EFFECTS OF MULTIMEDIA INSTRUCTION ON SS1 BIOLOGY STUDENTS ACADEMIC ACHIEVEMENT AND RETENTION IN BOSSO LOCAL GOVERNMENT AREA

BY

YUSUF HAMZIYAH

2016/1/59124BT

DEPARTMENT OF EDUCATIONAL TECHNOLOGY

FEDERAL UNIVERSITY OF TECHNOLOGY MINNA, NIGER STATE.

APRIL, 2023

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background of the Study

Biology is a branch of natural science that studies living things. How the world is organized, how it functions and what these functions are, how it evolves, how living creatures came into being, and how they interact with one another and their environment (Umar, 2011). Medicines, pharmacy, nursing, agriculture, forestry, biotechnology, nanotechnology, and a variety of other fields are included (Ahmed & Abimbola, 2011).

Biology is regarded as one of the most important subject in secondary school. Biology attracted more pupils than physics and chemistry in the senior secondary school certificate examination (SSCE) because of its importance (West African Examination Council, 2011). Biology is taught to pupils in senior secondary school as a foundation for human development, where career skills are honed and potentials and talents are identified and developed (Federal Republic of Nigeria, 2013). Secondary school pupils receive science instruction that is geared toward training future scientists, technologists, engineers, and related professionals (Kareem, 2015). Despite the importance and popularity of biology among Nigerian students, senior secondary school students have performed poorly (Ahmed, 2018). Nigeria may face personnel shortages in scientific and technology-related subjects as a result of this educational failure.

One of the key causes contributing to students' poor performance in biology in Nigeria has been recognized as poor teaching methods used by teachers at the senior secondary school level (Ahmed & Abimbola, 2011; Umar, 2011). The classroom-based convectional teaching approach consists of lectures and direct directions given by the teacher. This teacher-centered approach

stresses learning at all times through the teacher's leadership. Students are expected to pay attention to lectures and take notes. Instead of encouraging students to interact, ask questions, or fully comprehend the material, the teacher frequently speaks at them. The majority of classes use rote learning, in which students rely on memorization rather than having a thorough knowledge of the subject. Simply passing the exams, which consist of descriptions matching, and other forms of indicators, is all that matters to complete the curriculum (Adegoke, 2011; Umar, 2011).

Students become passive rather than active learners as a result of their continued usage of this strategy. It does not encourage in-depth learning and long-term recall of some complex biological notions (Ahmed, 2018; Ahmed & Abimbola, 2011; Umar, 2011). Educators see a compelling need to reevaluate teaching strategies and procedures at the senior secondary school level based on research findings. To solve these issues, a technology-enabled instructional system that promotes meaningful learning is required. A stimulating and captivating method should be supported in the twenty-first century to help students better learn, grasp, and retain biology ideas while also encouraging their future involvement. According to Adegoke (2010); Mayer, Dow, and Mayer (2013), and Moreno and Mayer (2013), multimedia presentations supported in visual and verbal formats augmented with photos, animations, texts, and narration.

Multimedia is a term frequently heard and discussed among educational technologists today. Unless otherwise specified, the word can also refer to the development of computer-based hardware and software packages that are mass-produced but nevertheless allow for individualized use and learning. Multimedia, in essence, combines many levels of learning into one instructional instrument that allows for curricula presentation flexibility. Multimedia, according to Mayer (2013), is an exciting combination of computer hardware and software that allows you to integrate video, animation, audio graphics, and test resources to create successful

presentations on a low-cost desktop computer. However, according to Philips (2020), “Multimedia is characterized by the presence of text, pictures, sound animation and video, some or all of which are organized into some colorant programme. Today's multimedia, on the other hand, is a meticulously woven mix of text, graphic, sound, animation, and video elements. It becomes interactive multimedia when the end user, i.e. the viewer of a multimedia project, has control over "what," "when," and "how" the pieces are delivered. Multimedia can thus be described as the combination of many media elements (audio, video, graphic, text animation, etc.) into a synergetic and symbiotic totality that benefits the end user more than any of the media elements could deliver alone. The system utilized to deliver instruction is referred to as media. Through the use of a multimedia instructional technique, students' attention and retention could be piqued and maintained (Adegoke, 2010). When students were taught genetics via multimedia, Starbek, Eriavec, and Peklai (2010) found that they retained more information and improved their comprehension abilities than the other groups. Similarly, (Gambari, Yaki, Gana, & Ughovva, 2014; Ilhan, & Oruç, 2016; Park et al., 2019; Saputri & Indriayu, 2014) that using multimedia technique as learning media has positive effects on students learning outcome when compared to the conventional strategy, and that multimedia enhances students learning interest and efficiency. Learning theories must be applied in the design of effective multimedia training.

According to Kim and Gilman (2018). Mayer and his colleagues, for example, proposed six multimedia learning principles: (a) the multimedia principle – students learn better from words and pictures than from words alone; (b) the spatial contiguity principle - students learn better when corresponding words and pictures are presented close or next to each other rather than far apart on the page or screen; (c) the temporal contiguity principle – students learn better when corresponding words and pictures are presented simultaneously rather than successively; (d)

the coherence principle – students learn better when extraneous words, pictures, and sounds are excluded rather than included; (e) the modality principle – students learn better when words in a multimedia are presented as spoken rather than printed text; (f) the redundancy principle – students learn better from animation and narration than from animation, narration, and on-screen text (Mayer, 2013).

According to Adegoke (2011), all six principles have been proven repeatedly in empirical research e.g., Mayer, Bove, Bryman, Mars, and Tapangco (2013) for multimedia principle; Mousavi, Low and Sweller (2014) for modality principle; Mayer has reported findings that were not in consonance with Mayer's (2014) multimedia learning principle. For instance, Muller, Lee, and Sharma (2018) found that the redundancy principle did not transfer to normal classroom situations. In his study, Muller (2018) suggested that addition of interesting information may help maintain the learners' interest in a normal classroom environment.

Other studies have shown that animation may be used effectively and has a favorable impact on instructional message design. Nusir, Alsmadi, Al-Kabi, and Shardqah (2010), for example, discovered that computer animation learning courseware improved students' academic performance and achievement level (high and low)

Moreno and Mayer (2018) and Tabbers (2016) found that learning outcomes of students who learnt biology with courseware version of animation + narration were better than their colleagues who learnt biology either with animation + on-screen text or animation + narration + on-screen text. Mayer and Anderson (2014) reported that simultaneous presentation of animation and narration improved learning. However, Grobe and Struges cited in Saibu (2017)

found that those taught through the conventional teaching methods achieved a mean posttest score slightly higher than those taught by the audio-tutorial (narration) method.

