questionnaire after the treatment to help measure their perception of how motivating they find the science teaching environment under the visual aids and traditional teaching approaches. The analysis of the responses of students in the questionnaire formed the basis for answering research question 3, that is, "What are students‟ perceptions of motivation about their integrated science classroom learning environment under the visual aids and traditional teaching approach?"

Tables 4.12 shows the distribution of the students‟ ratings (i.e. mean and standard deviation) of their perception of how motivating (i.e. in terms of cohesiveness and co-operation) they find science classroom learning environment

Table 4. 12: Students' ratings of their perception of their motivation through cohesiveness and cooperation during lessons.

Items	Cohesiveness and Cooperation	Mean	Std. Deviation
1	I was not afraid to respond to questions asked by my teacher during circulatory systems in human lessons.	3.0	.68
2	I enjoyed being in this circulatory systems in human class	2.7	.47

Items	Cohesiveness and Cooperation	Mean	Std. Deviation
3	I was able to study well with other colleague during the circulatory systems in human lesson.	2.7	.46
4	I helped other colleagues in this class who were having difficulty with their studies.	3.3	.46
5	My science class teacher gives as much attention to my question as he/she gives to other students.	3.4	.52
6	I got the same amount of help from my science class teacher as the other students during the circulatory systems in human lesson.	3.9	.24
7	My science class teacher treated me the same way as he/she treats other students in class.	3.5	.50
8	I receive the same encouragement as the other science students in this class.	3.3	.75
9	I get the same opportunity to answer questions during the lesson as the other students in the class.	3.7	.47
	Mean of means	**3.3**	**.26**

Source: Fieldwork, 2017

With regard to item 1, that was to find out from the respondents whether they were not afraid to respond to questions asked by my teacher during circulatory systems in human lessons. The finding reveal that respondents confirmed to the statement in affirmative (M = 3.0, SD = .68). This implies that quite a large number of the respondents established the fact that they freely asked questions during lesson period without being afraid. Concerning item 3 which sought to find out from respondents whether they were able to study well with other colleague during the circulatory systems in human lesson, the finding from the study reveals that respondents agreed with the statement that they often study well with their colleagues (M = 2.7, SD = .46). Also, with respect to item 6 which required to solicit respondents‟ views as to

whether they got the same amount of help from their science class teacher as the other students during the circulatory systems in human lesson, the outcome from the study indicates that respondents agreed with the statement that they always get help from their teachers as well as colleague mates (M = 3.9, SD = .24).

The overall mean suggest that students have a positive perception about their science classroom learning environment with a mean of 3.3 and a standard deviation of .26.

Also, Table 4.12 presents the results of students‟ ratings of their perception of their motivation through teacher support during lessons.

Table 4.13: Students' ratings of their perception of their motivation through teacher support during lessons.

Item	Teacher Support	Mean	Std. Deviation
1	My science class teacher maintained a friendly student-teacher relationship with me even after his lesson has ended	3.86	.35
2	My science teacher was willing to explain things again when asked to do so by any student during the circulatory systems in human lessons.	3.52	.50
3	My science teacher helped me when I was in difficulty.	3.31	.47
4	My science teacher took personal interest in my studies in the circulatory systems in human lesson.	2.83	.69
5	My science teacher listened to and accepted my comments on how he teaches.	3.44	.50
6	My science class teacher talks happily about science as a subject, which encourages me and other students to study science.	3.83	.38
	Mean of means	**3.47**	**.33**

Source: Fieldwork, 2017.

With regards to teachers‟ support in science classroom learning environment as shown in Table 4.13, respondents indicated that their science class teacher maintained a friendly student-teacher relationship with me even after his lesson has ended (M = 3.86, SD = .35). Also, respondents affirmed to the fact that their science teacher helped them when they are in difficulty (M = 2.83, SD = .69) and listened to and accepted their comments on how he teaches (M = 3.44, SD = .50). These findings reveal that respondents had favourable science classroom learning environment with respect to teacher support.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Overview

This chapter consists of summary of the study, key findings, conclusion and recommendations based on the findings.

5.2 Summary

The purpose of the study was to determine the effect of using visual aids as an instructional tool in the teaching of circulatory systems in humans on the performance of Junior High School students. Additionally, the study sought to investigate the effect of teaching strategies (Visual Aids and Traditional method) on the performance of students based on gender.

The research design used in this study was quasi experimental design, especially non-equivalent quasi experimental design. The target population was all JHS Form 2 students in the two schools involved in the study. The experimental group was chosen from one school while the control group was also chosen from the other school. Purposive sampling technique was used to select the two schools for the study. The sample size comprised 81 students with 39 of them in the experimental group and the remaining 42 students in the control group. The data collection was done by the researcher.

