UNIVERSITY OF EDUCATION, WINNEBA

USING MULTIMEDIA TECHNIQUES TO INFLUENCE FIRST YEAR INTEGRATED SCIENCE STUDENTS' ACADEMIC PERFORMANCE IN ECOLOGICAL CONCEPTS AT NEW EDUBIASE SENIOR HIGH SCHOOL

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A Thesis in the Department of Science Education, Faculty of Science Education, submitted to the School of Graduate Studies in partial fulfillment of the requirements for award of the degree of Master of Philosophy (Science Education) in the University of Education, Winneba

JULY, 2020

DECLARATION

STUDENT'S DECLARATION

I declare that this thesis is my own work, and that it has not been submitted for any degree or examination in any other university, and that all the source of information, I have used or quoted have been indicated and acknowledged in the references.

NAME: AMOS JAMUNG

SIGNATURE: ……..……..

DATE: ……...

SUPERVISOR'S DECLARATION

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

NAME: PROF. YAW AMEYAW

SIGNATURE: ……..……..

DATE: ……...

DEDICATION

This thesis is dedicated to all the Morgbarim Jamung family.

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First of all, my endless thanks to the merciful God, whose amazing grace and mercy has brought me this far. I wish to express my gratitude to my lovely wife, Salamatu Bukari. I wouldn't have ventured down this path had it not been her support. I wouldn't have made it this far without her prayers, encouragement, and financial support.

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GLOSSARY/ABBREVIATIONS

SHS	Senior High School.
ICT	Information and Communication Technology.
NESS	New Edubiase Senior High School.
UEW	University of Education, Winneba
SWMT	Satisfaction with Multimedia Techniques
WAEC	West African Examination Council
SAECT	Students' Achievement in Ecological Concepts Test

ABSTRACT

The study investigated the impact of multimedia techniques among first year Integrated Science students' academic performance in ecological concepts. Two null hypotheses accompanied the study. The study adopted constructivists' theory as its underlying framework. Nonrandomized control-group pretest-posttest quasi-experimental design was adopted for the study. The study participants comprised General Arts eighty-two (82) students in New Edubiase Senior High School. Students Achievement in Ecological Concept Test (SAECT) (pretest) and (posttest) with reliability coefficients of 0.89 and 0.77 respectively, and Satisfaction with Multimedia Techniques Questionnaire (SWMT) with reliability coefficients of 0.80 were the instruments designed to gather data. Descriptive statistics (means, simple frequencies and standard deviations) and inferential (t-tests) were used in analyzing the data obtained. The findings indicated positive results, and it showed a significantly improved performance of the students. The results from the questionnaire indicated positive attitude of the students towards the use of multimedia techniques in teaching and learning of Integrated Science. It is therefore recommended that the use of multimedia techniques in teaching and learning should be employed by teachers in New Edubiase SHS. Additionally, the implementation of multimedia techniques in teaching and learning will address different learning styles, and also facilitate students' learning abilities and thereby help to improve their academic achievement so teachers should readily use it.

CHAPTER ONE

INTRODUCTION

Overview

This chapter discusses the background to the study, statement of problem, research question, objective and purpose of the study. Furthermore, the chapter addresses educational significance of the study and the delimitation of the study. Lastly, the chapter contains definition of terms used in the study and the organisation of the chapters.

Background to the Study

Science is perceived as difficult subject that only exceptional students can pursue (Archer & DeWitt, 2017). Despite government of Ghana effort to motivate students to do science, more students are running away from it. However, there is no gainsaying to the fact that science plays a much pivotal role in the very existence of man's life, such as domestic, health, sanitation, education, and indeed in every endeavor of life.

Modern life also requires general scientific literacy for every Ghanaian citizen and this is why the study of science is compulsory for all students at basic and high school levels of education in Ghana. The hope is that students will become more scientifically literate thereby enabling them deal with societal and personal issues as responsible adults (Teaching Syllabus for SHS Science, 2010).

The rational for teaching Integrated Science is a conscious effort to raise the level of scientific literacy of all students that will be needed for their own survival and for the development of the country. Also, it is expected that scientific experiences in students

will cultivate in students the interest and love for science that will urge them to seek further studies in science as preparation for careers in science (Teaching Syllabus for SHS Science, 2010). However students perceived science to be so strange and too difficult, this perception cut across all levels of education where science is taught. Due to this perception about science, students at every level of the educational ladder try to avoid it when given opportunity.

Some of the few students, who attempt to study science fall out when they meet challenges, which they perceive difficult to solve. Others try to do away with the subject, especially, when it's time for science lessons, they do stay away from classes, while those who sit in the class for the lesson do so passively just waiting for the lesson to be over.

This attitude of students towards science can be attributed to several limiting factors, such as lack of teaching and learning materials and most importantly the approach to the teaching of science, which take into consideration, the methods, skills, preparation on the part of the teacher to achieve effective teaching. O'Connor (2002) identified the use of inappropriate teaching methods as one of the factors that contribute to the low participation and performance of science students.

Science can be understood by learners only when teachers use the right methodologies, adequate and appropriate Teaching and Learning Materials and also when right techniques are employed in the teaching and learning processes. These facilitate the acquisition of skills and understanding of concepts. Students become formal operational thinkers when they can understand abstract concepts. There are some concepts about certain things in nature that cannot be seen or touched that

science seeks to investigate. Such items pose a lot of problems to the learners especially; beginners who need to get fundamentals about these concepts. Examples of these concepts are fertilization in plant and animal, genetic, ozone layer, and climatic change. Such concepts when taught in abstract leaves the academically weak students to over-stretch their imagination. Taking into consideration among all these problems educators have tried several ways to overcome this learning problem hence the introduction of Information and Communication Technology in Education.

Information and Communication Technology (ICT) has become an important tool for all communication and industrialisation enterprises in the 21st century. This is due to the fact that, we are in the era of Information and Communication Technology (ICT). Where diverse innovative approaches are needed in the teaching and learning processes of educational institutions to motivate and sustain students' attention for better understanding and higher educational achievement. A number of previous studies have shown that an appropriate use of ICT can raise educational quality and connect learning to real-life situations (Lowther, Inan, Strahl, & Ross, 2008; Weert & Tatnall, 2005).

Castro and Alemán (2011) indicate that ICT assists in transforming a teaching environment into a learner-centered one. In both the developed and developing world, ICT has become a very crucial and critical instrument for improving the quality of education. For instance, a report presented by the National Institute of Multimedia Education in Japan, concludes that students' exposure to ICT through curriculum integration has positive impact on their achievement with regard to

knowledge, reasoning and presentation skills in various subject areas (Lemke & Edward, 1998).

Multimedia technologies can be used to better demonstrate and explain difficult concepts that cannot be easily explained in the classroom. They can be used to improve students' understanding and stimulate real processes. It allows learners to execute virtual experiment that would be dangerous and costly to be conducted in the school laboratory (Chen & Teh, 2013). The use of multimedia technology can help students to have access to the knowledge and expertise that was not available previously.

Students can effectively interact with information based on images, sounds and words design in a previously determined sequence at any time and in any order they desire in accordance with their own decisions, as well as analyse stimuli received during interaction and internalize them (Sari, 1993). Multimedia activate multiple sensations in the teaching environment, it contributes to perception, performance, memory, visual memory, visual attention and motor skills (Stephenson, 2002).

Research has shown that people only retain 10 percent of what they read, 20 percent of what they see and 30 percent of what they hear. But they remember 50 percent of what they see and hear, and as much as 90 percent of what they see, hear, and do simultaneously (Lindstrom, 1994). The use of multimedia in education is therefore suggested as one of the best approaches needed for the teaching and learning of ecology in Senior High Schools (SHS). As learners can see, hear and practice simultaneously what is being learnt.

The role of multimedia in the whole educational enterprise, particularly in the area of teaching and learning cannot be over-emphasised (Mayer, 1997; Najjar, 1996b). Multimedia programmes provide different stimuli in their presentation which include a number of elements some of which include Texts, Spoken word, Sound & music, Graphics, Animations, Still pictures and Videos (Aloraini, 2005). These elements are mainstreamed and presented to touch on different senses and aspects of learners. Its use in education helps to get the information closer to reality.

Many researches have recognised the effectiveness of multimedia as a teaching tool. However, very few educators and researchers have taken keen interest in investigating the contribution of multimedia in the teaching and learning process of ecological studies (Slawson, 1993).

Students need education for the ecological understanding of the environment as well as the effect of their behaviour towards the environment. Among the teachers who get involved in the educational and social issues lack the necessary philosophical background in the development of environmental responsible behaviour. To have environmental ethics programs, teachers need to understand several basic problems involving the human behaviour towards the environment as well as students.

The United Nation Educational, Scientific and Cultural Organisation (UNESCO) have increased among other things time, energy and money used to develop ecological oriented programmes in different countries since 1975 (Johnson, 1980). This is to create awareness to our environmental problems, how to prevent it and to create an environmental friendly world. However, the question to ask is whether this has yielded any better result in terms of improving our world or changed our attitudes.

It is not surprising that many emphasizes by various researchers of science curriculum at various levels of education have indicated that, "scientific concepts taught in abstract terms force students to resort to rote-learning without understanding" (Felder, 1993). This has led to the poor performance of students in Integrated Science at Senior High School level as indicated by the Chief Examiner's Report, West Africa Examination Council (WAEC, 2018).

This underscores the desire to investigate the effect of multimedia on first year Integrated Science students' academic performance in ecological concepts at New Edubiase Senior High School.

Statement of the Problem

Environmental problems have been increasing at an alarming rate, but our education systems have failed to develop in students an in-depth understanding of the fundamental principles concerning the environmental problems the world faces today. According to Bakshi and Naveh (1980), the problem between mankind and its environment is attributed to the gap between professional ecologist and mankind due to inadequate education.

Many researches have been conducted in the whole world to the teaching and learning of Ecology but students still find it hard to comprehend (Angela, 2018; Hugh, Marika, & Michael, 2002).

The general performance of the New Edubiase SHS students in the Integrated Science has been poor for 2018, 2019 as compared to 2017 year group (Appendix D). The Chief Examiner's Report for 2018 on Integrated Science when compared with that of 2017 shows a decline in performance of the students. This is attributed to lack of practical activities, inadequate preparation of student towards the examination, and

teachers not able to complete the syllabus before the examination. Other factors include poor teacher methodologies and the attitude of students towards Integrated Science. In 2018, the percentage of students who passed Integrated Science was 50.48 as compared to 52.89 in 2017 (Daily Graphic online, 2019). Most of the questions answered by the students show their abysmal performance on the ecological concepts. This can be seen in the West Africa Examination Council Chief Examiner's Report (WAEC, 2018).

These students' failure can be traced to students' inability to grasp properly the fundamental concepts in Science, and teachers' failure to communicate the fundamental concepts via the appropriate methods of teaching Science.

Most science teachers including myself have adopted various methods of teaching and learning Science with the hope of communicating effectively the core ideas and concepts of science to the students. Some of these methods of teaching employed over the years are the traditional method or lecture method of teaching, inquiry method etc. These methods including the addition of chart and improvised teaching and learning materials are unable to properly explain concepts like process of photosynthesis, transpiration in plants, greenhouse effect, and ozone layers.

Multimedia techniques are becoming useful in the teaching and learning in today's world. Interactive multimedia programmes make the idea of learning and doing not passive. However, not much research has been done using multimedia to teach ecological concepts. Therefore this study investigates how multimedia can be used to influence students' academic achievement in ecological concept at New Edubiase Senior High School.

Purpose of the Study

The study seeks to investigate how multimedia techniques influence first year Integrated Science students' academic achievement in ecological concepts at New Edubiase Senior High School

Research Objectives

The study sought to:

1. examine the performance of students in Ecological concepts after the use of multimedia techniques in teaching and learning.
2. determine the efficacy of multimedia techniques as compared to the traditional method of teaching.
3. determine the perception of the experimental students on the effectiveness of multimedia techniques in teaching Integrated Science.

Research Questions

1. What is the performance of students' in Ecological concepts after being exposed to multimedia techniques?
2. What is the efficacy of multimedia techniques as compared to the traditional method of teaching?
3. What are perceptions of students on the effectiveness of multimedia techniques in teaching Integrated Science education?

Research Hypotheses

1. Ho: There is no statistically significant difference in the academic performance of students before and after using multimedia techniques to teach Ecological concepts.
2. Ho: There is no statistically significant difference in the efficacy of the use of the multimedia techniques in teaching as compared to traditional method of teaching in Ecological concepts.

Significance of the Study

The study would help address the persistent poor academic achievement of the students in New Edubiase Senior High School (NESS). The study would also help schools with similar problems to adapt the method rather than the traditional methods that are used in the majority of school in Adansi enclave.

It is hoped that the outcome of this research would motivate Science teachers to incorporate the approach into the teaching and learning of Integrated Science which would improve Integrated Science teaching and learning in New Edubiase Senior High School. Finally, the outcome of the study would form the basis for the organisation of in-service training for teachers in Integrated Science in Senior High School in the Adansi South District.