Studies on animation + narration + on-screen text were made evident by Mubaraq's (2009) results that a still picture is better than (sound) words, animation better than a still picture, and sound better than silence. This was supported by Adegoke (2010), Adegoke (2011), and Chuang (2009) in their studies which examined the effect of animation, narration, and on screen text-based materials when combined simultaneously; the result showed that students in the animation + narration + onscreen text group scored significantly higher on the post biology achievement test than their colleagues who were in the animation + narration only group, as well as those who were in the animation + on-screen text group. These studies were also not in agreement with the redundancy principle. However, Okwo and Asadu (2012) reported that three media (video, audio + picture, and audio) were found to be equally effective with no significant difference effect among the means when used for teaching Biology. As a result, the researcher wants to look into the effect of multimedia instruction on biology students' academic achievement and retention in the Bosso local government area of Minna, Niger State, Nigeria.

1.2 Statement of the Problem

Today, biology education appears to be failing. The results of biology students' Senior Secondary School Certificate Examination (SSSCE) in Nigeria are extremely concerning, especially given that the students are expected to become future scientists. According to the West African Examination Council's 2019-2022 Annual Report, for the past five years (2015-2021), the number of students passing biology at credit level (A1-C6) in Nigeria has continuously been less than 50%. Educators see a compelling need to reevaluate teaching strategies and procedures at the senior secondary school level based on research findings. To solve these issues, a technology-enabled instructional system that promotes meaningful learning is required. A stimulating and captivating method should be supported in the twenty-first century to help students better learn, grasp, and retain biology ideas while also encouraging their future involvement. According to Adegoke (2010), Kuti (2006), Mayer, Dow, and Mayer (2006), and Moreno and Mayer (2010), multimedia presentations supported in visual and verbal formats enhanced with pictures, animations, texts, and narration are one of the potential ways.

Multimedia is widely acknowledged as the most effective way to improve learning outcomes. However, biology education has yet to explore the extent to which this has been accomplished. As a result, the purpose of this study is to see how multimedia instruction affects biology students' academic achievement and retention in the Bosso local government area , Minna, Niger State, Nigeria.

1.3 Aims and Objectives of the Study

The study's major goal is to find out the effect of multimedia instruction on biology students academic achievement and retention in Bosso local Government area

Specifically, the study is aimed to determine:

1. How multimedia instruction can improve student’s achievement in Biology

2. How multimedia instruction can improve student’s retention in Biology

1.4 Significance of the Study

The purpose of this research is to investigate the impact of multimedia instruction on biology students' academic achievement and retention in the Bosso local government area of Minna, Niger State, Nigeria. This study will be extremely beneficial to students, teachers, parents, the government, curriculum planners, and the entire country. This assignment will also assist in correcting any student or teacher's misconceptions about multimedia. This research will also assist educators to recognize the importance of incorporating media into education, and it will motivate curriculum planners to build curriculum that incorporates multimedia as a tool to increase learning and understanding in a content area or in a multidisciplinary setting.

Students benefit from the media environment since it allows them to study in ways that they couldn't before. When students are able to select media to gather knowledge in a timely manner, analyze and synthesize the material, and deliver it effectively, they have attained effective integration. Students are more involved in the class and take responsibility for their own learning. Teachers benefit because they have a more positive attitude toward their work and can provide more tailored learning. Through the use of media, the instructor also discovers handy

ways to gather and keep track of pupils' progress. Parents will profit from this research because they will watch their children flourish in Biology class and be able to absorb and comprehend the knowledge and instruction they give to their children.

Benefit to the Nation: This also benefits the country in terms of economic prosperity, which can be achieved through direct job creation in the technology industry as well as the development of a more educated workforce.

1.5 Research Questions

The following research questions were answered in the study:

1. What is the mean achievement scores of students taught biology with Multimedia Instruction and those taught with conventional method?

2. What is the mean retention scores of students taught biology with Multimedia Instruction?

1.6 Research Hypothesis

The following null hypotheses which were tested at .05 level of significance guided this study:

1. HO_1: There is no significant difference between the achievements mean score of students taught using multimedia instruction and students taught using conventional instruction.

2. HO_2: There is no significant difference between the retention mean score of students taught using multimedia instruction and students taught using conventional instruction.

1.7 Scope of the Study

The scope of the study is limited to the effect of multimedia instruction on biology students' academic achievement and retention in Bosso local Government area, Minna, Niger State. This study will take place in two selected secondary school in Bosso Local Government Area in Minna, Niger state. The class of interest is Senior Secondary School I (SS1) biology classes. The content area to be covered in the study will be limited to biology Senior Secondary School I scheme of work week I to week V topics with time frame of 6weeks.

1.8 Operational Definition of Terms

MULTIMEDIA: Is a technique (such as the combining of sound, text and video) for expressing ideas as in communication, entertainment or art in which several media are employed

MULTIMEDIA INSTRUCTION: It refers to learning environments that contains both words and pictures with the intention to promote learning such as illustrated textbooks, narrated slide show presentations, online narrated animations and educational computer games

ACHIEVEMENT: It refers to performance outcomes in intellectual domains taught at school, college and university

RETENTION: Is a person`s ability to transfer new information into their long-term memory so that it is easy for them to recall and put that knowlege to use in the future

CHAPTER TWO

2.0 REVIEW OF RELATED LITERATURE

2.1 Introduction

This chapter provides a review of relevant and related literature under theoretical/conceptual framework and empirical studies. The chapter ends with summary

2.2 Theoretical/Conceptual Framework

2.2.1 Theoretical Framework

This study was anchored on cognitive theory of learning. Inappropriate use of computers in the classroom is as a result of teachers having no theoretical base to inform and guide the instruction. Consequently, these theories have been justified relevant for inclusion in this study to offer frameworks for meaningful teaching and learning using computers, and to provide understanding of philosophies of teaching. For effective multimedia instruction in biology, several learning theories needed to be synthesized in the development of an efficient learning environment to enhance students' achievement and retention.

a. Cognitive theory of multimedia learning

The study is guided by the Cognitive Theory of Multimedia Learning (CTML) designed by Richard E. Mayer in the 1990s. CTML is a cognition model that attempts to build a meaningful connection between words and pictures. The theory explains that students learn more deeply with a combination of words and pictures than with either words or pictures alone. Based on the theory, multimedia brings about meaningful learning, and meaningful learning can only be said to have been achieved if the learner can apply the knowledge of what he/she has learned in new situations. Principles such as multimedia principles, coherence, personalization, and pre-training principles, amongst others, that add more thought specifically to the construction of presentations

are found in the theory (Moreno & Mayer, 2018). These principles are applied in the design of the multimedia instructional packages used in this study.

With the evolution of multimedia in education, learning has gradually moved from the era of the teacher being the repertoire of knowledge or the students being the passive recipients. Now, the role of both teachers and students' have significantly changed. Teachers are now facilitators of learning and students are active participants in the learning process (Oshinaike & Adekunmisi, 2012). Adegoke (2010, 2011) found that learners retain more when a variety of senses are engaged in learning; and that the experience allows them to retain and recall information. Son & Simonian (2016) opined that supplementing traditional teaching classroom with multimedia learning tools could enhance students' motivation to learn, and make them active in the learning process, thereby, improving practice. Likewise, several similar studies have reported the increased academic success of students where multimedia techniques are applied, and this success is attributed to the ability of multimedia technology to capture students interest and get them engaged in the course of learning (Ilhan, & Oruç, 2016; Park et al., 2019; Son & Simonian, 2016). This implies that the mental representation and connections of learning materials in words and pictures enhance students' engagement via active learning (Park et al., 2019). Hence, multimedia, in its many formats, has been found to play a crucial role in education indeed. However, care must be taken when designing multimedia instructions so as not to overload the working memory (Moussa-Inaty et al., 2019).