The instruments employed in the study were Teacher Made Achievement Tests for both Pre-test and Post-test as well as questionnaire. The test items were based on the Junior High School Science Syllabus and Topics. The scores from the achievement tests were analysed through the use of Statistical Package for Social Science (SPSS) software version 21. Descriptive statistics such as percentages, frequencies, tables, mean scores, and standard deviations were used to describe the

general performance of students. The Independent sample *t*-test was used to compare the mean scores of science achievement scores between the control and the experimental groups before the treatment. Independent sample *t*-test was also used to determine whether there was any significant difference between male and female students‟ performance based on the teaching strategies used. Also, paired-sample *t*-test and independent sample t-test were used to test the hypotheses. The key findings of the study are summarized below.

5.2 Findings

The findings from the study indicated that there was a significant improvement in the science achievement mean scores of students in the control group (traditional method) from the pre-test to the post-test. Also, the results portrayed that there was a statistically significant increase in the science achievement mean scores of the experimental group taught using visual aids.

Although, the findings from the study indicated that there were statistically tremendous improvements in the science achievement mean scores for both the control and the experimental groups, the improvement in the performance of students taught using visual aids software was more than that of the students taught using the traditional method of teaching and learning circulatory system.

The outcome of Research Question 2 indicated that there was no statistically significant difference in the science performance mean scores between the male and female students when taught using the traditional approach of teaching and learning circulatory system in humans since $p > 0.05$ significant level. This implied that the traditional method had no effect on the performance of male and female students in Circulatory system. Also, to examine further whether there was any statistically significant difference between the achievement of male and female students taught

Circulatory system in human using visual aids as an instructional tool, the results indicated that there was statistically significant difference since $p < 0.05$ in the Science achievement mean scores between the male and female students when taught with Visual aids as an instructional tool. Thus, the finding revealed that female students performed better than male students in the post-test.

Finally, with regards to student‟s perceptions about the motivation of the science classroom learning, the study shows that students have a positive perception about their science classroom learning environment. For example, student‟s confirmed that science class teacher maintained a friendly student-teacher relationship, science teacher helped them when they are in difficulty and listened to and accepted their comments on how he teaches.

5.3 Conclusion

The study indicates from the findings that Junior High School students performed better when taught science, specifically circulatory system in human, using visual aids as an instructional tool than when they are taught using the traditional method of teaching and learning.

The study also reveals from the findings that if visual aids as an instructional tool is used in teaching and learning circulatory system in human, there would be possibility that the gap between male and female students would be close.

The findings reveal that if students are taught using visual aids as an instructional tool, their performance would improve far more than students taught using the traditional method of teaching, as visual aids make lesson more practical and also enhances students‟ visualization instead of memorization of concepts.

The study, therefore, concludes that visual aids is one of the solutions to the abysmal performance in questions involving circulatory system in human. Thus, if

Visual aids is introduced in the teaching and learning of science concepts in Junior High Schools in Ghana, there is expected to be an improvement in science performance.

5.4 Recommendations

From the summary of the main findings of the study, some recommendations are made for teachers, policy makers, school authorities and future researchers.

1. Appropriate use of visual aids is a skill; therefore, teachers may be trained on how to use visual aids in the teaching of an Integrated Science at the JHS level. Teachers may be encouraged to use visual aids in order to enhance the interest and motivation of the students and keep them attentive in the class.
2. Curriculum planners and policy makers may realize the importance and effectiveness of audio-visual aids and can make it a part of the teacher education programmes so that teachers are trained in proper use of visual aids.
3. There is need for the Ministry of Education to mount periodic training sessions for teachers who are already in the field to be retrained on recent discovery regarding the use of teaching/learning resources in teaching lessons in Junior High Schools.

5.5 Suggestions for Further Studies

Following what this study focused on, a few areas are suggested for further studies. The research concentrated on investigating the effectiveness of visual aids in teaching only circulatory system in human. A study can be undertaken on using visual aids to investigate other areas of science such as mosquito cycle, carbon cycle and respiration. This will provide adequate literature on the usefulness of using the visual aids to inspire teachers more to use it in the classroom.

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APPENDIX A:

Teacher Achievement Test

Class Test **Form 2** **Pre-test**

Objective Question

1. The liquid component of blood is called
   A. Platelet
   B. Leukocyte
   C. Erythrocyte
   D. Plasma
2. Which of the following blood cells is/are produced in the red bone marrow?
   I. Platelets II. Red blood cells III. White blood cells
   A. I and II only
   B. II and III only
   C. I, II and III only
   D. I and III only
3. The pigment that gives the red color to blood is called
   A. Haemocyanin
   B. Haemoglobin
   C. Copper
   D. Iron
4. Which of the following statements, about red blood cells is true?
   A. The have nuclei but no haemoglobin in their cytoplasm.
   B. They produce antibodies to fight infection.
   C. They transport oxygen as oxyhaemoglobin from lungs to all parts of the body.
   D. They transport soluble and products of digestion?
5. Which of the following blood cells fight infection?
   A. Red blood cells
   B. White blood cells
   C. Platelets
   D. Plasma