Delimitation of the Study

The study was restricted to form one General Arts students offering Integrated Science in New Edubiase SHS because the researcher was assigned to those classes as at the time of the study. In addition the study was delimited to Ecological concepts in Integrated Science. Also it did not cover internet, blog, and webinar.

Limitation of the Study

The researcher encountered many setbacks during the study. Some of the students were absent during some of the intervention period. In addition limitation maybe due to the commitment level of the students to learn during the instructional period. Finally, other instruments such as observations and personal interviews would have made the study more comprehensive, but are not included as instruments.

Definition of Terms

Traditional method of teaching: The teacher gives instruction in a lecture-style, where there is no use of computer in such a class. Learner learns through memorization.

Multimedia is the combination of computer hardware and software that allow you to integrate video, animation, audio, graphics and text resource to develop effective presentations (William, 2007).

Multimedia method of teaching: The teacher used computer assisted instruction in teaching students in the class.

Multimedia technology includes interactive, computer-based applications that allow people to communicate ideas and information with digital and print element.

Multimedia techniques are the skill and ability to used multimedia technology.

Organization of the Study

The study consists of five chapters. Chapter one which is the introduction comprises of the background to the study, statement of the problem, purpose of the study, significance of the study, research objectives and research questions, delimitation and limitation of the study, and definition of terms.

Chapter two deals with the literature review. The Views of Researchers and educationist on Information Communication Technology and multimedia as a teaching technology in Science education are discussed. The third chapter, which is on methodology focuses on the design of the study, population and sampling, the instrument for the data collection, data collection procedures and data analysis.

Analysis of the results and discussion are gathered in chapter four. The last chapter, that is five, accounts for summary of finding, conclusion, recommendations and suggestion for further studies.

CHAPTER TWO

LITERATURE REVIEW

Overview

This chapter discusses the literature review related to the subject under study. The review briefly describes and discusses the constructivist's and cognitivist's theories. It also discusses the use of Information and Communication Technology and the impact of multimedia all in education. It is reviewed under the following headings:

1. Theoretical Framework
2. Learning Styles
3. Ecology of Education
4. Instructional Techniques in Science classroom
5. Information and Communication Technology in Education
6. Impact of Multimedia on Students' Cognitive Understanding
7. Effect of Multimedia in Science Education
8. Traditional Method versus Multimedia Method of Teaching and Learning

Theoretical Framework

The theoretical framework of this research is embedded in the constructivist and social cognitivist theories of learning. Constructivism is 'an approach to learning that holds that people actively construct or make their own knowledge, and that reality is determined by the experiences of the learner' (Elliott, Kratochwill, Littlefield, Cook, & Travers, 2000). Constructivist believes that learners have prior knowledge and experiences, which are often determined by their social and cultural environment. Constructivist is an approach to teaching and learning based on the idea that learning

is as a result of mental construction. Students learn by fitting new information together with their past experience. Constructivists believe that learning is affected by the context in which an idea is presented as well as by the students' personal beliefs. Constructivism calls for active participation in problem solving and critical thinking regarding an authentic learning activity to which students find relevant and engaging (Briner, 1999).

Learning is an active process rather than a passive process. Constructivism states that learners construct meaning only through active engagement with the world such as experiments or real-world problem-solving. Information may be passively received, but understanding cannot be, for it must come from making meaningful connections between prior knowledge, new knowledge, and the processes involved in learning.

Learners, constantly try to develop their own individual mental model of the real world from their perceptions of that world. As they perceive each new experience, learners continually update their own mental models to reflect the new information; therefore construct their own interpretation of reality.

The constructivism approach relies on how students with their understanding interact with courseware; the assumption is that, knowledge is constructed by the students themselves, not through the delivering of the courseware (Winn, 1993). In this constructivist view, the knowledge is constructed, not transmitted and the students actively learn (Jonassen, 1999).

To enhance learning, students should be given opportunity for exploration and manipulation within the environment as well as opportunities for discourse between students (Dickey, 2007). Within this content, students have opportunity to apply new knowledge and skills in a collaborative shared environment. In learning constructivist

activity, the role of teachers is "to help and guide the student in the conceptual organization of certain areas of experience" (Glasersfeld, 1983). Communication technologies must do more to enhance students' private learning process. Interactive communication does more than merely conveying information (Garrison, 1993). Constructivism suggests creating environments where learners are required to examine thinking and learning processes; collect, record, and analyzes data; formulate and test hypotheses; reflect on previous understandings; and construct their own meaning (Crotty, 1994).

The instructional relationship between the teacher and the students is quite different in the use of multimedia techniques in teaching and learning. The role of the teacher becomes more complex as it involves the management of the learning environment, providing instruction and scaffolding activities, monitoring feedback and progress, and assessing students' performance. Students, on the other hand, play an active part and assume more responsibility for their own learning. They seek information and construct knowledge on their own based on their previous experience and interact actively with their peers and teacher to enhance their learning processes. In other words, they become more autonomous and independent seekers of information and knowledge. The technology used plays the role of an enabler, providing sufficient resources to ensure successful establishment of the learning environment. The emphasis in learning is upon the students, who are active learners seeking information and knowledge on their own, determining how to reach the desired learning outcomes themselves, and not relying on teachers to supply them with information. Here, students become active participants in their own learning processes, and learn to solve problems and work collaboratively with their peers. Learning takes place in a

meaningful, authentic context, and it is a social collaborative activity where peers play an important role in encouraging learning. In this respect, the teacher is no longer perceived as the sole authority of learning, but rather, as the person to facilitate learning, guiding and supporting learners' to construction their own knowledge (Orlich, Harder, Callahan, & Gibson, 1998). In this mode, the focus is on the learning process rather than on the content, and also on learning 'how to learn' rather than 'how much is learned'. This environment encourages students to develop critical thinking, problem-solving and team skills, with technology being integral to their learning.

The emergence of multimedia technologies has made it very possible for learners to become involved in their work. With multimedia technologies, they can create multimedia applications as part of their project requirements. This would make them active participants in their own learning process, instead of just being passive learners of the educational content. It also fosters collaborative and cooperative learning between and among students, thus better preparing them with a skillset for real life work situations (Roblyer & Edwards, 2000). With multimedia projects, students can make use of the knowledge presented to them by the lecturer, and represent them in a more meaningful way, using different media elements. These media elements can be converted into digital form and modified and customized for the final project. By incorporating digital media elements into the project, students are able to learn better since they use multiple sensory modalities, which make them more motivated to pay more attention to the information presented and better retain the information. Therefore, multimedia application design offers new insights into the learning process of the designer and forces him or her to represent information and knowledge in a new and innovative way (Agnew, Kellerman, & Meyer, 1996).

The social cognitive theory holds that portions of individual knowledge acquisition can be directly related to observing others within the context of social interactions, experiences, and outside media influences. Observing a model can also prompt the viewer to engage in behaviors they have already learned (Bandura, 1986). The observer may choose to replicate the behavior modeled.

Media provides models for a vast array of people in many different environmental settings. The models can be those of an interpersonal imitation or media sources. Effective modeling teaches general rules and strategies for dealing with different situation.

Social cognitive theory is pervasively employed in studies examining attitude or behavior changes triggered by the mass media. As Bandura (2008) suggested, people can learn how to perform behaviors through media modeling. In a series of TV programming, according to social cognitive theory, the awarded behaviors of liked characters are supposed to be followed by viewers, while punished behaviors are supposed to be avoided by media consumers.

The social learning theory of Bandura (2008) emphasizes the importance of observing and modeling the behaviors, attitudes and emotional reaction of others.

It states: learning would be exceedingly laborious not to mentions hazardous, if people had to rely solely on the effects of their own action to inform them what to do. Fortunately, most behavior is learned observationally through modeling: from observing others one forms an idea of how new behaviors are performed, and on later occasions this coded information serves as a guide for action. In education, teachers play the role of model in a child learning acquisitions.

In particular, the process of observational learning was an important advance in our understanding of media effects, describing how visual media could teach, reinforce, and prompt behaviors portrayed on the screen.

Humans are neither completely autonomous from their environment nor totally subservient to environmental influences. Rather, human capacity to transform sensory experiences into symbolic cognitive models, or schemas, that guide human actions. Cognitive schemas arise both from direct, first person experiences (enactive learning) and the vicarious experiences of others (observational learning). Both mechanisms impart behavior in the same basic way, by influencing judgments of the likely consequences of a behavior, or outcome expectations (Bandura, 1986).

Multimedia techniques in teaching and learning may be explained in social cognitive theory terms through the interplay of basic human capabilities to use symbols, exercise forethought, learn through vicarious experience, and to reflect upon and regulate their behavior (Bandura, 1986). The human capability of self- reflection makes it possible for individuals to analyze their experience with the media and also to modify their thought processes to respond better to the media alternatives available to them.

Learning Styles

The theory of learning styles describes the different ways by which learners adopt, receive and processes or react to information that can be fitted into cognitive schema. The theory stresses the fact that individuals perceive and process information in different ways using a combination of their senses and skills (Felder and Silverman, 1988). An example of the classification of learning styles is the Felder (1993) model,

which organizes learners into five dichotomous learning styles: sensing / intuitive, visual / verbal, inductive / deductive, active / reflective, and sequential / global:

How much a student learns depends on whether the instructional experiences are linked to the learning styles. Studies indicate that if the learner's learning styles are compatible with teacher's teaching styles, he/she is likely to retain information longer, apply it effectively and is also inclined to have a more positive attitude towards the subject than anyone who experiences learning mismatch (Felder, 1993).

Erinosho (2008) advised that a teacher must recognize the diversity of learning styles among students in the class, and should therefore adopt strategies that are effective and suitable to them. She further pointed out that, a good teacher is expected to apply a range of active learning approaches that incorporate problem-solving, reading, discussion, experiment, group work and broad base strategies that can accommodate the differences and similarities in learning styles. Also a single lesson maybe though using a combination of techniques, which will engage students' practical work (kinaesthetic cues), demonstration (visual cue), hands-on or group work (kinaesthetic and active cues), discussion and questioning (verbal, orals and active cues) and drilling exercise (sequential cue).

Ecology of Education

Ecology is the scientific study of interaction between organisms and their environment. Ecology provides us with information to better understand the world around us. This information also can help us improve our environment, manage our natural resources, and protect human health.

The environment of an organism includes both biotic and abiotic factors. These two factors have to coordinate each other to share the resources that are present within the environmental ecosystem (Levin et al., 2013).

Human pressure on many elements in physical environment confronts us today as the primary reason of current environmental problems. To deal with such problems, studies in recent years focus on human factor (Barr, 2007; Evans et al., 2007).

If one of the root causes of our environmental crises is our lifestyle which we choose by our act of will and which can be altered by our conscious choice (Levins & Lewontin, 1985) then ecology education may help us understand the need to adapt a style of living that harmonizes with the environment.

For that reason, we need to raise the consciousness of individuals about their responsibilities in overcoming environmental problems, which can be achieved with an effective environmental education (Campbell, Waliczek, & Zajicek, 1999).

Environmental education also aims at helping peoples understand the ecological balance and their role in it, form opinions as to how they can live in harmony with the environment and acquire necessary skills for active and responsible participation (Erol & Gezer, 2006).

Ecology usually deals with theoretical concepts. Due to the abundance of the relationships between ecological concepts, it is difficult for students to learn these concepts thoroughly. This can be achieved by educating our students through ecology to appreciate their environment and sustainable use of resources.

When ecology education is incorporated into the school curriculum, students learn about the environment, develop skills to investigate and solve issues in the environment, acquire attitudes of care and concern for the environment, adopt

behaviors and practices which protect the environment, and understand the principles of ecologically sustainable development.

Perelrnan (1976) suggests that the goal of ecology education is to develop an ecologically educated person, who in turn, is capable of creating an ecologically harmonious society. Zverve (1982) also argues that the goal of ecology in school education is to develop an ecologically "cultured" person who is, in turn, capable of creating an ecologically "cultured" society.

According to Zverve (1982), the main function of an ecological culture is to regulate humankind's attitudes toward his or her own future, the future of nature, and the resolution of contemporary and future global problems.

Instructional Techniques in Science Classroom

Teaching style is explained as the manner in which a teacher effectively and efficiently interacts within the classroom environment to bring about quality learning of the subject among students (Woolfolk, 2009). The techniques aspect of teaching is the different ways in which the teacher presents information to be learned. Three teaching styles were identified by (Wood, 1995), as discipline-centered, teacher-centered and student-centered. Discipline-centered style focuses more on the subject matter than on what teacher does. The aim is to teach content as prescribed in the syllabus or textbook regardless of whether it meets the needs of students or not (Erinosho, 2008).