Also, some studies have shown that learners' cognitive/learning style influences their academic performance. This implies that each individual has a specific way of grasping a particular concept or situation. This specific way of understanding concept or situations is called Learning Style. James and Gardner

(2015) defined learning style as the "complex manner in which, and conditions under which, learners most effectively perceive, process, store, and recall what they are attempting to learn" (cited in Hawkar, 2014, p. 241). Several researchers have investigated the effect of learning style on the academic achievement of students. While some studies found a significant effect of learning style on academic achievement, some did not. For example, studies of Bethel-Eke and Eremie (2019) and Magulod (2019) showed learning styles to impact significantly on learning. However, some studies have debunked the notion that learning style has any significant effect on academic performance. For example, Munir, Ahmad, Hussain, and Ghani (2018); and, Huang, et, al. (2019) do not find any significant relationship between learning style and students' academic performance. Also, while some researchers suggest that learning style issues should be taken into consideration when trying to understand how learners learn more effectively (Kirshner, 2017; Knoll et al., 2016), some other researchers believe that instructional designers do not need to necessarily take students preferred learning style into account to facilitate learning, but rather focus on consideration of mental constraints (Moussa-Inaty et al., 2019). Hence, learning style may be an important variable to also consider and experiment in this study.

Gender inequality, particularly in developing countries is not a new phenomenon. It has been a topic that has drawn the concerns of NGOs, stakeholders, educators, amongst others, which has prompted the cry for equality in education for the girl child. United Nations (UN, 2013) opined that achieving gender equality in education means an equal opportunity for both males and females to have equal learning process, equal learning outcome, as well as equality in external results after leaving school. The issue of gender and academic achievement has for a long time remained a controversial one. For instance, while some studies found a significant effect of gender on students' academic achievement (Heo & Toomey, 2020; Otutola, 2017), some did not

(Akinoso, 2018; Abidoye, 2015; Adigun et al., 2015; Nnamidi & Oyibe, 2016; Powell, 2004). Some researchers, therefore, concluded that male and female students would perform equally the same if they are exposed to the same type of instructions (Huang et al., 2019; Moussa-Inaty et al., 2019). Therefore, as Calsmith (2007) opined, the influence of gender and differences in academic performance is a complex task, making many studies appear to be contradictory. Hence, while Gender has been linked with the performance of students in several studies, but with no definite conclusion, this study aims to add to the body of literature in the area, and also find out if multimedia instructional packages could help enhance gender equality in the academic achievement of students in Biology.

2.2.3 Conceptual Framework

The Conceptual framework in this study is a group of concepts that are broadly defined and systematically organized to provide a focus, rationale, and tool for the integration and interpretation of learning experience in Biology using Multimedia instruction. The conceptual framework of this study includes brief history of computers in education, Multimedia instruction, Multimedia instruction as an effective teaching method, conventional lecture method of science teaching and Information and Communication Technology (ICT) skills needed by science teachers today for effective implementation of Multimedia Instruction.

(a) Brief History of Computer Education in Nigeria

Although, the first computers were not meant to be an educational tool; the Electronic Numerical Integrator and Computer (ENIAC) was the first large-scale electronic digital computer built for calculations in United States (Shurkin, 2006). Educators soon recognized the computer's academic potential. Computers soon replaced the slide rule and other primitive devices that allowed students to calculate mathematical problems with more accuracy (Molnar, 2009).

PLATO, an acronym for Programmed Logic for Automatic Teaching Operations was one of the first generalized computer-assisted instruction systems, originally built by the University of Illinois.

In recognition of the value of computer in Nigeria, the Federal Government of Nigeria decided to introduce computer education into the nation's secondary school system during the 32nd ministerial council meeting of the National Council on Education in 1987. This was followed by the inauguration of the National Committee on Computer Education the same year. The functions of the committee according to Olu and Abiodun (2009) include planning for a dynamic policy on computer education and literacy in Nigeria as well as devising clear strategies and terminologies to be used by the Federal and State governments in introducing computer education. The general objectives of the policy include to bring about a computer literate society in Nigeria; enable school children to appreciate and use the computer in various aspects of life and in future employment (Report on National Committee on Computer Education, 1988). According to the National Computer Policy (1988), the first objective isto ensure that the general populace appreciates the impact of information and computer technology on today's society, the importance of its effective use, and the technologies that process, manage, and communicate the information. The second general objective is to ensure that the people of Nigeria will know how to use and program computers, develop software packages, understand the structure and operation of computers and their history, and to appreciate the economic, social and psychological impact of the computer.

The modalities and the strategies for achieving the stated objectives include training teachers and associated personnel, provision of hardware facilities, curriculum development, software development and evaluation and maintenance of hardware and peripherals. The policy

recommends a continuous evaluation of progress. The starting point of this evaluation is to compare existing school practice with policy stipulations. This will provide a framework for policy revision. Furthermore, in order to adequately respond to the changing needs of the schools, it is necessary for the Ministry of Education, curriculum developers, and teacher trainers to understand existing practice as compared to national goals.

(b) Multimedia Instruction

One of the most recent and progressive methods of teaching science is Multimedia Instruction (Leach, 2015). The computer is simply an electronic device or machine that accepts data, processes data and gives out output with great speed and accuracy. Multimedia Instruction consists of instructional messages that contain words (such as printed or spoken text) and pictures (such as illustrations, diagrams, photos, animation, or video). The rationale for multimedia instruction is that people can learn more deeply from words and pictures than from words alone. In its traditional form, Multimedia Instruction relies on software that presents information and guides a learner through a series of subject matter, objectives, quizzing the student periodically and assessing progress to a mastery level. Multimedia Instruction does not supplant or fully replace the teacher in a classroom environment. The computer has many purposes in the classroom that can be utilized to help a student in all areas of the curriculum. The computer-aided instructional program allows students to study science concepts while advancing at their own pace, enabling them to spend the necessary time on each subject lesson. The teacher's role in this environment is to provide targeted help to students when they need aydditional assistance.

(c) Types of Multimedia Instruction Software in Education

Educational classrooms use multimedia formats from various media. Text and graphics include slideshows, presentations, diagrams and infographics. Audio includes podcasts and recordings. Screen captures, lecture captures and animation are examples of video components of multimedia. Other multimedia components include blogs, vlogs, webinars and other interactive content. There are many ways to use different types of multimedia, either individually or layered for a deeper understanding of a school subject. Audiobooks are ideal for second-language learners. Song files and music videos can be used to compare social norms in different eras. A teacher who is adept at different types of multimedia can offer their students a better understanding of the subject.