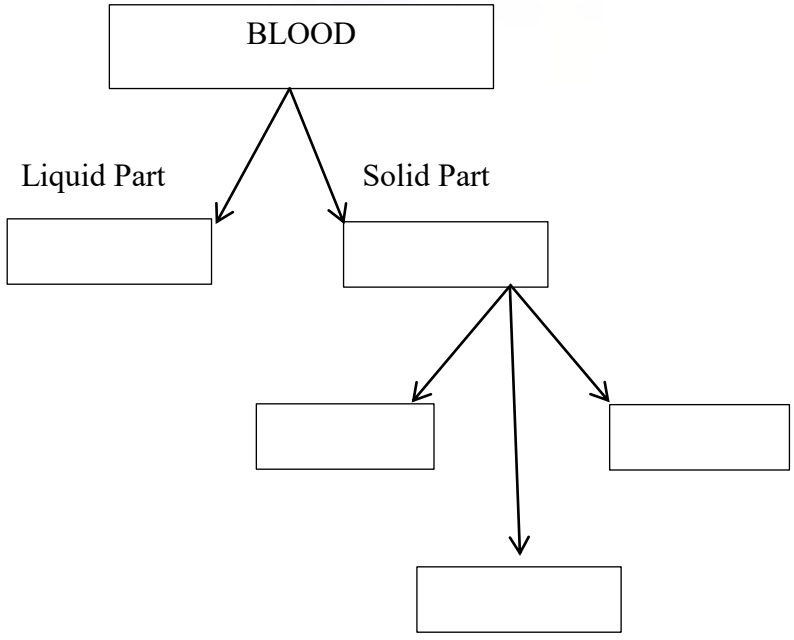
6. Which of the following diseases affects the circulatory system?
   A. Haemorrhoids
   B. Shingles
   C. Kwashiorkor
   D. Measles
7. The unit for measuring blood pressure is
   A. Mm/hg
   B. Hg/mm
   C. Mmhg
   D. Cm hg
8. Cancer of the blood also called
   A. Hypotension
   B. Hypertension
   C. Leukaemia
   D. Tuberculosis
9. Which of the following is believed to be a factor that causes haemorrhoids?
   A. Constipation
   B. Persistent cough
   C. Regular discharge of faces
   D. Frequent urination
10. All the following are systems of high blood pressure except.
   A. Dizziness
   B. Heart attack
   C. Headache
   D. Constipation
11. The main function of platelets is to
   A. Carry Carbon (iv) oxide
   B. Fight against diseases
   C. Help in clotting of blood
   D. Help maintain constant body temperature
12. Blood cells are produced in the
   A. Spleen
   B. Liver
   C. Heart

D. Bone marrow

13. Which of the following blood cells produces antibodies
    A. Lymopoeytes
    B. Red blood cells
    C. Platelates
    D. Phagocytes
14. The main function of phagocytes is to
    A. Consume intruder germs
    B. Produce antibodies
    C. Help in blood clotting
    D. Carry carbon (iv) oxide.
15. About 55% of blood is made up of plasma while the remaining 45% is made up of
    A. Cells
    B. Dissolved food substances
    C. Dissolved gases
    D. Liquid

SECTION B

1. The cluster map below shows the composition of blood. Complete the cluster map by filling in the blank spaces;



2. What is plasma?
3. Explain two examples of blood circulatory diseases.
4. What is the importance of blood clotting at injured of the skin.

APPENDIX B

Science Classroom Environment Inventory Instrument

In the table are statements about situations you experience in science you learn in school.

On a scale of 1 - 3 (1 = Never, 2 = Sometimes, 3 = Often), CIRCLE a number that indicates how often you experience the situations described in the table in science lessons.

S/N	**Statements about the science you learn in school**	**Never**	**Sometimes**	**Often**	**Always**
1.	I was not afraid to respond to questions asked by my teacher during circulatory systems in human lessons.				
2.	I enjoyed being in this circulatory systems in human class				
3.	I was able to study well with other colleague during the circulatory systems in human lesson.				
4.	I helped other colleagues in this class who were having difficulty with their studies.				
5.	My science class teacher gives as much attention to my question as he/she gives to other students.				
6.	I got the same amount of help from my science class teacher as the other students during the circulatory systems in human lesson.				
7.	My science class teacher treated me the same way as he/she treats other				

	students in class.				
8.	I receive the same encouragement as the other science students in this class.				
9.	I get the same opportunity to answer questions during the lesson as the other students in the class.				
10.	My science class teacher maintained a friendly student-teacher relationship with me even after his lesson has ended				
11.	My science teacher was willing to explain things again when asked to do so by any student during the circulatory systems in human lessons.				
12.	My science teacher helped me when I was in difficulty.				
13.	My science teacher took personal interest in my studies in the circulatory systems in human lesson.				
14.	My science teacher listened to and accepted my comments on how he teaches.				
15.	My science class teacher talks happily about science as a subject, which encourages me and other students to study science.				