In teacher-centered style, the teacher is the focus, acting as the authoritative expert, the main source of knowledge and the focal point of all activity. Teaching is merely to transmit information and to help the students to master facts for examination purpose, through lectures, explanations, and illustrations. In such teaching environment,

students are passive learners and they regurgitate content. This type of teaching style allows for minimal teacher-student interaction (Erinosho, 2008). The most common approaches are lecture and demonstration:

Lecture approach involves oral presentations of materials to the student by the teacher. The advantage of using this approach is that it allows much information to be communicated quickly to students. It is useful for introducing a lesson, or summarizing the main points in the lesson or providing factual knowledge to the students as a group. It weakness is that lecture contribute minimally to conceptual understanding in school science (Birke & Foster, 1993). It also short-changes the sensing, visual, active, inductive, and sequential learners. To overcome this difficulties students face under this approach as suggested by Mckeanchie (1994), is to use audio-visuals to enhance presentation and to captivate and sustain students' interest.

Demonstration is when a teacher shows students a procedure or the student showing a procedure to another student. There are many reasons a teacher might want to adopt this techniques, such as when unavailability of materials, are not available to students, safety, difficulty of presenting a concept or to save time (O'Brein, 1991).

Student-centered styles are promised on the learning styles theory of uniqueness of learners, the active nature of learning and curiosity of young learners. The teaching techniques include questioning, concept mappings, collaborative learning, cooperative learning, case study, discussion, simulation, class/home practice and project (Erinosho, 2008).

Concept mapping was developed by Novak in 1991 that also derived the idea from Ausbel's (1963) cognitive theory which places central emphasis on the connection of

student's existing knowledge as the anchor for subsequent meaningful learning. Concept map is a useful tool for organizing and visually representing interrelated structure of concepts within a domain of knowledge. Concept maps are useful tools for helping students learn about the structure of knowledge and tie new knowledge to current experience (Novek, 1991). They are useful for cooperative learning to make students each other and strength their understanding of a subject matter and as members of a group, to bring their thought processes to bear on the interpretation of concepts and relationship (Danmole & Femi-Adote, 2004).

Collaborative learning is an active technique that helps students to use a team approach for achieving mastery of science. The students work together in manageable groups and share responsibility in learning with one another. The teacher gives the group a challenging question or project. When the teacher pose the question, each member group member will first spend time to think about the problem from his/her stand point and then share this with others. The group will examine all individual responses and jointly arrive at a common understanding of the problem. The joint answer is then peered review before submission to the teacher for assessment. The benefit is that student develops communication and group skills, which are essential characteristics in context of team learning (Erinosho, 2008).

The case study approach involves students analyzing and discussion a problem or an idea by applying learned knowledge in science. Students may work as individuals, in groups, or in a think pair-share to analyze the case. This is a useful approach because it enables students to relate principles and ideas of science to real life situations and to link science concepts to broad social issues (Erinosho, 2008).

Simulation approach is a teaching technique that involves initiating activity that resemble real life situation in teaching certain concepts and idea. Examples of simulation are role-play, games and models. Role-play is a simulation technique that deliberately constructs approximation of real life experience whereby the teacher describes a scenario and the students act it, thus throwing up some idea (Yardley-Matwiejczuc, 1997). Students are placed in a situation that resemble real life and are expected to assume the role of specific characters that will discuss the problem. Another form of role-play involves students acting in a situation that require a decision to be taken. Here they take up roles and make presentations, which express their or feeling about the problem from the perceptive of the role being acted.

Class/ home practice approach is an example of active learning strategy that provide opportunities for few interactions and applications of knowledge in any situation. Given class/homework provides opportunity for students to review and practice learned skills on their own. This reinforces learning, build confidence and promote retention. They help students to work independently, to imbibe necessary study habits, and learn how to manage time. Individual assignments using class/homework are valuable with students who do not participate much in classroom activities (Erinosho, 2008).

Usually, a project is initiated as an out of class activity to stimulate experimentation, data gathering, and creative thinking in students. A problem to be answered is identified by the teacher, which could be open-ended or one that required data collection and the students will be required to use the learned knowledge to tackle it (Erinosho, 2008).

Multimedia approach of teaching and learning could cater for both the learning styles and the teaching styles. Multimedia technology allows information to be demonstrated in so many different ways and enable teaching styles to be directed toward a broader range of learning preference (Pippert, 1999).

The use of multimedia for the purpose of education is beneficial because it allows an easier and broader variety of teaching styles with which information can be obtained; it promotes interactive learning and as a result, encourages greater enthusiasm towards education in both teachers and students (Pryor & Bitter, 2008).

Information and Communication Technology in Education

The term Information and Communication Technology (ICT) is a broad and comprehensive expression. It is not restricted to the computers or the internet alone. It ranges from the use of FM radio to satellite for communication (Danials, 2002). The contemporary society is highly influenced by ICTs in every aspect of life, including education. The effects are experienced more in the field of education since it has the potential for teachers to transform the teaching methodology to meet individual needs (Yusuf, 2005). Today, schools are under pressure to adapt to this technological innovation. ICT provide remarkable opportunities for developing countries to enrich their educational system since it can help in acquiring and assimilating knowledge.

Schools use a diverse set of ICT tools to communicate, create, disseminate, store, and manage information (Blurton, 2000). ICT has become integral to the teaching-learning interaction, through such approaches as replacing chalkboards with interactive digital whiteboards, using other devices for learning during class time, and the "flipped classroom" model where students watch lectures at home on the computer and use classroom time for more interactive exercises.

Students with different styles of learning: ICT can provide diverse options for taking in and processing information, making sense of ideas, and expressing learning. Students learn best through visual and tactile modalities, and ICT can help these students 'experience' the information instead of just reading and hearing it (Kenney, 2011). Mobile devices and tables can also offer programs ("apps") that provide extra support to students with special needs, with features such as simplified screens and instructions, consistent placement of menus and control features, graphics combined with text, audio feedback, ability to set pace and level of difficulty, appropriate and unambiguous feedback, and easy error correction (Rodriquez, Strnadova, & Cumming, 2013).

When teachers are digitally literate and trained to use ICT, these approaches can lead to higher order thinking skills, provide creative and individualized options for students to express their understandings, and leave students better prepared to deal with ongoing technological change in society and the workplace (Goodwin, 2012).

ICT Integration Enhance Teaching and Learning

Technology provides a remarkable role in making education inclusive since it has the potential to improve educational performance of students. Furthermore, utilization of ICT facilitates learner-centered approach rather than conventional teacher-centered pedagogy. The present day curricula promote aptitude and performance of the learners, emphasizing on the application of the information rather than factual knowledge. ICT facilitates the dissemination of knowledge based on the contemporary curricula (Oliver, 2000). As a result, incorporating ICT in teaching helps both teachers and students since it has the potential to impart quality education if it is used effectively.

The constructivist method views learning as realistic and learner-centered. ICT is an effective tool in constructivist approach of learning. Applying educational technology as a constructivist device can help students to display their ideas, express their knowledge, examine, exploit, and process information, in a collaborative learning environment (Barron, 1998). Computers help students in developing high order thinking. Gredler (2000) also went in the same direction by stating that ICT integration helps in Constructivist learning where students interact with other learners, the teacher, sources of information, and technology. Such an atmosphere provides the learner with direction and settings to build their knowledge and skills.

Teachers play a crucial role in integrating ICT. The present day teachers should know not only the content of their subject but also the pedagogy to impart the knowledge effectively by integrating technology. According to (Zhao & Cziko, 2001) in order to integrate ICT in teaching teachers must recognize the usefulness of technology, they should believe that the application of technology does not disrupt the classroom climate. Moreover, they should also have the confidence to manage technology. Nevertheless, research studies indicate that majority of the teachers do not take advantage of the potential of ICT to promote the quality of learning, even though they have a favorable attitude towards it (Assan & Thomas, 2012).

ICT Enhances Accessibility to Learning

Education is not just teaching students based on prescribed syllabus in the four walls of a classroom. It has much border objectives, goals as well as other concepts. ICT is an answer to this concept. It helps to deliver education anytime and from anywhere (Pegu, 2014). It also affects the way knowledge is imparted and students learning process since learning will be effective if only the strategies are learner driven rather

than by the teacher. ICT can foster the educational needs of special needs students since it can be utilized at their own pace (Moore & Kearsley, 1996).

Teleconferencing classroom where students around the world are invited to discussion related to a specific topic. Under such circumstances students besides acquiring knowledge collectively, also share their learning experiences, which enable to express themselves and contemplate on their learning. ICT helps to reduce communication obstacles like space and time. ICTs also make it easy for the development of electronic resources such as electronic libraries where the students, teachers and experts are able to access research information and study materials from anywhere at their own pace (Cholin 2005). Such conveniences provide exposure of academics and research scholars in sharing scholarly material.

ICT Enhancing the Learning Environment and Motivation

ICT is a powerful tool for promoting educational opportunities. It is transforming the processes of teaching and learning environment by including elements of vitality to the learning milieu. Teachers need to encourage students to be active learners so as to engage in active knowledge construction. This entails open-ended learning situations rather than a learning condition which focus on the sheer transmission of facts (Jonassen, Peck, & Wilson, 1999).

ICT has the potential to create powerful learning environments in various ways. It has the potential to access numerous information's using various sources. It also helps in examining information from different perspectives, thus promoting the credibility of learning environments (Amin, 2013). Furthermore, ICT may also help to understand complex concepts through simulations, contributing to an authentic learning environment. Consequently, ICT functions as a facilitator of active learning and high-

order thinking (Jonassen, 1999). Moreover, ICT can also function as an instrument of curriculum differentiation. It promotes opportunities to modify the learning material and activities to the requirements and capabilities of every individual learner, particularly by giving personalized feedback (Akele, 2013). Multimedia computer software can be used to provide an audio-visual effect which helps to create interest and engage students in the learning process. Interactive software applications can also help students to get engaged in the lesson activities.

Researches prove that students using ICTs for learning purposes are engaged in the process of learning. ICT acts as a mediator of cognitive development, augmenting the acquisition of basic cognitive competencies which are essential in a knowledge society. Jonassen and Reeves (1996) stated that student utilizing ICTs for educational purposes get immersed or involved in the process of learning. Computers with Internet access can enhance learner motivation since it incorporates the media opulence and interactivity of different ICTs. It gives an opportunity to connect with real people and to get involved in real life situations. Consequently, the application of ICT in teaching and learning will not only improve the learning environments but also help next generation for their future lives and careers (Wheeler, 2001).

ICT Enhancing Academic Performance

The relation between ICT integration and student performance has been the topic of research and discussion for the last two decades. There is a belief that ICT improves the performance of students since technology helps to improve teacher students' interaction. Kulik, (2003) meta-analysis study pointed out that, in general, students who used computer-based learning scored higher than students who learned without computers. ICT integrated learning helps students to grasp the concept better and also

retain it for a longer period of time. ICT also help students to develop a positive attitude towards learning since they are engaged in the learning process.

Fuchs and Woessman (2004) analyzed the international data from the Programme for International Student Assessment (PISA). The findings revealed that there is significantly positive correlations exist between the availability of ICT and students' performance. However, the correlation becomes weak and insignificant when other student environment factors are taken into consideration. Similarly, Attwell and Battle (1999) studied the correlation between having a home computer and students' academic performance. Approximately 64,300 students in the United States took part in the study. The results revealed that students who have access to a computer at home for educational purposes have performed well in reading and math. Kulik (1994) study on 75 students in the United States divulged that students who used computer tutorials in Mathematics, Science and Social Studies performed very well in the test. Kulik studies also stated that computer tutorials on reading helped elementary students to improve their reading skills.

Yusong, LeBoeuf, Basu, and Turner, (2003) reported that web-based teaching supports active learning processes emphasized by constructivist theory. Web-based education enhances understanding through improved visualization and finally, the convenience; it could be used anytime, at any place. Thus, ICT helps to intensify students 'content knowledge, involving them in building their own knowledge of the topic, and also help them in the development of higher order thinking skills.

Several studies have recognized that ICT helps in developing constructivist learning techniques which changes students' approach towards learning as well as the content material (Windschitl, 2002). Fister, and McCarthy, (2008) also illustrates the potential

of tablets to enrich mathematics instruction. Therefore successful integration of ICTs facilitates collaborative and constructive learning, which promotes the academic performance of students.

Multimedia in Education

According to Reiser (2001), in 1905 at St. Louis in USA the first of its kind students were offered educational stereograph, slides and films. Beginning in 1908, the first collection of education films was introduced into the classroom. The new approach includes education video with sound which was called "audiovisual instructional movement" (Reiser, 2001). Instructional television plays a role in the classroom through the creation of public broadcasting station in 1950s. In 1970s, computer-assisted instruction was been developed for use in the classroom. That marks the beginning of "education technology". By 1980s, majority of American school were using computers for education purposes (Reiser, 2001). By 1990s, computers and internet has introduced a virtually endless capacity for information and presentation of material. These have proven to be influential tools for education. Online resources, PowerPoint CD Rom and many more are being developed in hope of more effective and interesting ways to convey information and enable students understand better in the classroom. This new materials are collectively called multimedia and have truly shaped the modern educational system (Velleman, Moore, & David, 1996).