(d) Multimedia Instruction as an Effective Teaching Method

Collier (2014) found that instruction supplemented by properly designed multimedia is more effective than instruction without multimedia. Computers can be used for text and test reading, games, tutorial, drill and practice, and simulation of laboratory experiments. Multimedia instruction plays an important role in classrooms and laboratory work not as substitute for other activities but as an additional tool. Cuoco and Goldenberg (2017) found in a Mathematics curriculum that Multimedia offered the learner the ability to play with concepts in order to visualize results. The researchers went further to say that learners who could manipulate formulae, variables, and models independently using a multimedia instruction based tool gained a better working knowledge of concepts compared to learners listening to the same concepts presented by lecture. Bergman and Cheney (2014) established that multimedia instruction increases learner knowledge when it involves the synergy of multiple senses. This implies that learners would retain new knowledge better when the curriculum is presented with a

combination of formats of text, sound, graphics and video. Mahmood (2014) supported this view that there was significant difference in critical thinking skills between students who received multimedia instruction and students that did not. Multimedia instruction gives students immediate feedback from the computer. Interactions between instructors and students, as well as peer interactions between students are requisite to facilitate critical thinking and promoting enriched learning. A major advantage of multimedia instruction is that, by necessity, it requires the student to be an active participant in the learning process. In order to progress from one screen of information to the next, in most cases, the student must respond using the computer's peripheral hardware (e.g. keyboard, mouse, joystick, or specially-designed devices) (Scott, 2007). As a result, it is impossible for students to assume the role of a mere observer.

(e) ICT Skills Needed by Science Teachers Today for Effective Implementation of Multimedia Instruction

Lack of ICT skills of teachers are major obstacle to the realization of Multimedia Instruction related goals. The UNESCO (2018) ICT competency standards for teachers, describes three skills needed by the science teacher: technological literacy, knowledge deepening, and knowledge creation. These skills are seen as part of a development continuum, and each kill has different implications for education reform and improvement, plus different implications for changes in the components of the education system including pedagogy, teacher practice, professional development, curriculum and assessment, and school organization and administration.

ICT plays a unique, but complementary role in each of these approaches, with new technologies requiring new teacher roles, new pedagogies, and new strands to teacher education (Hennessy, Harrison & Wamakote, 2010). The successful integration of CAI into the classroom depends on

the ability of teachers to structure their learning environments in non-traditional ways, merging technology with new pedagogies (Hennessy, et al., 2010). This requires a very different set of classroom management skills to be developed, together with innovative ways of using technology to enhance learning and encourage technology literacy, knowledge deepening and knowledge creation. At the knowledge creation end of the continuum, the curriculum goes beyond a focus on subject knowledge to explicitly include 21st century skills that are needed to construct new knowledge and engage in lifelong learning–the ability to collaborate, communicate, create, innovate and think critically. Teacher development is seen as a crucial component here. It ideally coordinates teachers' sophisticated professional skills with the pervasive use of technology. Teachers model the learning process for students, and serve as model learners through their own ongoing professional development both individually and collaboratively (Glazer & Hannafin, 2016).

(f) Conventional Method of Science Instruction

A method of teaching is a logical and systematic way of impacting knowledge to the learners to attain set objectives. Teaching methods could be teacher or student-centered. It is teacher centered when it is dominated by the teacher. Examples of teacher dominated teaching methods are lecture, demonstration and so on. On the other hand, it is learner centered when dominated by the learner and it leads to a better performance by the students. Examples of learner dominated teaching methods include discovery, computer-aided instruction and so on. Computer-aided instruction is the most recent method of science teaching.

According to Ugwu (2014), methods of teaching adopted by teachers influence the learners' learning styles and the acquisition of science process skills which is greatly needed for science and technology accomplishment in the country. Ugwu recommended that emphasis today should

be on activity-based teaching. Modified lecture method involves instructional delivery by combining lecture with demonstration accompanied with instructional materials to make lesson interesting and meaningful to the students. The method may encourage students to participate actively in the lesson through questions and comments to avoid boredom. The choice of the lecture method as control comparative independent teaching variable in the study was due to the fact that it is the dominant teaching strategy used by the teachers irrespective of the age of the learners, subject and concept under treatment. Another consideration for the choice of this teaching method is that teachers find it easy and therefore continually using it to teach all science subjects right from primary to tertiary institutions despite its criticisms by the educational experts to the detriment of the students' performance. Nevertheless, the Nigerian Educational Research and development Council (NERDC) stipulates the use of activity-based and guided inquiry approaches to biology teaching, but the adoption and application of these methods are still an illusion in the study area because of paucity of instructional materials and unwillingness of the science teachers to improvise alternative materials locally to improve instructional delivery. Consequently, the teachers resort to conventional lecture method and walk into the classroom with a key-point text for one-way communication; and copy a few points on the chalkboard. Lessons are rarely planned and instructional materials are hardly used by these teachers. This explains the choice of lecture as the control independent variable to expose its ineffectiveness in delivering biology concepts; and to provide a way forward that suggests the use of CAI that could combine activity-based and inquiry approaches to science teaching.

The teacher as the authority-figure does most of the conversations with the learners as mere receivers of instruction. The students listen; write down a few notes and asks few or no question. The technique does not encourage meaningful learning as the students are denied of full chance

to contribute keenly in the learning. It does not take cognizance of the slow learners. It encourages rote-learning and rarely provides opportunity to practice communication and manipulative skills. Students taught with conventional lecture method will see science process skills as skills only scientists possess which to them is quite abstract, unattainable and unapproachable (Muhammed & Mundi, 2014). Consequently, students' interest in science and their desire for further studies in science-related disciplines is either completely killed or is made to diminish largely as a result of the teaching method employed by the teacher which does not give consideration to learner's involvement. The computer-aided instructional approach provides learners with different ways to learn that enable them to participate actively in the lesson. The learner unlike in the conventional method is made the major focus of the teaching and learning process. This explains the choice of computer aided instruction.

2.3 Empirical Studies

The relevant works of other researchers pertaining to conventional methods of science instruction and Multimedia Insruction strategy versus achievement and retention, and gender are reviewed in this section. Although the studies vary in their research topics, designs, locations, population, samples sizes, instruments and the variables considered.

Gupta and Tyagi (2014) tested the effectiveness of computer-assisted instruction on achievement in Biology among Senior Secondary School students. The result of the study revealed that post-test achievement scores of the experimental group were significantly higher than that of the control group students. So, they concluded that computer-assisted instruction is effective in enhancing the achievement of students.

Stephen, Sowmya, and Senthilkumar (2014) tested the effect of computer-assisted instructional package as a self-learning material in learning English grammar. They concluded that the

package developed by them for eighth standard students is an effective and appropriate one for use as a supportive material to teach English language.

Angel and Viswanathappa (2013) investigated the impact of computer assisted nstruction on academic achievement in Mathematics. The study reveals that use of computer-assisted instruction enhances achievement in learning Mathematics. Thus mediation of information and communication technology in the teaching learning process enhances learning which in turn helps to provide quality education.

Khasnis (2013) conducted a study on enhancement of Mathematics learning through computer-assisted instruction, which showed positive outcomes in the students‟ immediate achievement in Mathematics and attitude towards Mathematics. The investigator concludes that computers should be integrated into the Mathematics education system for effective learning.