Multimedia technology allows information to be demonstrated in so many different ways and enable teaching styles to be directed toward a broader range of learning preference (Pippert, 1999). The use of multimedia for the purpose of education is beneficial because it allows an easier and broader variety of teaching styles with which information can be obtained; it promotes interactive learning and as a result,

encourages greater enthusiasm towards education in both teachers and students (Pryor & Bitter, 2008).

The growth in the use of multimedia in education sector has accelerated in recent years and set to continue expansion in the future. The development of multimedia technologies for learning offers new ways in which learning can take place in schools and at home.

Multimedia in Teaching and Learning

The use of multimedia in 21st century and it infusion into teaching and learning has transformed delivery methods in many schools According to Mayer, (2003), multimedia delivery in science teaching and learning includes computer-controlled integration of text, graphics, drawings, still and moving images, animation and audio. Others are any types of information that can be represented, stored, transmitted and processed digitally to help student learn science concepts better. These include Interactive Multimedia and Computer-Aid Instruction (CAI).

Interactive Multimedia programmed takes the idea of learning and doing not simply watching. With interactive multimedia programs, the learning process become active and not passive and it ensures those users are doing not simply watching. Interactive multimedia provides a powerful new educational tool that can greatly enhance teaching and learning. Research indicate that the use of multimedia leads to enhanced learning on criteria such as acquisition of content, development of skills and efficiency of learning and satisfaction with instruction (Falk & Carlson, 1992).

In addition, Computer-Aid Instruction (CAI) according to Arnorld, (2007) is a technology that assists the teaching and learning process. CAI can adapt to the abilities and preference of the individual student and increase the amount of

personalized instruction a student receives. Moreover, computer learning experience often engage the interest of students, motivating them to learn and increasing independence and personal responsibility for education. Multimedia can also help students visualize objects that are difficult or impossible to view,

The use of multimedia technology has offered an alternative way of delivering of instruction.

An electronic information technologies are been transformed from expensive, exotic gadgets into standard classroom equipment, their extraordinary multimedia capacities are rapidly becoming a routing part of many learning environments (Slawson, 1993). Interactive multimedia is one of the most promising technologies promising at the time and has the potential to revolutionize the way we work, learn and communicate.

Multimedia has shown a positive effect in the development of higher cognitive skills in science learning (Aloraini, 2012). The use of animated representations of abstract scientific concepts has been related with an enhanced holistic understanding of the content (Blankenship & Dansereau, 2000; Spotts & Dwyer, 1996). Some suggest that animation would enhance learning by allowing users to dynamically interact with the content, in a way that represents the dynamics of the process, thus improving their holistic understanding of the system but there is no clear explanation of how this would be achieved, nor what learning processes could be supported by the interaction.

Many theoretical approaches have been used to design and analyze educational outcomes, with diverse focus on behavioral, social or cognitive issues involved in learning. The information processing theory and the theory of Dual Coding have strong support among instructional designers. These theories focus on the role of information stimulus and its relationship with sensory and cognitive input channels.

Successful applications balance input load and processing capabilities. Newer approaches using computers to support generative activities have shown positive effects in the stimulation of metacognitive processes, also improving problem solving strategies (Hokanson & Hooper, 2000).

The Impact of Multimedia on Students' Cognitive Understanding

During the last decade, there have been increases in computer interaction and computer intelligence. Educational applications have evolved from text based application to video application and now interactive application. This fast track evolution comes under the umbrella of 'multimedia'. Multimedia uses more than one kind of representation to convey massages. Each representative element represents concrete and abstract concepts.

This increase on the reliance of technology combined with how the brain processes information help in educational instruction. There have been numerous research that shown us that the brain processes information using two channels, and these are visual and auditory (Baddeley, 1992). When information is presented in both channels, the brain processes more information. The ability of the brain to process information is a multi-step process that involved perception, attention, selection organisation, and integration of information (Sweller, 2003). The brain is made up of long term memory which stores our information for long time as the name implies 'long term memory'. This information is organized into schema, and these schemas allow us to organize information into meaningful order to form new information.

Before information can be stored in the long term memory it must be process in the working memory sometimes called short term memory. This working memory can

process limited amount of information and can only handle small amount of information before integrating it into the long term memory.

Baddeley (1992) proposes an auditory and a visual channel in our working memory. The auditory channel handles information that can be heard, while the visual channel processes that can be seen. However, when both the auditory and the visual channels are use the working memory can process more information. Sometimes, there is cognitive overload if too much information are delivered in an ineffective manner can hinder the information been integrated from the working memory to the long term memory.

The information in the working memory is integrated into long term memory using existing schema (Sweller, 2003). If there is no existing schema new schema need to be created by the working memory by organizing the information (Baddeley, 1999). If information given cannot be related to the existing schemas due to poor organization the working memory cannot handle even less information.

Multimedia techniques can be used to help in the brain processing, such as:

1. Effective multimedia uses both channel in it communication. This increases the overall amount of information processing of the brain.
2. Effective multimedia present information in an organize manner that make uses of the existing structure to present information in an organize form to help student to integrate the information into long term memory.
3. Effective Multimedia involved the use of visual and auditory as the old text may be difficult sometime to be process.

Mayer (2005) stated that “People learn better from word and picture than from words alone.” That using both words and picture is more effective than words alone. This

conformed to how the brain process information. Mayer (2005) also tell us that narration and video is much more effective that narration and text. Hence, Multimedia techniques in teaching and learning can increase the effectiveness of information processing in the brain.

Multimedia has shown positive effect in the development of higher cognitive skill in the teaching of science. Moore (2000) also affirms that the addition of multimedia to education result in a more thorough comprehension of material when compared to the traditional text and lecture formats.

Traditional Method versus Multimedia Method of Teaching and Learning

The traditional method of teaching and learning also refer to as teacher-centered approach is a method where the teacher is the focus, acting as authoritative expert. The teacher is the main source of knowledge and the focal point of all activity. Teaching is merely to transmit information and to help students to master fact for examination purpose, through lecture, explanation, and illustrations. In such teaching environment, students are passive learners and they regurgitate content. This type of teaching style allows for minimal teacher-student instruction (Erinosho, 2008). The main teaching skill involved in the traditional method is lecturing. Lecturing involves oral presentations of materials to the student by the teacher. The advantage of using this approach is that it allows much information to be communicated quickly to students (Erinosho, 2008). In traditional method of teaching and learning, the classroom situation is one that the teacher in front of the students, giving explanation, information, and instruction. They usually uses chalk or marker pen to write something on the blackboard or whiteboard. The teacher stands in front of the class

and gives a lecture. Students sit passively in the classroom and listen. To avoid the boredom, the lecturer introduces a series of questions to arouse interest.

In multimedia method of teaching two or more different types of instructional media are used in a presentation. Mayer (2001) noted that multimedia instructional delivery involves the use of VCD/DVD or Power Point or 16mm film, software etc. where still picture, text, graphic, motion picture, background sound as well as some narrations are synchronized and/or combined at the same time in order to enhance learners' understanding of concepts. In this approach, timekeeping and coordination of different media are involved. It also includes the use of interactive elements such as graphics, text, video, sound and animation at the same time to deliver lesson (Dike, 2008).

Compared with traditional classroom, multimedia classroom setting differ greatly from traditional classrooms. In multimedia classrooms, students' seat can be modified according to the situation needed. Inside the classroom all equipment are available and makes the students confortable to study. They sit at wide tables with comfortable chairs and have plenty of room to spread work. Furthermore, they also have the opportunity to move the furniture around for group discussions.

Amthor (1991) provided a favorable finding for the use of multimedia teaching. He came out that when interactive video method of instruction was compared to the more traditional methods of instruction; achievement was improved by over 38 percent while the time needed to teach the subject matter decrease by 31 percent.

Also Comsell Company found out that in their research on the multimedia method of instruction, students who are taught using multimedia move through the learning

experience, 30 percent faster than their counterparts in traditional classroom (Roden, 1991).

CHAPTER THREE

METHODOLOGY

Overview

This chapter outlines the research procedure and methods used in the collection of data and data analysis. It covers study design, target population, sample technique, research instruments, data processing and analysis and ethical issues.

Study Design

This study utilised a case study based on experimental research, which adopted quasi-experimental research design. The study employed nonrandomized control-group pretest-posttest design (Leedy & Ormrod, 2005).

The case study method allows investigators to retain the holistic and meaningful characteristics of real-life events (Yin, 2009). It allows an investigator explores a real-life, contemporary bounded system over time, through detailed, as well as in-depth data collection. Its unique strength is its ability to deal with a full variety of evidence sources such as documents, interviews, and observations. Since the research was to be conducted in the classroom, the researcher chooses to use a quasi-experimental research design in order not to disrupt the class activities.

Quasi-experimental design lack random assign group, however, there is a comparison between groups which are self-selected groups by the researcher. Quasi-experimental design identifies a comparison group that is as similar as possible to the treatment group in terms of pre-intervention characteristics. In order to have two equivalents set the researcher chooses to use Nonrandomized control-group pre-test-post-test design.

The nonrandomized control-group pretest–posttest design compromise between the static group comparison and the pretest–posttest control group design. It involves two

groups to which participants haven't been randomly assigned. But it incorporates the pre-treatment observations (pre-test). The nonrandomized control-group pretest–posttest design is depicted in Table 1.

Table 1: The nonrandomized control-group pretest–posttest design

GROUP	**TIME**		
Group One	Pretest	Treatment	Posttest
Group Two	Pretest	No Treatment	Posttest

Population

The population is a group of individuals or objects which have the same characteristic (Creswell, 2008). The target population consisted of all the students in the selected Senior High School. The school has three levels being it forms one, form two and form three. Each level of the school has about fifteen (15) to twenty (20) streams. Form three has fifteen (15) streams; form two has twenty (20) streams and Form one has seventeen (17) streams as at the year (2020) when the research was being conducted. The entire School population was two thousand four hundred and eight (2408). The breakdown is represented in Table 2. This represented the number of students offering Integrated Science in the school. The accessible population for this study consisted 383 General Arts students of form one. There are nine classes for the General Arts students in form one all offering Integrated Science as core subject, of which 82 students representing two classes where used as a sample for the study.

Table 2: Sex Distribution of Integrated Science Student

FORM	MALE	FEMALE	TOTAL
FORM ONE	342	411	**753**
FORM TWO	411	400	**811**
FORM THREE	454	390	**844**
TOTAL	**1207**	**1201**	**2408**

The Selected Senior High School Population distribution for (2019/2020) academic year.

Sample procedure

Purposive sampling technique was used to select the classes for the study. Purposive sampling which is a non-probability was used because it allows the researcher to choose the subjects based on the purpose of the study or because they possess the information the researcher needs or they possess special knowledge of the research issue, or capacity or willingness to participate in the research (Creswell, 2008).

A pre-test was administered to the nine (9) classes in form one General Arts students, the results of the pretest was subjected to a statistical analysis. The two classes representing 40 and 42 students that show no statistically significant differences, which in turn proves the equivalence of the two groups was selected for the study.

SHS 1 students were the perfect students to be used for the study since the topics treated were found at their level and the researcher was also assigned to the SHS 1. They were also available and have the willingness to participate in the study.

Sampling and Sample Size

According to Creswell (2008) a sample is a true representative of the population from which it was selected or a subgroup of the target population that the researcher plans to study for the generalization about the target population.

Two equivalent classes out of the nine classes were selected for the study; this was obtained from the pre-intervention test (Pre-test) which was carry out before the intervention activities. This two classes one representing as a control group and the other as experimental group.

The sample of 82 students representing two classes out of the nine (9) classes General Arts students in form one was chosen.

Research Instruments

The main instruments used included a set of pre and post-treatment test items as well as students' questionnaire. The scores of the pre-intervention and post-intervention test items were used in the analysis to answer the research questions one and two. The student's questionnaire was to gather data on effectiveness of multimedia and perception of students' on the use of multimedia techniques in teaching and learning of Integrated Science and at the same time used to answer research question three.

The general benefits of a questionnaire which include consistency of presentation of questions to the respondents, the assurance of anonymity for the respondents and the less time it takes to administer (Mujis, 2004) was appropriate for this study which was time bound. A questionnaire was found to be appropriate for the study because the study employed a discussion of experimental student's perception on the uses of multimedia techniques in teaching and learning of Integrated Science.

Questionnaire was probably the most common data collection instrument used in educational research which is more familiar to respondents (Mujis, 2004). However, the disadvantages are that they often have low response rate and cannot probe deeply into respondents' opinion and feelings (Mujis, 2004), but this was not the case with this study because the sample size was well manageable.

Closed-ended objective test items were also used as an instrument. These were used to collect data on the performance of the students on the introduction to the ecological studies at the pre-test and post-test. The closed-ended question will be appropriate for this study since it allowed respondents to choose between the optioned provided by the researcher and have increasingly become popular compared with open-ended question (Smith, 1987). The pre-test will be used to find the equivalent set for the study while the post-test will be used to answer the research question one and two.

Students' Achievement in Ecological Concepts Test (SAECT)

The SAECT was self-constructed test named 'Students Achievement in Ecological Concepts Test' (SAECT). This SAECT comprised three assessments and these included pre-test, formative assessment and post-test. The formative assessments were used in the cause of the lessons. These were made up of observing and monitoring students' response, written answer, reasoning abilities, the used of terminologies and explanation of phenomena.

A post-test instrument was used to collect data for the study. It was assessments that were used to determine the evidence of change in knowledge in Ecological concepts after the administration of the treatment. This test was made in three parts; the first part provided the general information about the purpose of the test; the second part asked for the preliminary information about the students' personal data such as name,

sex, class, school, and the third part consisted of 20 test items of an achievement test drawn from the topic taught on the interaction of nature, thus Ecosystem, Atmosphere and Climate change in the Integrated Science textbook. The test items would include 20 test items which comprises of question;

- True or False (six question)
- Multiple tests (fourteen question)

Each of the 16 multiple choice items had four options: one correct answer and three plausible detractors. One mark was awarded for each correct answer circled. The sample of the posttest (SAECT) is found at the Appendix B.

For the purpose of content validation and reduction of errors the test items was submitted to a group of Science teachers in the Department, Head of Department of Science and later to the supervisor who is a Senior Biology lecturer in the Science Department in UEW to look at and judge based on scientifically and pedagogically, in terms of the scientific material, its suitability to students and the clarity of its form. After knowing the views and suggestions, few questions were modified then the test came out in its final form (Appendix B1 and B2). The test items were pilot tested and the reliability coefficient of the post-test was calculated using Cronbach Alpha coefficient which was found to be 0.77.

The pre-test and post-test scripts were scored out of 20 marks each. Each correct answer is score one mark making the total 20 marks. The scores were used in a statistical analysis to determine the significant difference between the control and the experimental group to ascertain if there is an improvement in their academic achievement as compare with that of the control group.

Time allocated for the pre-test and post-test exams were 15 minutes. Each correct response attracted a maximum of one point (Appendix C).

Description of the Questionnaire Items

This test was made in three parts; the first part provided the general information about the purpose of the test; the second part asked for the preliminary information about the students' personal data such as name, sex, class, school, and the third part consisted of 10 test items.

The Items consist of ten (10) items, being Satisfaction with Multimedia Techniques (swmt) that elicited information on the respondents' perception of the effectiveness of the multimedia techniques and it inclusiveness in teaching and learning of Integrated Science (Appendix A).

Scoring of the Questionnaire Items

A likert scale with five options (Strongly Agree (SA), Agree (A), Neutral (N), Disagree (D), and Strongly Disagree (SD) was used to score the questionnaire items. The items on the questionnaire consisted of both positively and negatively statements in order to minimize participant guessing responses. Positive worded items (example,

"I was more enthusiastic and motivated during the use of multimedia techniques in teaching and learning of Ecological concepts") were scored as follows:

Response intensity	Symbol	Score
Strongly Agree	SA	5
Agree	A	4
Neutral	N	3
Disagree	D	2
Strongly Disagree	SD	1

Negative worded items (eg. "The use of multimedia techniques in teaching and learning is not an effective means of helping students to understand relationships among concepts") were scored as follow:

Response intensity	Symbol	Score
Strongly Agree	SA	1
Agree	A	2
Neutral	N	3
Disagree	D	4
Strongly Disagree	SD	5

Likert scale was used score the questionnaire items because it looks interesting to respondents and people often enjoy completing a scale of this type (Mujis, 2004). Again, likert scale is easier to construct, interpret and also provide the opportunity to compute frequencies and percentages as well as statistic such as the mean and

standard deviation of scores. Likert scales are often found to provide with relatively high reliability (Fraenkel & Wallen, 2000).

Variable scores were obtained by averaging the numerical values of the responses for the related items on the variable. A mean score near 5 was considered a very high level of support, between 3 and 4 a high level of support, and a score between 1 and 2 was regarded as the low level of support. For the student perception on the use of multimedia technique in teaching and learning of Integrated Science a mean score of 3.0 represent a neutral position. This value represent neutral position was used in this study to indicate a position that respondents neither agree nor disagree with the statement. A mean value below 3.0 gives a general picture of disagreement while a mean value above 3 gives a general picture of agreement with the statement. However, it must be noted that, a mean value above or below 3.0 does not imply that all the respondents agree or disagree with the statement, but the majority were. Agreement or disagreement to a statement was therefore considered on majority basis. The percentage of the participants' responds to the likert scale items were also used to indicate the extent to which participants agreed or disagreed to the items.

Pilot Test

According to Polit and Hangler (2001) is a small-scale version or trail done by the investigator in preparation for the major study. This helps in establishing the reliability, validity and practicality of the questionnaire because it serves among other things: to check the clarity of the items, gives feedback on the validity of test items and also to make sure that data collected or obtained answer the research questions. In view of this assertion, the instruments used in this study were based on an initial pilot study conducted during the first semester of 2020 academic year on a small set of 19

students. This pilot test was conducted to establish not only the reliability of the survey questionnaire, but also to identify defective items to help correct any ambiguities that might be detected and get an idea of the expected response rate before administering it to the actual participants of the study. The pre and post-test items internal consistent was determined by the use of test retest method of reliability co-efficiency. A reliability value of 0.89 and 0.77 for the pre and post-test respectively was obtained with the use of Cronback alpha co-efficiencies.

Validity of the Instruments

According to Joppe (2000), validity in quantitative research determine whether the instrument truly measures that which it was intended to measure or what it was set up to measure how truthfully the research result are. Creswell (2008, p.169) also stated that "validity means the individual's scores from an instrument make sense, are meaningful, and enable you, as a researcher, to draw good conclusion from the sample you are studying to the population".

The validity of the instruments was based on content validity, where the instrument used was based on the evidence that the items and domains of the instruments are appropriate and comprehensive related to its intended measurement. Items was sample based on the content in their textbooks; syllabus and WASSCE sample questions and administer to the students to see if the results reflect on the intended outcome. The test items were given to group of Science teachers in the Department, the Head of Department of Science in the school and later to the supervisor to determine its validity.

Reliability of the Instrument

Joppe (2000) defines reliability as the extent to which results are consistent over time and if the result of the study can be produced under similar methodology, then the research instrument is consider reliable. Reliability means that the scores from an instrument should be stabled and consistent (Creswell, 2008, p. 169). Score should be nearly the same when the researchers administer the instrument multiple times at different times (Creswell, 2008). Additionally, for an instrument to be reliable it must demonstrate that if it were to be carried out on a similar group of respondents in a similar context, then similar results would be found (Cohen, Manion & Morrison, 2008).

To ensure the reliability of the research instrument for the study, the test instrument was pilot tested on Form Two General Arts students at the New Edubiase Senior High School (NESS) using 19 students. The SHS two students of NESS were used because they have the same characteristics as the actual participants of the study in terms of environment. These students which were used in the pilot test do not form part of the sample for the study. Data from the pilot test were subjected to statistical analysis to determine the reliability of the research instrument using Cronbach alpha. Cronbach alpha coefficient of 0.89 and 0.77 was arrived for the pre-test and post-test respectively. The reliability analysis of the questionnaire was performed statistically and Cronbach alpha coefficient of 0.80 was arrived at using SPSS.

Data Collection Procedure

Phase 1: Pre-treatment phase

This was important because it was to test the appropriateness and effectiveness of the learning packages and test items to be used on the students for data collection. The pilot testing was done in the New Edubiase Senior High School in the Adansi South district of Ghana. Nineteen (19) students were used in the pilot test to ascertain the effectiveness of the instruments. The pilot test was very useful because it helped in the modification of some items in the learning packages and test items and made it more effective.

In the pre-treatment phase the researcher discussed with the Integrated Science teacher to introduce the researcher to the class. In order not to disrupt the school programme, the researcher consulted the class time table with the help of the students to allocate the students' free period which was used for the pilot test.

After the pilot test, the pre-test items were administered to the Form One General Arts students. The data obtain was subjected to statistical analysis to determine the two equivalent classes for the study.

To ensure proactive participation, students were assured of confidentiality of their responses, and that no revelation was to be made to others and privacy was maintained.

Phase 2: Treatment

The treatment involved the preparation of PowerPoint presentation which included: video, animation, text and pictures for the experimental group with the used of laptop, projector, screen and Bluetooth speakers. The researcher delivered the lesson with

PowerPoint presentation to the experimental group. With the control group the lesson was delivered using the traditional method with the use of dialogue and discussion method of delivery. The researcher delivered the lesson in both the experimental and control group. This was to refute the impact of changing the teacher on the study, putting into consideration that the teaching by the multimedia will not affect the traditional method of teaching because this may result in wrong interpretation for the study on the two groups.

Phase 3: Post Treatment Phase

At the end of the four week a post-test was administered personally by the researcher to the students. The mode of administration was as end of semester exams. This ensured hundred percent (100%) collecting of the test item responses. The strict rules of all examination were applied to ensure that response will not be affected by other respondent's views. Again for respondents to be candid about their response they were made to understand that the test conducting is for an academic purpose and that the information they were providing are kept strictly confidential and that no name should be written on the test paper or answer sheet provided but only serial numbers given to them.

Data Analysis

The researcher employed statistical processing and used quantitative data analysis method. The pre and post-intervention test scores of both control and experimental group were analyzed using quantitative t-test analysis as well as descriptive statistic tool such as the mean, standard deviation etc. to determine the impact of multimedia techniques on students' performance.

Analyses of the research results obtained from the questionnaire were then carried out statistically by the use of SPSS. The SPSS was chosen for data analysis because it is reasonable user friendly and does most of the data analyses needed as far as quantitative and qualitative analysis are concerned (Muijs, 2004). The raw data entries were done by the researcher in order to ensure accuracy of entry of data.

The data from the test conducted was subjected to a statistical analysis with t-test where statistical significant differences between the experimental group and the control group at a significance level of 0.05.

The equivalence of the two groups was verified through measuring the difference between the two mean and calculated the t-test (t) value of the identified variables.

CHAPTER FOUR

RESULTS AND DISCUSSION

Overview

The purpose of the study was to examine how the use of multimedia techniques can influence first year Integrated Science students' academic performance in ecology concepts. The chapter presents the results that were collected during the research process, and categorises them based on the objectives of the study. The results are presented descriptively (frequency and percentage) and represented in the form of tables and graphs for quick visual impression. The chapter first presents the demographic characteristics of the respondents followed by the age distribution, research question one, two, and three results. The discussion is also presented in this chapter.

Demographic Characteristics of the Respondents

Sex distribution of the respondents

The result indicates that majority (57.32%) of the respondents are females while (42.68%) of them are males (Table 3).

Table 3: Sex distributions of the respondents

Gender	Frequency	Percentage
Male	35	**42.68**
Female	47	**57.32**
Total	**82**	**100.0**

Age distributions of the respondents

The result shows that majority (75.60%) of the respondents are within the age bracket of 16-20 years. This was followed by respondents in the age range of 21-25 years (18.30%). A smaller percentage (6.10%) of the respondents is within the age group of 11-15 years (Table 4)

Table 4: Age distributions of the respondents

Age range	Frequency	Percentage
11-15	5	6.10
16-20	62	75.60
21-25	15	18.30
Total	**82**	**100.0**

Research question 1:

What is the Difference in Academic Performance of Students in Ecological Concepts after Being Exposed to Multimedia Techniques in Teaching and Learning of Integrated Science?

Hypothesis Testing

To determine whether there was statistically significant difference in the academic performance of students in Ecological concepts after being exposed to multimedia techniques in teaching and learning of Integrated Science. The Research Question 1 was formulated into a null hypothesis as:

Ho: There is no statistically significant difference in the academic performance of students before and after using multimedia techniques to teach Ecological concepts.

The dependent sample two tailed t-test analysis was employed and the mean score for the tests showed statistical significant difference ($t(41) = 18.81$; $p<0.05$) (Table 5).

Table 5: Results of t-test Analysis on the Use of Multimedia Techniques on Ecological Concepts Pre- and Post-test Mean Scores

Test	No.	Mean	SD	t	Df	p-value
Pretest (experimental)	42	5.50	1.61	18.81	41	0.00
Posttest(experimental)	42	13.29	2.59			

Both the pre-test and post-test were scored over 20 marks with 10 marks as the pass mark. The average mean score of the pre-test was 5.50 (SD =1.61) whilst that of the post-test was 13.29 (SD = 2.59), yielding a mean difference of 7.79. The result clearly shows that there is a significant difference in their academic performance after the intervention. Therefore the t-test analysis was found to be statistically significant at 0.05 significant level (t (41) = 18.81; p=0.00), meaning that the difference between the pre-test average score and the post-test average score was statistically significant. The difference was in favour of the post-test. Hence the multimedia techniques in teaching and learning could significantly influence students' performance in Ecological concept. It was therefore concluded that the use of multimedia techniques to teach Ecological concepts showed a significant difference in first year General Arts students' performance in Integrated Science at New Edubiase Senior High School. Hence the hypothesis was rejected since there was significant difference between the pre-test and post-test.