Krishnan (2013) developed and tested a multimedia package for students at primary level with dyslexia. The findings revealed that the package is effective in reducing the reading miscues. Significant enhancement was seen in the reading attainment scores and reading capacity of dyslexic students after the intervention of the multimedia package.

Mehar and Kumar (2013) investigated the effect of audiovisual aids on achievement in Physics in relation to Creativity. He arrived at the conclusion that audio-visual aids were found to contribute significantly to higher achievement scores and Creativity of students. Significant interaction was also found to exist between the two variables.

Nirmavathi (2013) conducted a study to test the effectiveness of multimedia for the development of scientific attitude. The sample consisted of Secondary School students of ninth standard. The multimedia package, prepared by researcher for teaching science, was found to be more effective than the conventional method on the scientific attitude of ninth standard students.

Tyagi (2013) developed and validated a computer-assisted instruction learning module on Biology. The study revealed that computer-assisted instruction provides greater opportunities for students to learn and is better than the traditional method of learning. It enhances achievement and is capable of providing novel multisensory learning experiences.

Abbas (2012) developed and tested a metacognition integrated science learning package for students at Secondary School level. She found that the prepared package is effective in enhancing achievement in Chemistry, meta cognitive ability, self-efficacy, scientific creativity, social skills and retention capacity as well as in reducing anxiety of secondary school students. The study implies application of modern technologies embedded with metacognition in the teaching-learning process in our classroom.

Anilakumari (2012) conducted a study on multimedia remedial tracking package for dysgraphia among primary school students with specific learning disabilities and found that the package is more effective on the performance of primary school students with specific learning disabilities having different learning styles with respect to different aspects of dysgraphia and with respect to different aspects of dysgraphia characteristics.

Tankha (2011) tested the effect of blended-learning approach on learning of Mathematics. It was found that blended-learning, which was the combination of traditional face-to-face teaching methods with authentic online learning activities, has the potential to transform student learning experiences and outcomes. The study also revealed that the approach allows for more creative and interactive course assignments.

Anboucarassy (2010) conducted a study to find out the effectiveness of multimedia approach over the conventional method in teaching Biological science among ninth standard students. The study revealed that there was a significance difference in the achievement of the experimental

group over the control group. It was also found that multimedia helped the students in the experimental group to sustain their interest and also their retention power as compared to the traditional method of teaching. The investigator concluded that the multimedia approach is considered to be one of the best techniques for teaching Biology at ninth standard level.

Kumar and Habtemariam (2010) undertook a study entitled Learning with Multimedia: A constructive cooperative approach in education and concluded that most of the multimedia programs for educational purpose create situations that enable students to interpret information for their own understanding.

Ponraj and Sivakumar (2010) conducted a study to find out the effectiveness of Computer-Assisted Instruction in teaching Zoology in relation to the learners‟ personality. The sample consisted of 40 students in Control Group and 40 students in Experimental Group. The data were collected using appropriate tools and it was analysed by „*t*‟ and „F‟ test. It was concluded that the achievement scores of the students in the experimental group were higher than those of the control group students.

Rajakumaran, Soureche, Venguidaragavane, and Viswanathan (2010) in their article „Role of ICT in teaching and learning Mathematics‟, states that information and communication technology is a very powerful resource that can bring about substantial changes in teaching and learning of subjects, especially Mathematics. They further state that this will enable the students to manipulate diagrams dynamically and encourage them to visualize the Geometry as they generate their own mental images.

Reddy, Ramar, and Ponnambalam (2009) tested the effectiveness of multimedia based modular instruction on the achievement in Science of problem students. Two matched groups of problem students were constituted for the experiment. The problem students in the Control Group were

given routine treatment during the school hours. The problem students in the experimental group were subjected to multimedia based modular instructional strategy for a period of three months. The obtained results established the effectiveness of multimedia based modular instruction on the achievement in Science of the problem students.

Mohanty (2018), in his article "Multimedia approach to teaching", stated that a variety of resources, starting from the traditional media to the internet, are now accessible and if multimedia is to be taken advantage of in the teaching-learning process, teachers have to use their imagination, ingenuity and initiative.

Sindhu (2018) developed an E-learning strategy for teaching Biology at Higher Secondary level. Three techniques of E-learning strategy, viz. website learning, E-mail learning and voice chatting techniques, were selected. She concluded that the strategy is highly effective for teaching Biology at higher secondary level. She also compared the performance of different intelligent groups with regard to three of the techniques of the E-learning strategy.

Nimavathi and Gnanadevan (2018) developed a multimedia programme for the teaching of Science in standard IX. They studied its effectiveness over the conventional method of teaching. The study revealed that the multimedia programme prepared by the researchers has an impact on learning of standard IX students and also in their attitude towards use of computers.

Susan (2008), in her paper „Multimedia packages: Relevance for effective evaluation", explains the importance of multimedia packages in the present scenario, role of teachers in multimedia approach and evaluation of a multimedia package. A structure of a multimedia evaluation performance was also presented in this paper. She is of the view that the multimedia package should be evaluated in terms of the presentation of the content, teaching experiences given, language used, computer potentialities, etc.

Benjamin and Sivakumar (2017), in their article" Multimedia enhances effective self-learning", emphasized the need and importance of learning by using self-learning multimedia CDs, and dwells on the quality as well as quantity of teaching and learning, bringing forth the need and significance of learning Science through self-learning with the help of CD-based Courseware.

Jyothi (2017) prepared a self-instructional module on the topic "Chemical Bond" for Class 9 students of Chemistry and compared the effectiveness of the self-instructional module with conventional teaching methods. The investigator found that the self-instructional module prepared by a teacher through power-point presentation has immense positive impact on learning of Chemistry.

Anshu (2016) made a comparative study of the effectiveness of single medium and multimedia on learning gains of 9th graders in Chemistry at different levels of academic achievements and intelligence. The study revealed that multimedia is as effective as the traditional method for the teaching of Chemistry to develop the „knowledge" and „understanding" domains of students having different and varied abilities.

George (2016) conducted a study on the awareness and achievement of student teachers at primary level in their use of modern instructional strategies. It was found that the student teachers at primary level do not have adequate awareness about modern instructional strategies. Again, she compared cooperative learning package and computer assisted instruction software with conventional lecture method on the academic achievement of the student teachers. She concluded that the academic achievement and delayed memory achievement of student teachers using modern instructional strategies was found to be better than that of student teachers using conventional lecture method.

Anbuchelvan and Solayan (2015) found out the effect of using audio-visual equipment on reading-writing communication among the students of standard V. The major finding of the study was that the experimental group scored significantly higher on performance in reading and writing

communication than did the control group.

Blijleven (2015) carried out a study entitled “Multimedia cases: towards a bridge between theory and practice“. The study was conducted within the context of the Multimedia in Science and Technology Project. The project developed and investigated multimedia cases for the professional development of prospective teachers in elementary science education. They found that a multimedia case via guiding task contributes to a meaningful interaction

between theory and practice.