Research Question 2:

What is the Efficacy of Multimedia Techniques as Compared to the Traditional Method of Teaching in Ecological Concepts?

Hypothesis Testing

To determine whether there was statistically significant difference in the efficacy of multimedia techniques as compared to the traditional method of teaching. The Research Question 2 was formulated into a null hypothesis as:

Ho: There is no significant difference in the efficacy of the use of the multimedia techniques in teaching as compared to traditional method of teaching in Ecological concepts.

The independent sample for two tailed t-test analysis was employed and the mean scores for the tests showed statistical significant difference ($t(80) = 6.10$; $p<0.05$) (Table 6).

Table 6: Results of t-test Analysis on the Efficacy of Multimedia Techniques as Compared with the Traditional Method of Teaching Ecological Concepts

Test	N	Mean	SD	t	df	P-value
Control group	40	9.98	2.30	6.10		0.00
Experimental group	42	13.29	2.59			

Both tests were scored over 20 marks with 10 marks as the pass mark. The average mean score of the control sample test was 9.98 (SD =2.30) while that of the

experimental was 13.29 (SD =2.59), yielding a mean difference of 3.31. The t-test analysis was found to be statistically significant at 0.05 significant level (t (80) = 6.10; p=0.00), meaning that the difference between the traditional method of teaching average score and the multimedia techniques of teaching average score was statistically significant. The difference was in favour of the multimedia techniques of teaching. Hence the multimedia techniques in teaching and learning could significantly influence students' performance in Ecological concept than the traditional method of teaching. It was therefore concluded that the use of multimedia techniques to teach Ecological concepts showed a significant difference in First Year General Arts students' performance in Integrated Science at New Edubiase Senior High School as compared to traditional method of teaching. Hence the hypothesis was rejected since there was a significant difference between the pre-test and post-test.

Research Question 3

What are Perceptions of Students on the Effectiveness of Multimedia Techniques in Teaching Integrated Science Education?

Table 7 indicates the rating of experimental group on the effectiveness of the multimedia techniques integration in Integrated Science as an instructional strategy and some of their responses are illustrated using graphs and charts as shown below.

Table 7 : Results of Student Perception on the use of Multimedia Techniques in Integrated Science

SN	Items / Satisfaction with multimedia techniques.	SD n(%)	D n(%)	N n(%)	A n(%)	SA n(%)	MS	SD
1	I was more enthusiastic and motivated during the use of multimedia techniques in teaching and learning of Ecological concepts	1/ (2.4)	1/ (2.4)	3/ (7.1)	10/ (23.8)	27/ (64.3)	4.45	0.92
2	The use of multimedia techniques in teaching and learning motivates students in practicing and applying what has been taught in class	1/ (2.4)	2/ (4.8)	3/ (7.1)	12/ (28.6)	24/ (57.1)	4.33	0.98
3	The used of multimedia techniques promotes the students' understanding of concepts and do away with rote learning memorization of facts	0/ (0.0)	1/ (2.4)	2/ (4.8)	18/ (42.9)	21/ (50.0)	4.41	0.70
4	The use of multimedia techniques in teaching and learning is an effective way to sustain the interest of students of all abilities	1/ (2.4)	1/ (2.4)	1/ (2.4)	12/ (28.6)	27/ (64.3)	4.50	0.86
5	The use of multimedia techniques in teaching and learning arouse and sustains students interest in the cause of study	1/ (2.4)	3/ (7.1)	2/ (4.8)	9/ (21.4)	27/ (64.3)	4.38	1.04
6	The use of multimedia techniques would not make the student feel more involved and cooperate in class	23/ (54.8)	17/ (40.5)	0/ (0.0)	1/ (2.4)	1/ (2.4)	4.48	0.67
7	The use of multimedia techniques in teaching and learning is not an effective means of helping students to understand relationships among concepts	23/ (54.8)	17/ (40.5)	2/ (4.8)	0/ (0.0)	0/ (0.0)	4.50	0.60
8	The use of multimedia techniques in teaching and learning would affect my learning during my private lesson in a negative way	15/ (35.7)	21/ (50)	3/ (7.1)	2/ (4.8)	1/ (2.4)	4.12	0.92
9	Teachers should not be encouraged to use multimedia techniques in teaching and learning of Integrated Science	20/ (47.6)	17/ (40.5)	3/ (7.1)	1/ (2.4)	1/ (2.4)	4.3	0.89
10	Multimedia techniques in teaching and learning will go a long way to facilitate the study of Integrated Science	1/ (2.4)	0/ (0.0)	1/ (2.4)	8/ (19.0)	32/ (76.2)	4.67	0.75

Student's Perceptions of Multimedia Techniques

Item 1: I was more enthusiastic and motivated during the use of multimedia techniques in teaching and learning of Ecological concepts.

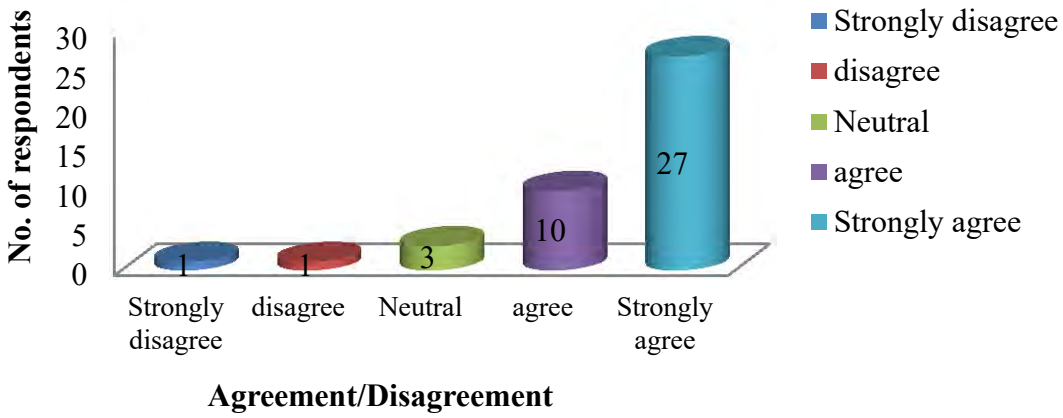

Fig. 1: Multimedia techniques motivate students' interest in learning ecological concepts

From Figure 1, the results show that 37 students representing 88.1% of the respondents agree/strongly agreed while 2 students representing 4.7% disagree/strongly disagree that "multimedia techniques motivate students in Ecological Studies.

Item 2: The use of multimedia techniques in teaching and learning motivates students in practicing and applying what has been taught in class.

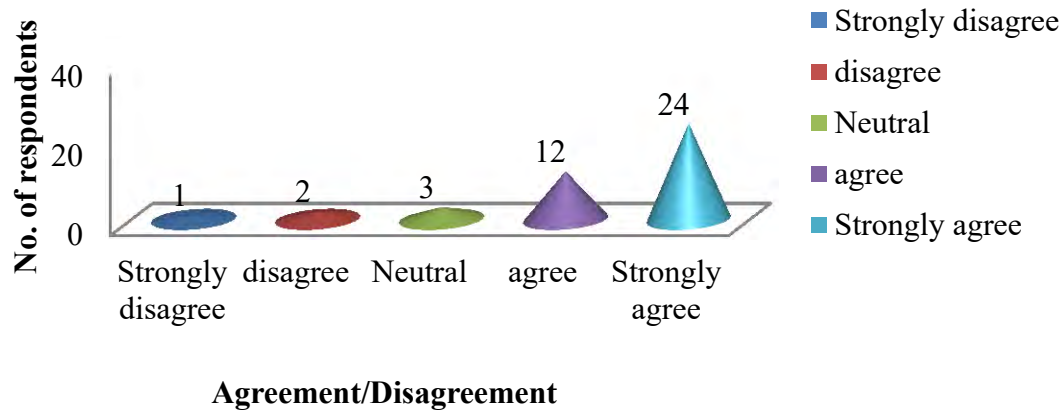

Fig. 2: Multimedia techniques motivate students to practice what they learn in class

The results as shown if Figure 2 indicates that 36 students representing 85.7% of the respondents agreed/strongly agreed that multimedia techniques motivate student to practice what have been learned. However, 3 students representing 7.1% did not agreed/disagreed.

Item 3: The use of multimedia techniques would promote the student understanding of concepts and do away rote learning memorization of facts

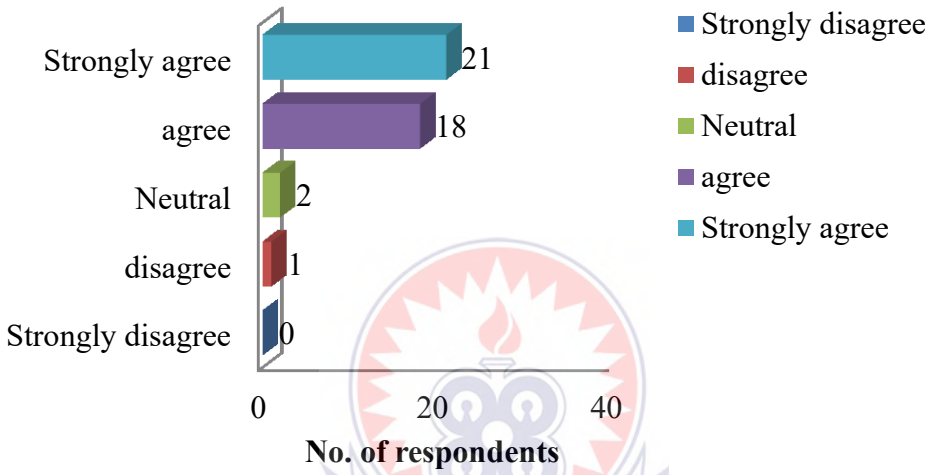

Fig. 3: Multimedia techniques promote students' understanding and do away with rote learning

As noted in Figure 3, 39 students representing (92.9%) of the respondents agreed/strongly agreed that "multimedia techniques promote the students' understanding of concepts and do away rote learning and memorization of facts" However, 1student representing 2.4% of disagreed while 2 students representing 4.7% did not agreed or disagreed.

Item 4: The use of multimedia techniques in teaching and learning is an effective way to sustain the interest of students of all abilities.

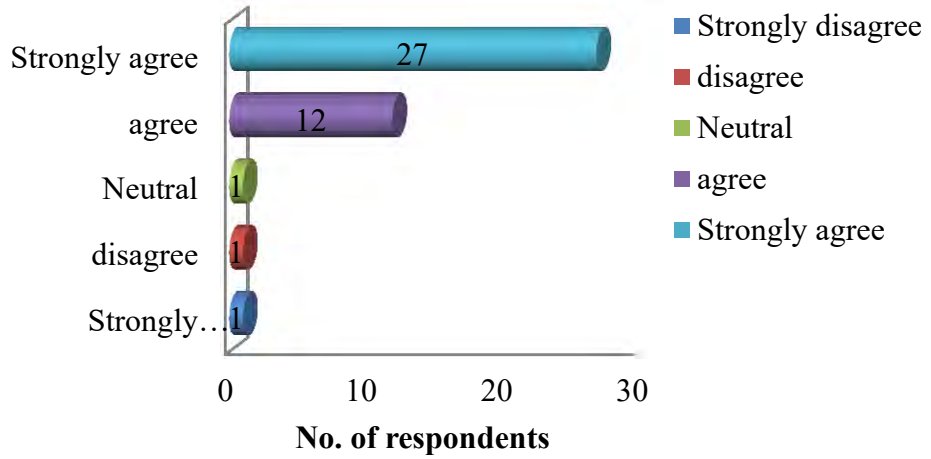

Fig. 4: Multimedia techniques sustains the interest of students' of all abilities

From Figure 4, 39 students representing (92.9%) of the respondents agreed/strongly agreed that multimedia techniques in teaching and learning is an effective way to sustain the interest of students of all abilities, whiles 2 students representing 4.7% are in total disagreement to item 4.

Item 5: The use of multimedia techniques in teaching and learning arouse and sustain students' interest in the cause of study.