Chou (2015), in his study „Designing good institutional contexts for innovation in a technology-mediated learning environment“, developed a research framework to delineate the relationships among knowledge sharing (KS), coordination and support of technology-mediated learning environment (CTML) and three antecedents of technology-mediated learning innovation (TML). Results indicate that KS has a positive influence on all the three antecedents of TML innovation, while CTML exerts a positive impact only oninstructors“ ability to explore.

Devi and Kumar (2015), in their article “The usage of technology in Mathematics education“, states that Mathematics education demands a multimedia environment for the presentation of its ideas. Authors feel that this will facilitate better conceptual understanding of Mathematics.

Gladiz (2015) developed a computer assisted model to teach Biology at higher secondary level. The result of the study revealed that post-test achievement scores of the experimental group were

significantly higher than that of the control group students. So she concluded that the model is highly effective for teaching Biology.

Sangeetha (2015) identified the impact of multimedia and co-operative learning in enhancing the writing competence of High School students. She found out the existing level of writing competence of High School students and identified the impact of multimedia and cooperative learning on it. She also compared the relative efficacy of multimedia and cooperative learning on the writing competence of students. The study revealed that both the approaches are effective in improving students‟ performance, but it cannot be said that one of the two approaches is more effective. Also, small group interactions and use of multimedia enhances language learning by making it more interesting.

Casanova (2014) made an analysis of computer-mediated communication (CMC) technologies as tools to enhance learning. The findings of the study indicate that the faculty was mainly using CMC technologies to support teaching practices and to improve teacher's productivity. Information technologies were basically targeted to increase interactivity, open avenues for feedback and provide online resources, but less used for inquiry based and active learning.

Gurvich (2014) carried out a study on the development and validation of a computer mediated simulation training application designed to enhance task modification decisions among pre-service physical education teachers. The study revealed the importance of developing the decision making skills among pre-service teachers and establish the need for further examination of these skills in teacher education programme.

Jung (2014) conducted a multivariate analysis of students‟ perceptions regarding web-based multimedia materials as learning tools for human anatomy. The study was conducted to investigate the relationship between three educational factors and to determine which sub

categories among the educational factors significantly affect the learner‟s perception. He concluded that the web-based multi-media materials were useful for both anatomical lab activities and knowledge construction.

Fulick (2014), in his study on knowledge building among school students working in a networked computer-supported learning environment, suggests that students employ a range of tacit tools and rules when engaging in knowledge-building and that the process of critical incidental identification and recall used in the research may be employed as a valuable pedagogical tool when online discussion is used with students.

Meza (2014) conducted a study on the use of computer technology by college bound seniors graduating from a large urban high school in a southwest border community. The purpose of the research was to describe and examine how college bound seniors use computer technology to pursue higher education. In this study, he found that the college bound seniors primarily used computer technology to prepare, select and apply for college.

Ada, Chinyelu, Anyachebelu and Anemelu (2012) investigated the effect of computer-assisted instruction (CAI) package on the performance of Senior Secondary Students in Mathematics (Algebra) in Anambra State, Nigeria. The study examined the significance of retention and achievement scores of students taught using computer-assisted instruction and conventional method. The sample consisted of forty senior secondary school students drawn from two secondary schools. Stratified random sampling was used to select 40 students (20 males and 20 females).

Three research questions and three hypotheses were formulated, and tested at 0.05 level significance. The Algebra Achievement Test (AAT) was made of 50 items of multiple choice objective type, developed and validated for data collection. The Algebra achievement Test

(AAT) was administered to students as pre-test and post-test. The results of students were analyzed using t-test statistic to test the hypotheses. The result indicated that students taught using (CAI) package performed significantly better than their counterparts taught using the conventional method of instruction. Students taught using CAI performed better than the control group in retention test. Also there was no significant difference in the posttest performance scores of male and female students taught using CAI package. Based on the findings it was recommended that Computer-Assistant Program should be encouraged for teaching and learning of Mathematics.

Ada, Chinyelu, Anyachebelu and Anemelu (2012) used CAI which was also a major variable in this study. The study used performance variable while this study used achievement and retention variables. The study was carried out in different location and subject area. Thus, the researchers' study was carried out in Mathematics in Anambra State while this study was carried out in biology

in Niger State. The study in Mathematics may not be generalized to biology; hence there is need for this study.

Nnaobi (2013) investigated enhancing students' performance using computer-aided instruction (CAI) in tertiary institutions in Rivers State. The study used two groups of nonrandomized pretest-posttest design. The normal lecture method was carried out among the two groups with instructional materials such as models, pictures and flow charts. The experimental group (Chemistry/Computer science students) was exposed to chemistry lesson packages in computer drill and practice software on organic for a period of 4 weeks while the control group (Agricultural science students) was taught with instructional material. The research used 90 students of Agricultural science department and 60 students of Chemistry/Computer science

department using purposive random sampling. Two research questions and 2 hypotheses were stated and formulated. The research questions were answered using mean and standard deviation while the hypotheses where tested using ANOVA. It was revealed that computer-aided instruction enhanced students' achievement and retention much better than teaching with instruction materials. The period for the Nnaobi's study was considered to be short. It would have been better if the researcher used 6-7 weeks for treatment and administration of the instrument. The study was conducted among the tertiary institutions' students while this present study was carried out among the secondary school students. The variables are not the same in that of Nnaobi's and this study. For these reasons, there is need for this study.

Madjoub (2013) compared the effects of Computer Assisted Instruction (CAI) on the achievement of Junior High School (JHS II) students in Pre-Technical skills after exposing them to CAI and the traditional methods of instruction. The theoretical framework for the study is that people learn most things better through construction of computer games or multimedia composition rather than through traditional methods of directly teaching content. The study involved 59 out of 386 students from two schools in Kumasi Metropolis in Ghana. Twenty-eight of the students formed the CAI group while 31 formed the traditional group. Quasi-experimental design was used for the study. Structured pre-test and post-test achievement test with a reliability co-efficient = 0.74 and 0.75 respectively were used to collect data. The study utilized 4 hypotheses which were analyzed using Predictive Analysis Software (PAS) version 18. The study revealed that the CAI group performed better than the traditional method of instruction group. However, there was no statistically significant difference between the achievements levels of the two groups. It was recommended that CAI should be introduced in the teaching of Pre-Technical skills throughout the country. The study of Madjoub compared CAI and lecture

method which were also compared in this study. The study covered only one learning outcome variable, achievement but the present study covered achievement. The study was carried out in Ghana while this study was carried out in Nigeria. Hence, there is need for this study.

2.4 Summary of Literature Reviewed

Although most of the studies reviewed covered the variables, achievement and retention, but there are in the areas of Mathematics, introductory technology, Agricultural Science which may not be generalized to Biology. Also there is a need for the study, effect of Multimedia instruction on SS1 student's achievement and retention in Bosso Local Government Area. This study was anchored on cognitive theory of learning. The review revealed that in spite of the many research efforts aimed at closing the performance gaps, students' achievement in biology is still very low. On the basis of these reviewed empirical studies, none of the above studies was carried out in Niger state, particularly in Bosso Local Government Area. For this reason, there is urgent need on the study on the use of improved method of Biology teaching.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Introduction

This chapter is presented under the following sub-heading, research design, population, sample and sampling techniques, instruments for data collections, validation of the instrument, reliability of the instruments, methods of data administration, administration of instrument and data collection and analysis.