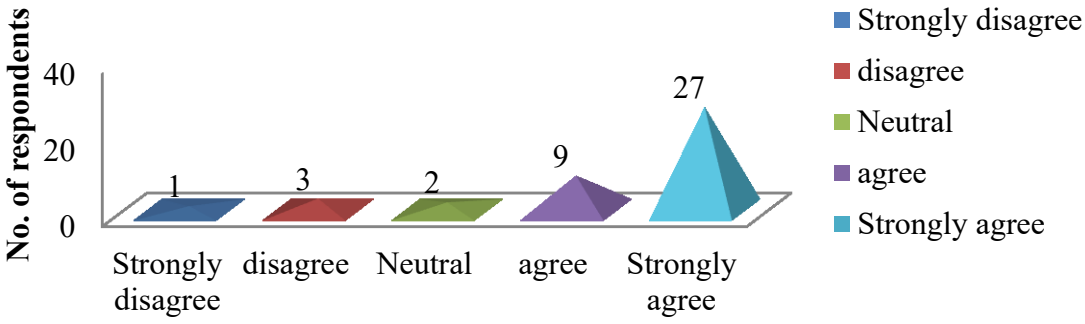

Fig. 5: Multimedia techniques arouses and sustains the interest of students in the cause of study

Figure 5, indicate that 36 students representing 85.7% of the respondents agreed/strongly agreed that multimedia techniques in teaching and learning arouse and sustain their interest in the cause of study. However, 4 students representing 9.5% disagree/strongly disagreed while 2 students representing 4.7% neither agreed nor disagreed.

Item 6: The use of multimedia techniques would **not** make the student feel more involved and cooperate in class.

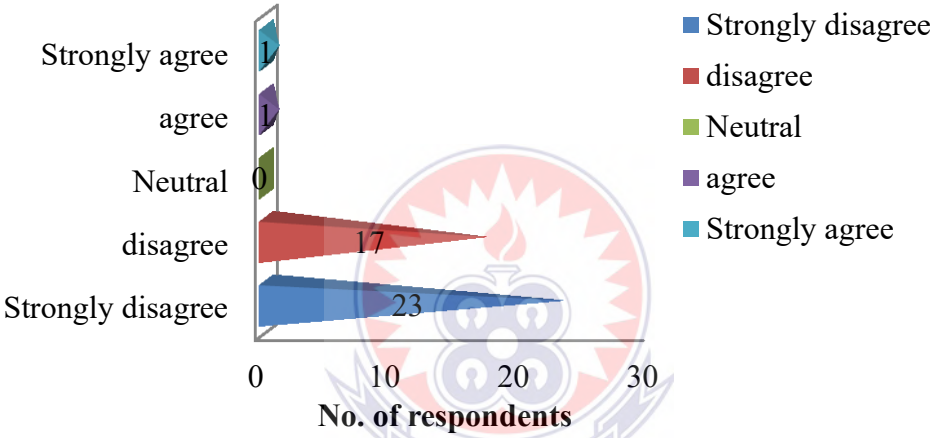

Fig. 6: The use of multimedia techniques do not involved students' in the class

According to Figure 6, 40 students representing 95.3% of the respondents disagree/strongly disagree that multimedia techniques did not involve them in class. However, 2 students representing 4.7% agreed/strongly agreed to the statement.

Item 7: The use of multimedia techniques in teaching and learning is **not** an effective means of helping students to understand relationships among concepts.

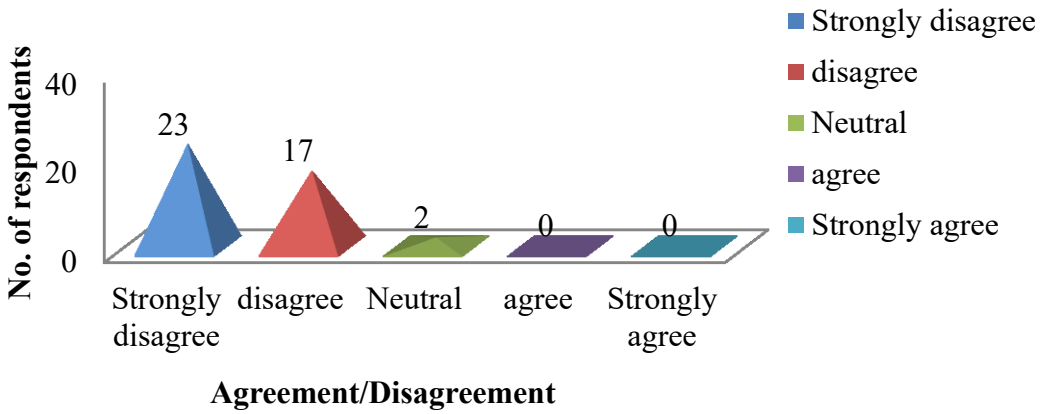

Fig. 7: Multimedia techniques do not help students to understand the relationship among concepts

As observed in Figure 7, 40 students representing (95.3%) of respondents disagree/strongly disagreed that multimedia techniques in teaching and learning is not an effective means of helping students to understand relationships among concepts whiles 2 students representing 4.7% neither agreed nor disagreed.

Item 8: The use of multimedia techniques in teaching and learning would affect my learning during my private lesson in a negative way.

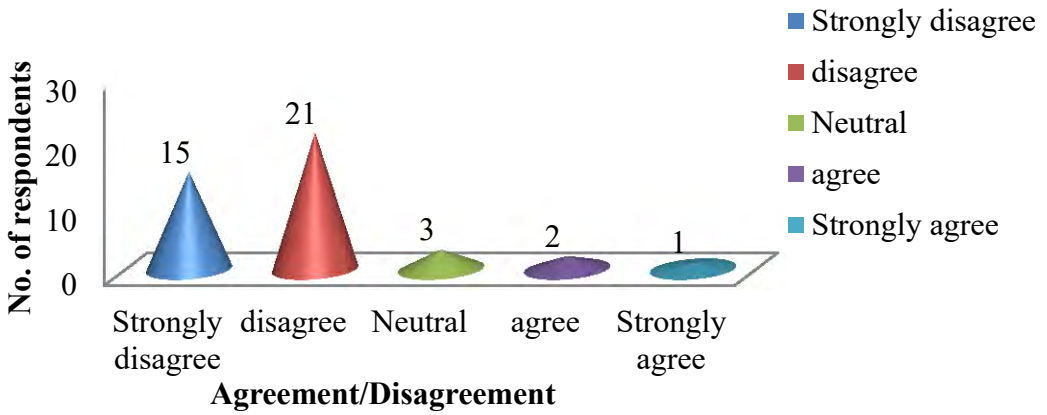

Fig. 8: Multimedia techniques affect students negatively during private studies

As noted Figure 8, 36 students representing 85.7% of the respondents strongly disagree/disagreed that multimedia technique in teaching and learning would affect them during their private lesson in a negative way. However, 3 students representing 7.1% of the respondents agreed/strongly agreed to that assertion.

Item 9: Teachers should **not** be encouraged to use multimedia techniques in teaching and learning of Integrated Science.

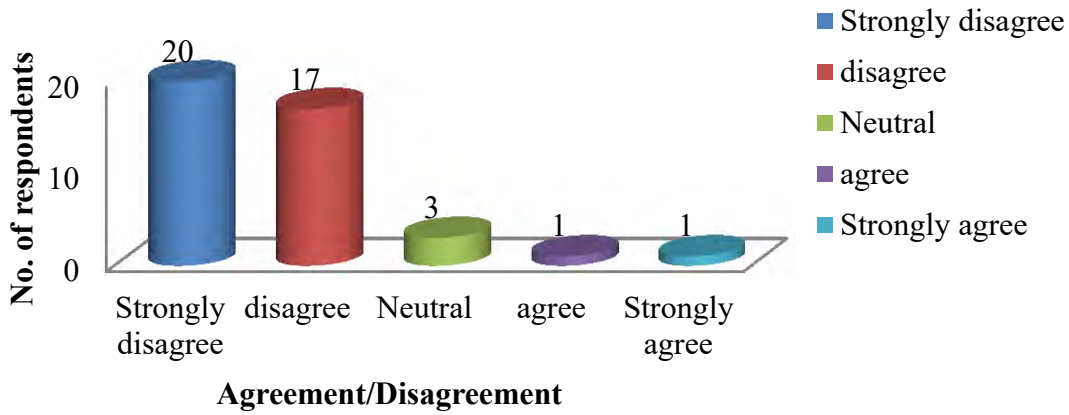

Fig. 9: Multimedia techniques should not be encouraged as teaching instruction in integrated science.

As reflected in Figure 9, 37 students representing 88.1% of the respondents strongly disagreed/ disagreed with the statement that teachers should not be encouraged to use multimedia techniques in teaching and learning of Integrated Science, as against 2 students representing 4.7% who agree to that.

Items 10: Multimedia techniques in teaching and learning will go a long way to facilitate the study of integrated science.

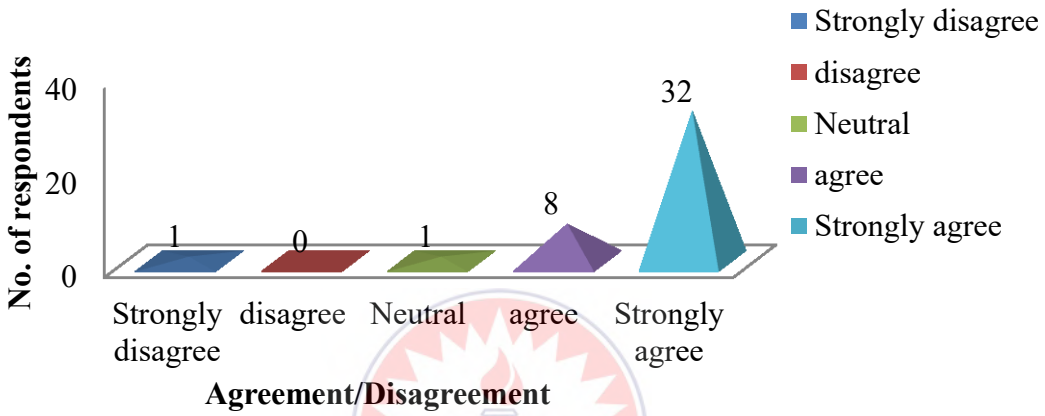

Fig. 10: Multimedia techniques facilitate the studies of integrated science

From Figure 10, the results show that 40 students representing 95.2% of the respondents strongly agreed/ agreed that multimedia techniques will facilitate the study of Integrated Science while 1 student representing 2.3% strongly disagreed to the statement. Likewise, 1 students representing 2.3% neither agreed nor disagreed with the statement given in item 10 as illustrated in Fig. 10.

DISCUSSION

Research Question One: What is the Difference in Performance of Students in Ecological Concepts after being exposed to Multimedia Techniques?

With respect to research question one, the finding reveals that there was a significant difference between the pre-test and post-test thus; (t (41) = 18.81. That implication is that, the Multimedia techniques in teaching and learning approach improved students' academic achievement since the post-test mean score was higher (13.29) as against the pre-test (5.50). The average score difference between the two tests is statistically significant (0.00) at an alpha level of 0.05. This implies that students performed better when multimedia techniques were used in the teaching and learning process. This finding is in line with similar studies (Roden, 1991; Carlson & Falk, 1989) which suggest that superior academic performance is achieved when multimedia forms of instruction are utilized.

Multimedia is multi-sensory that stimulates multiple senses of the audience at a time. Its interactive nature makes it exceptional. Gilakjani (2012) mentioned three reasons and rational for using multimedia in a classroom. According to the author, multimedia use increases students' interest level, enhances their understanding and increases their memorizing ability. Multimedia is able to provide a variety of learning styles at the same time to cater for different students and address individual differences (Pippert, 1999). Multimedia can present different phenomena and processes vividly, simulate complex content and present different levels of abstraction. This helps to facilitate meaning and authentic learning. Multimedia can be useful when students have low motivation and lack prior knowledge.

Multimedia has been one of the most well-known and effective training tools and was referred to as technological wave of the future (Harris, 1993).

In conclusion, multimedia techniques have improved students' academic performance.

Research Question 2: What is the Difference in Efficacy of Multimedia Techniques as Compared to the Traditional Method of Teaching?

The post intervention results from the tests indicated that, there is much improvement in the students' academic performance in the multimedia instruction as compared to the traditional methods of teaching. The overall mean score indicates a positive outcome. The implication is that students were able to score good grades on the subject after been introduced to multimedia technique during instructions within the intervention period of this research. This is in line with a study conducted by Amthor (1991) which found that interactive video method of instruction improved achievement by over 38 percent. Also a study conducted by Roden (1991) found that multimedia method of instruction enhanced students' learning experience by 30 percent faster than their counterparts in traditional classroom. Similarly, a study was conducted which aimed at comparing the efficiency of the teachers' traditional explanation and multimedia method in the students' academic achievement and attitudes. The result of the study indicate that the academic achievement of the experimental group rose as a result of using the multimedia method as there were statistically-significant differences of the average achievement in favour of the experimental students who used the multimedia teaching (Aloraini, 2012).

Multimedia teaching overcomes the traditional method of teaching which is teacher-centered; it shifts the focus to the students. The students are likely to be addicted to it due to the abundance of network information and games. With the absence of the teacher the students' interests are also catered for with the addition of videos and games.

Research Question 3: What is Students' Perception on the Effectiveness of Multimedia Techniques in Enhancing Integrated Science Education?