3.2 Research Design

This study adopted a quasi-experimental research design that seeks to examine the effects of Multimedia instruction on the academic achievement and retention of students in biology. The "Pre-test-Post-test Equivalent Groups Design" was employed to attain the required outcomes due to the experimental nature of the study. This paradigm includes two levels of treatment: Multimedia Instruction (experimental group) and Conventional Instruction (control group).

3.3 Population

The population for the study comprised of 102 students in two selected senior secondary school one (SSS 1) biology students in Bosso Educational Zone, Niger state.

3.4 Sample and Sampling Techniques

The target population of this research was the first year senior secondary biology students in Bosso Minna, Niger State, Nigeria. The sample used for this study consists sixty students in which were chosen from two intact classes randomly drawn in the area of study considering

time, cost and administrative constraints and experimental nature of the study. The two schools used are Ahmadu Bahago Secondary School and Bosso secondary school Minna, Niger state.

3.5 Instrument for Data Collection

The instruments for this research were the treatment instrument "Multimedia Instructional Package (MIP)" and the test instrument, "Biology Achievement Test". Biology Achievement Test was used as research instrument. The test was developed in four units of Biology taught during the experiment. The units were; classification of living things, the cell, skeleton and supporting systems in animals and nutrition in animals. There were total 20 MCQs in the said achievement test carrying 40 marks in total.

3.6 Validation of Instrument

The validity of the research instrument must be confirmed in order for the study's results to be precise and authentic. Conducting research is pointless and time-consuming without proving the instrument's validity. As a result, the instrument was validated by Dr. I. I. Kuta and Dr. Daudu O. A., errors noticed were corrected and effected. The items for the multiple choice questions achievement were drawn from past West African Senior School Certificate Examination (WASSCE) questions papers whose validity have been satisfactory established being a standard test and were considered valid for the purpose of the research by the experts.

3.7 Reliability of Instrument

Apart from validity, reliability was confirmed through test retest reliability technique. For this purpose, the test was distributed among 25 students of another school which were not in sample. Then again the same test was given to the same students after two weeks. Pearson's product moment correlation was applied between the results of tests. The reliability coefficient was found 0.813 which showed that the test was reliable.

3.8 Method of Data Administration

In each of the two schools used for the study, the researcher used one intact class for each school. This is to avoid the experimental group students from mixing up with the control group students to exchange ideas. This might be controlled by not allowing them know that they were used for the study which could be achieved by teaching all the classes by their original teachers. For successful execution of the experiment, two teachers having same academic qualification and experience were selected. The teacher appointed to experimental group was expert in the application of computer and other information and communication technology.

3.9 Administration of Instrument

Before conduction of experimental, formal approval was sought from the head of school where experiment was to be done. After getting permission, experimental process was started. Students of control group were taught through conventional teaching method while students of experimental group were taught through Multimedia instruction. The experimental process was completed in three weeks. Then a posttest was given to the students of both groups immediately to examine their academic achievement. After completion of experimental process, raw data was

organized, tabulated and analyzed through statistical tool i.e., mean, standard deviation and independent samples t-test. The researcher adopted to fill on the spot and return immediately method so as to ensure 100% return of the instruments.

3.10 Data Collection and Analysis

The study was experimental and therefore, data was collected though pre-test, post-test and retention test. After collection of data, it was organized properly, classified, tabulated, analyzed and interpreted based on descriptive statistics i.e., mean, standard deviation and inferential statistics. The hypotheses stated were tested using t-tests at 0.05 level of significance and used for the acceptance or rejection of the stated hypothesis.

CHAPTER FOUR

4.0 DATA PRESENTATION AND ANALYSIS OF DATA

4.1 Introduction

This chapter presents the results of the data analysis for the study. The presentation and analysis was organized according to the research questions and null hypothesis that guided the study.

4.2 Research Question One

What is the mean achievement scores of students taught biology with Multimedia Instruction and those taught with conventional method?

Analysis of the research question was made and presented in table 4.1 below.

Table 4.1 Mean and Standard deviation of pre-test and post-test scores of experimental and control groups in biology achievement test

Group	N	Pretest		posttest		Mean Gain
		M	S.D	M	S.D	
Experimental	30	41.25	4.15	72.15	7.29	30.89
Control	30	41.49	4.18	56.92	7.39	15.43

The data presented in Table 4.1 indicated that the experimental group had a mean performance of 41.26 and a standard deviation of 4.15 in the pre-test and a mean performance of 72.15 and

standard deviation of 7.29 in the post-test. The result indicated that the mean differences between the post-test and pre-test was 30.89 in the experimental group. The control group had a mean performance of 41.49 with a standard deviation of 4.18 in the pre-test. While in the post-test, the mean performance was 56.92 and a standard deviation of 7.39. The post-test gain was 15.43. This implies that the experimental group performed better than the control group in practical test.

4.3 Research Question Two

What is the mean retention scores of students taught biology with Multimedia Instruction?

Analysis of the research question was made and presented in table 4.2 below.

Table 4.2 Mean and Standard deviation of post-test and retention test of experimental and control group

Group	N	Posttest		Retention test		Mean Diff.
		M	S.D	M	S.D	
Exp.	30	72.15	7.29	67.15	4.15	5
Control	30	56.92	7.39	40.97	7.39	15.95

The data presented in Table 4.2 indicated that the experimental group had a mean performance of 72.15 and a standard deviation of 7.29 in the post-test and a mean performance of 67.15 and standard deviation of 8.73 in the retention test. This make a loss in retention in the experimental group to be 5. The control group had a mean performance of 56.92 and a standard deviation of 7.39 in the post-test and a mean performance of 40.97 and standard deviation of 8.42 in the

retention test, loss in the retention was 15.95. This implies that the experimental group had more retention ability than the control group.

4.4 Testing of Hypotheses

HO_1: There is no significant difference between the achievements mean score of students taught using multimedia instruction and students taught using conventional instruction.

Table 4.3. T-test analysis of means scores of the posttest of students taught with multimedia and those taught with the conventional instruction

Group	N	M	S.D	DF	Tcal	T table	Decision
Experimental	**30**	**76.15**	**7.29**				
Control	**30**	**56.92**	**7.39**	**58**	**12.91**	**1.98**	**significant**

The analysis of data in table 4.3 showed that t-cal (12.91) is greater than t-table (1.98). Hence the null hypothesis is rejected which implies that there is a significant difference.

HO_3: There is no significant difference between the retention mean score of students taught using multimedia instruction and students taught using conventional instruction.

Table 4.4: T-test analysis of the retention of students taught with multimedia instruction and those taught with conventional instruction

Group	N	M	S.D	DF	Tcal	T table	Decision
Experimental	**30**	**67.15**	**4.15**				
Control	**30**	**40.79**	**7.39**	**58**	**10.91**	**1.976**	**significant**

The analysis of data in table 4.3 showed that t-cal (10.91) is greater than t-table (1.976). Hence the null hypothesis is rejected which implies that there is a significant difference.