The results from the questionnaire indicate that students had a good interest in the multimedia techniques during teaching and learning. The overall mean score for each sub-scale (swmt) are above 4.0 indicating positive interest in the multimedia techniques. The implication is that students were motivated in the classroom, which then have positive effect on their understanding of the concept and enhance their studies. This was not surprising since there has been a conscious effort by the researcher to facilitate students' understanding and performance, by introducing the multimedia techniques in teaching the selective concepts in Ecological studies. The finding is in line with the study conducted by Falk and Carlson (1992) which indicated that the use of multimedia techniques lead to enhanced learning on criteria such as acquisition of content, development of skills and efficiency of learning and satisfaction with instruction. Also, Moore (2000) opines that multimedia has a positive effect in the development of higher cognitive skills in science learning.

CHAPTER FIVE

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

Overview

This chapter presents summary of findings, conclusion, recommendations and suggestion for further studies.

Summary of Findings of the Study

This section focuses on the summary of the major findings of the study. It looks at the summary of the Integrated Science students' performance on some ecological concepts in New Edubiase S. H. S. Purposive sampling technique was used to select the classes for the study. Two equivalent classes were selected for the study; this was obtained from the pre-intervention test (Pre-test) which was carried out before the intervention activities.

The major summary of key findings from the above analysis of the Research Questions that guided this Research studies are as follows;

Knowledge is known to be a strong determinant factor of academic achievement in all subjects. Science can be understood by learners only when teachers use the right methodologies, adequate and appropriate Teaching and Learning Materials and right techniques are employed in the teaching and learning processes. The teaching methods have a significant main effect on the academic achievement of the students. Multimedia has shown positive effect in the development of higher cognitive skill in the Science teaching (Moore, 2000) as observed in this study.

The finding from the discussed research question one, hypothesis suggests that, there was an increase in the academic performance of the students in the post test in the experimental group which is depicted in the Table 5.

Secondly, from the research question two, hypothesis suggests that, there was an increase in the academic performance of the students in the experimental group which is depicted in the Table 6. The average mean score of the control sample test was 9.98 (SD =2.30) whilst that of the experimental was 13.29 (SD =2.59), yielding a mean difference of 3.31. The t-test analysis was found to be statistically significant at 0.05 significance level (t (81) = 6.16; p=0.00), meaning that the difference between the traditional method of teaching average score and the multimedia techniques of teaching average score was statistically significant. The difference was in favour of the multimedia techniques of teaching. Hence the multimedia techniques in teaching and learning could significantly influence students' performance in Ecological concepts than the traditional method of teaching.

The research question three, students foresee that multimedia techniques should be employed in the teaching and learning of Integrated Science. In the entire test items (swmt) indicated mean score above 4 (agreement). The average mean score of the entire test items (swmt) was 4.40 (agreement).

Conclusions

Based on the finding of the study, the following conclusions were made:

Mayer (2005), states that "People learn better from word and picture than from words alone." That using both words and picture is more effective than words alone. This conformed to how the brain processes information (Baddeley, 1992). Mayer (2005) also opines that narration and video is much more effective than narration and text. Hence, the of Multimedia techniques in teaching and learning influence the performance of students in the New Edubiase Secondary School.

The implementation of multimedia techniques in teaching and learning which invariably influences students' performance in the post-test administered. This is so because, the result of the post-intervention indicated positive results. The achievement of the Integrated Science students in New Edubiase Senior High School (NESS) in the post-test attests to the impact of the multimedia techniques in teaching and learning.

Recommendations

The following recommendations have been suggested based on the findings of the study:

It is recommended that students in New Edubiase Senior high School should be taught using multimedia techniques to improve their academic performance in Integrated Science.

Teachers should be assisted through in-service training by the stakeholders to used multimedia for instruction to improve students' performance in New Edubiase Secondary School.

Ghana Education Service should advocate for the inclusion of the multimedia techniques in teaching and learning to facilitate the academic achievement of the students at all levels of education.

Suggestion for further studies

It is suggested that, further studies should be conducted on other concepts in Integrated Science in Senior High Schools to study more on the impact of the multimedia techniques on student academic achievement.

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APPENDICE A

STUDENTS' QUESTIONNIARE

TEACHING WITH MULTIMEDIA TECHNIQUES

INSTRUCTIONS

Thank you for taking time to complete this questionnaire. Please answer each question to the best of your ability. Your thoughtful and truthful responses will be greatly appreciated. **Your individual name or any identification number will not at any time be associated with your responses.** Your responses will be kept completely **confidential** and will not influence your course grade and any of your examination results anywhere.

Please read the following statement s and kindly provide the information required.

A. Background information

Please tick [✓] in the appropriate space provided below and supply answers where required.

1. Name / ID no ……
2. Gender [ ] Female [ ] Male
3. Age……..years
4. What is your pre-entry qualification?

   [ ] MSLCE [ ] BECE

   If any other specified……

STATEMENT	SA	A	N	D	SD
I was more enthusiastic and motivated during the use of multimedia techniques in teaching and learning of Ecological concepts					
The use of multimedia techniques in teaching and learning motivates students in practicing and applying what has been taught in class					
The used of multimedia techniques would promote students understanding of concepts and do away with rote learning memorization of facts					
The use of multimedia techniques in teaching and learning is an effective way to sustain the interest of students of all abilities					
The use of multimedia techniques in teaching and learning arouse and sustains students' interest in the cause of study					
The use of multimedia techniques would not make the students feel more involved and cooperate in class					
The use of multimedia techniques in teaching and learning is not an effective means of helping students to understand relationships among concepts					
The use of multimedia techniques in teaching and learning would affect my learning during my private lesson in a negative way					
Teachers should not be encouraged to used multimedia techniques in teaching and learning of Integrated Science					
Multimedia techniques in teaching and learning will go a long way to facilitate the study of integrated science					

APPENDIX B1

Students' Achievement in Ecological Concept Test (ONE) **Time: 15mins**

Subject: Integrated Science **Pre-Test**

GENERAL INSTRUCTION: Please choice one from the best option from the (**A-D**) which best answer the question given. **Answer all the questions on this paper.**

1. Which of the following best defines the term 'population'?

   a) People living in a given area
   b) People and a few organisms living in a niche
   c) People and a few organisms living in a biome
   d) People and other organisms living in a given area

2. Temperature is an example of:

   a) A producer
   b) A biotic factor
   c) An abiotic factor
   d) A secondary consumer

3. The food chain grass ⟶ sheep ⟶ man includes:

   a) Producer, Secondary consumer and Tertiary consumer
   b) Producer, Primary consumer and Secondary consumer
   c) Primary consumer, Secondary consumer and decomposer
   d) Primary consumer, Secondary consumer and tertiary consumer

4. Why are decomposers important in the ecosystem?

a) Because they are also living organisms

b) Because they help in the recycle process

c) Because they form part of the food chain

d) Because they are at the tail end of the food chain

5. What are the causes of flooding in our community?

a) Urbanization and over population

b) Weed and garbage around the house

c) Throwing of water in gutters and sewage around

d) Weed grown along water ways and throwing of garbage in gutters

6. Among the symbioses relationship which one is harmful to it host

a) Mutualism

b) Parasitism

c) Commensalism

d) Epiphytism

7. Which tropic level has the largest organisms and possesses the largest energy in the food chain?

a) Producer

b) Primary consumer

c) Secondary consumer

d) Tertiary consumer

8. Tropic level are formed by

a) Only plants
b) Only animals
c) Only carnivorous
d) Organisms linked in food chain

9. The percentage of oxygen and carbon dioxide is:

a) 20.95% and 0.04%
b) 20.00% and 0.40%
c) 2 0.95% and 0.004%
d) 20.00% and 0.44%

10. Which of this statement best describe food web?

a) It is the energy flow in the ecosystem
b) It is the energy flow chart in the ecosystem
c) It is a number of food chain linked together
d) It is organisms linked through their feeding habit

11. A quadrat is used to sample:

a) Land animals
b) Land vegetation
c) Floating organisms of a marine habitat
d) Floating organisms of a freshwater habitat

12. Why is it not good to defecates at open places?

    a) Because it will not decay
    b) Because it spread diseases
    c) Because it is not pleasant to the eye
    d) Because some animals will feed on it

13. Why is it not good to burn bush after weeding on farm?

    a) Because it hardens the soil
    b) Because it cause soil erosion
    c) It expose the soil to harsh conditions
    d) Because it kill the organism on the farm

14. Human activities are responsible for the following effects on the earth or its atmosphere except:

    a) Global warming, acid rain
    b) Population increase, acid rain
    c) Global warming, population increase
    d) Increase in gravitational pull on the earth, lead poisoning

15. Phytoplankton acts as primary consumer in the aquatic habitat. TRUE/FALSE

16. Deforestations increase the amount of Carbon dioxide in the atmosphere.
    TRUE/FALSE

17. Global warming is predicted to the cause of flooding in the coastal areas.
    TRUE/FALSE

18. Salinity of water cannot determine the types of fishes found in the water.

    TRUE/FALSE

19. Epiphytes are plants that grow on plant and are supported by that plant.

    TRUE/FALSE

20. Aquatic organisms do not need sunlight for their survivor. TRUE/FALSE

APPENDIX B2

Students' Achievement in Ecological Concept Test (Two) **Time: 15mins**

Subject: Integrated Science **Post-Test**

GENERAL INSTRUCTION: Please choice one from the best option from the (**A-D**) which best answer the question given. **Answer all the questions on this paper.**

1. Which of the following best defines the term 'community'?

   a) All people living in a given area
   b) All people and a few organisms living in a niche
   c) All people and other organisms living in a given area
   d) All populations of all the different species in a habitat

2. Symbiosis is an example of:

   a) A producer
   b) A biotic factor
   c) An abiotic factor
   d) A secondary consumer

3. Which of this best describe a three links food chain in ecosystem?

   a) Producer, Secondary consumer and Tertiary consumer
   b) Producer, Primary consumer and Secondary consumer
   c) Primary consumer, Secondary consumer and decomposer
   d) Primary consumer, Secondary consumer and tertiary consumer

4. Why are plants important in the ecosystem?

a) Because they are also living organisms

b) Because they help in the recycle process

c) Because they form the base of food chain

d) Because they are at the tail end of the food chain

5. A quadrat is used to sample:

a) Floating organisms of marine habitat

b) Floating organism of freshwater habitat

c) Land animals

d) Land vegetation.

6. Among the symbioses relationship which one is harmful to it host

a) Mutualism

b) Parasitism

c) Commensalism

d) Epiphytism

7. Which tropic level possesses the lower energy in the food chain?

a) Producer

b) Primary consumer

c) Secondary consumer

d) Tertiary consumer

8. Organism that forms the phytoplankton of a pond are:

a) Fish
b) Toad and crabs
c) Water lily species
d) Diatom and blue-green bacteria

9. Ozone layer is form from

a) Oxygen
b) Carbon
c) Hydrogen
d) Nitrogen

10. Which of this statement best describe food web?

a) It is the energy flow in the ecosystem
b) It is the energy flow chart in the ecosystem
c) It is a number of food chain linked together
d) It is organisms linked through their feeding habit

11. What one best describe the agent of Air pollution:

a) Cooking
b) Farming
c) Fishing
d) Driving

12. What is the hottest layer of the atmosphere, which can reach temperature above 1000 degrees Celsius?

    a) Mesosphere
    b) Troposphere
    c) Thermosphere
    d) Stratosphere

13. Which of these causes the greenhouse effect?

    a) Excess of nitrogen in the atmosphere
    b) Excess of carbon dioxide in the atmosphere
    c) Heat from cooking fires of ever-increasing population
    d) None of the above

14. What is the atmosphere layer closest to the ground?

    a) Mesosphere
    b) Troposphere
    c) Thermosphere
    d) Stratosphere

15. Zooplankton acts as primary consumer in the aquatic habitat. TRUE/FALSE

16. Deforestations increase the amount of oxygen in the atmosphere. TRUE/FALSE

17. Global warming is predicted to the cause of flooding in the coastal areas. TRUE/FALSE

18. Salinity of water cannot determine the types of fishes found in the water.

    TRUE/FALSE

19. Epiphytes are plants that grow on plant and are feed that plant. TRUE/FALSE

20. Plant does NOT depend on sunlight for their survivor. TRUE/FALSE

APPENDIX C

Marking Scheme for Pre-Test

D	**B**
C	**B**
B	**D**
B	**D**
D	**FALSE**
B	**TRUE**
A	**TRUE**
D	**FALSE**
A	**TRUE**
C	**FALSE**

Marking Scheme for Post-Test

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

APPENDIX D

New Edubiase Senior High School Integrated Science performance in WAEC Examinations

Year	Number of students that wrote	Number of students that passed	Pass rate % A1 to C6	Remark
2017	462	375	81.16	**Good performance**
2018	625	343	54.88	**Performance dropped as compared to the 2017**
2019	562	53	9.43	**Poor performance**

Source: New Edubiase Senior High School