4.5 Discussion of Result

The results showed that the experimental group had higher mean performance than the control group in the post-test. This finding indicates that multimedia instructional package has a positive effect on students' academic achievement in biology. This finding is in consonant with the works of Nazir, Rizvi, and Pujeri (2012), which found out that learning with multimedia instruction increased interest in the learner and enhances learning. This means that multimedia instructional approach is more effective than the conventional method. It flexibility in instructing and having more access repeated lessons make the students to learn and retain more content. Similarly, analysis on the retention shows that there is significant difference in the retention of content of study. The experimental group retained more content compared to the control group. This result was in accordance to the work of Nwanekezi and Kalu (2012) who found out that students taught with multimedia instruction tended to be superior to their counterparts with regard to retention in Basic Science Concepts studied. This inferred that multimedia instruction significantly improves active participants in learners and making learning more meaningful. It also connect the existing and new knowledge to consolidate learning experience.

CHAPTER FIVE

5.0 SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Introduction

This chapter presents the summary of the entire work, conclusion drawn from the study and offer recommendation for further research.

5.2 Summary of the Work

Chapter one provided the background to the study. The central objective is to investigate the effects of Multimedia Instruction on biology student's achievement and retention in Bosso Local Government Area of Niger state.

In chapter two, review of related literature was made. Chapter three presented the methodology that was used in collecting data for the study. Design of study, population of the study, sample and sampling techniques, and method of data collection and analysis were made in the study.

Chapter four presented and analyzed the data that was generated for the study. This study found that the multimedia Instruction approach of teaching biology has significant effects on the academic achievement and retention of students of secondary schools in Bosso Local Government Area of Niger state.

5.3 Conclusion

Based on the findings of this study, the following conclusions were drawn:

i. Students taught with multimedia instruction performed higher in the post-test than those taught with conventional instruction, as the result of the effectiveness of the method used

ii. There was significant difference in the retention score of students taught with multi-media and those taught with conventional method

iii. Multimedia instruction is effective on teaching biology and it consolidates retention of learning content than conventional instruction.

5.4 Recommendations

Base on the results of these findings the following recommendations are made.

1. Biology teachers should adopt the components of multimedia instruction. This will enable them to cater for diverse learning styles of students in their classrooms as this, will improve academic achievement and development of practical skills.

2. Government should provide more funds and grants to equip laboratories, studios and workshops that will facilitate production and multimedia instruction.

3. Biology teachers should be given on-the-job training opportunities such as short-term courses, seminars and workshop to enable the teachers to update their knowledge; this will help them to constantly keep abreast with the ever-changing scientific knowledge and various modern

REFERENCES

Adegoke, B. A. (2011). Effect of multimedia instruction on senior secondary school students' achievement in Physics. European Journal of Educational Studies, 3(3), 537-541.

Ahmed, M. A., & Abimbola, I. O. (2011). Influence of teaching experience and school location on Biology teachers' rating of the difficult levels of nutrition concepts in Ilorin, Nigeria. Jostmed, 7(2), 52-61.

Bethel-Eke, O. A., & Eremie, M. (2019). Styles and academic performance of junior secondary school student in Rivers State: Implications for counseling. International Journal of Innovative Development & Policy Studies 5(3), 52-61. ISSN: 2354-2926. www.Seahipaj.Org

Federal Republic of Nigeria. (2013). National Policy on Education. 4th ed. Nigerian Educational Research and Development Council (NERDC) Press, Lagos, Lagos State, Nigeria

Gambari, I.A., Yaki, A. A., Gana, E. S., & Ughovwa, Q. E. (2014), Improving secondary school students' achievement and retention in Biology through video-based multimedia instruction. Insight: Journal of Scholarly Teaching, 9, 78 – 91.

Hawkar, A, A. (2014). Learning styles and their relation to teaching styles. International Journal of Language and Linguistics, 2(3), 241-245. https://doi.org/10.11648/j.ijll.20140203.23

Huang, C. L., Luo, Y. F., Yang, S. C., Lu, C. M., & Chen, A. (2019). Influence of students learning style, sense of presence, and cognitive load on learning outcomes in an immersive virtual reality learning environment. Journal of Educational Computing Research, 58(3), 596 – 615. https://doi.org/10.1177/0735633119867422

Ilhan, G. O., & Oruç, S. (2016). Effect of the use of multimedia on students' performance: A case study of social studies class. Educational Research and Reviews, 11(8), Pp. 877- 882, ISSN 1990-3839. https://doi.org/10.5897/err2016.274.

Kareem, A. A. (2015). Effects of Computer Assisted Instruction on Students' Academic Achievement and Attitude in Biology in Osun State, Nigeria. Journal of Emerging Trends in Educational Research and Policy Studies, 6(1), 69-73.

Mayer, R. E. (2013). Multimedia learning (2nd Ed). New York: Cambridge University Press.

Mayer, R. E. & Moreno, R. (2013). Nine ways to reduce cognitive load in multimedia learning. Educational Psychologist. 38, 43 – 52.

Moussa-Inaty, J., Atallah, F., & Causapin, M. (2019). Instructional mode: A better predictor of performance than student preferred learning styles. International Journal of Instruction, 12(3), 17-34. P-ISSN: 1694-609x. https://doi.org/10.29333/iji.2019.1232a.

Moreno , R. & Mayer, R.E. (2018). A coherence effect in multimedia learning. The case of minimizing irrelevant sounds in the design of multimedia instructional messages. Journal of Educational Psychology, 97, 117-125

Munir, et. al. (2018). Relationship of learning styles and academic performance of secondary school students. Rawal Medical Journal. 43. 421-424.

Odo M. I., Adenle, S. O. & Okwori, R. O. (2012). Enhancing mastery of practical skills in students of vocational and technical education through activity based instruction. Journal of Technical Education and Training, 4(2) 21-29.

Oshinaike A. B., & Adekunmisi S. R. (2012). Use of multimedia for teaching in Nigerian University system: A case study of University of Ibadan. Library Philosophy and Practice. http://unllib.unl.edu/LPP/

Park, C., Kim, D., Cho, S., & Han, H. (2019). Adoption of multimedia technology for learning and gender difference. Computers in Human Behavior, 92. https://doi.org/10.1016/j.chb.2018.11.029.

Sharma, P. (2018). Role of interactive multimedia for enhancing students' achievement and retention. International Women Online Journal of Distance Education, 2(3) 12-23. Retrieved from: http:// www.wojde.org

Son, B., & Simonian, M. (2016). An integrated multimedia learning model vs. the traditional face-to-face learning model: An examination of college Economics classes. Journal of Educational Multimedia and Hypermedia, 25(4), 305–321.

Umar, A. A. (2011). Effects of biology practical activities on students' process skill acquisition in Minna, Niger State, Nigeria. Journal of Science, Technology, Mathematics and Education, 7(2), 118-126.

W

e

s

t

A

f

r

i

c

a

n