IMPACT OF MULTIMEDIA ON THE ACADEMIC ACHIEVEMENT AND RETENTION OF SECONDARY SCHOOL STUDENTS IN BOSSO, MINNA, NIGER STATE

BY

OPARA, Chinonso Emmanuel

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BEING A RESEARCH PROJECT SUBMITTED TO THE DEPARTMENT OF EDUCATIONAL TECHNOLOGY IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF BACHELOR IN TECHNOLOGY IN EDUCATION TECHNOLOGY (B. TECH) IN THE DEPARTMENT OF EDUCATIONAL TECHNOLOGY; SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION, FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA NIGERIA.

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ABSTRACT

Persistent under-achievement of Biology secondary school students in internal and external examinations has been a concern issue to educational stakeholders. Ineffective teaching methods was identified as one of the major causes of the menace. Therefore, there is need to explore the impact of multimedia on the academic achievement and retention of secondary school students in Bosso, Minna, Niger state. The study adopted a quasi- experimental design using pretest, posttest, non-randomised, non-equivalent experimental group design. The research was guided by four research questions with four corresponding null hypotheses tested at 0.05 level of significance. Eighty-two (82) Biology students from senior secondary schools. From the two schools, a school was assigned into experimental and control groups. The Biology Achievement Test (BAT) was used for data collection. The instrument was pilot tested and data obtained was analysed using Pearson Product Moment Correlation (PPMC) coefficient and 0.91 reliability coefficient was obtained. Mean- and Standard Deviation was used to-answer the research questions. Independent t-test statistics was used to analysed the hypotheses at 0.05 alpha level. Findings revealed that students taught Biology using multimedia package (CAIP) achieved better than those taught using conventional method. The study also revealed that students taught' Biology using the multimedia package (CAIP) retained better than their counterparts in the control group. There was no significant difference between the achievement mean scores of male and female students taught Biology using the multimedia package while there was a significant difference between the mean retention scores of male and female students taught Biology using the multimedia package. It could therefore be concluded that, multimedia should be encouraged in instruction delivery to enhance students' achievement and retention in Biology in secondary school

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Study

Multimedia-based gadget such as smartphones, iPads, tablets and laptop computers have ruled the globe today, Instructors are now fond of technology so that teachers use multimedia to raise the motivation and interests of pupils (Ercan, 2014). Traditional approaches such as passive pupils, who write and debate what is less utilized on board as technology advances and expands. Gambari et al. (2014) observed that the classroom-based traditional teaching approach in secondary schools comprises of lectures and teacher-based instructions, adding that the successful usage of animation has shown good teaching outcomes. Multimedia has a favorable effect on cognitive performance, academic performance, understanding and application (Aloraini, 2012). Interactive multimedia is an alternate tool for the present method of learning (Belinda & Tse, 2007).

This stresses that multimedia provides pupils with interaction and exploration. It enables students to learn more about their own courses by themselves, because of the interaction that the multimedia it provides. Multimedia definitions may vary from writer to author, although most agree that multimedia is a mix of texts, images, animations, videos and sounds split into contents and presented in various manner or forms (Pavithra, 2018). In view of its significance in industrialized society, multimedia is essential. Multimedia is one of the strong instruments in a high-tech information education environment that help instructors improve their professional skills and help students meet their educational objectives (Badarch, 2013). The usage of ICT may be seen as an additional benefit that provides an appropriate atmosphere for the educational system. This may be why Ololube (2006) said that ICT offers an educational system with a new phase in terms of its pedagogical approach. This makes it impossible to overemphasize the multimedia and advantages

of learning, since information and communication technology has shown to enhance general communication in the classroom effectively. Multimedia involves students, helps pupils retain information, stimulates interest in the topic and demonstrates the applicability of numerous ideas (Mateer et al., 2020). Multimedia is able to attract various sensory organs; some of the students gain more from reading, others from listening and others from touching (Jung-Tu & Tai, 2016). Multimedia is intended to address the usage of the different human sensory bodies by deliberately, thoughtfully and well-designed information which at the same time appeals to the senses.

Individual learning may encourage active, autonomous learning. Multimedia software may also be utilized to make collaborative work easier. Small groups of students may work together via multimedia apps - both to learn from one other and to enhance their conversation skills. (Andresen and Brink, 2013). 2013. Compared to conventional training, multimedia usage increases students' academic performance. The usage of multimedia favorably impacts education in terms of academic performance when correctly planned compared to conventional teaching (Akkoyunlu & Yilmaz, 2005).

Academic success refers to school performance as represented by a score on a performance test. Performance as the learning result for students who incorporate the information, knowledge and concepts that have been gained and retained in and beyond their studies (Umar et al., 2015). Academic performance is an indicator of the pupils' retention skills. Retention, however, is the capacity to repeat the idea learned when the need arises. Eze et al. (2020) found that retention is the capacity to preserve and remember what is learned when needed. Retention is typically evaluated using academic performance. It is thus regarded after a given length of time as the accomplishment on a topic. Retention assists in the growth of knowledge. (Eze et al, 2020). 2020. Umar et al. (2015) stated that instructors must employ effective educational methods, including

the usage of multimedia, to retain information by the students for a long time. Osemmwinyen (2009) showed that the success and retention of students may be stimulated and sustained by the use of suitable educational medium such as multimedia. In addition, Aloraini (2012) demonstrated that multimedia training improves the retention level of the learner. Gambari et al. (2014) pointed out that biological performance in secondary education was low and mentioned the underlying reason of failure in WAEC tests as inadequate teaching technique, underlining the need of technology integration into education and learning to make it relevant. The purpose of this research is thus to investigate the effect of multimedia on the academic performance and retention of high school pupils in Bosso, Minna, Niger State.

1.2 Statement of the problem of research

In any nation's existence, biology is extremely essential. The West African Examination Council (WAEC) Chief Examiner Reports have repeatedly shown that secondary school pupils in science have low performance (WAEC, 2002; 2003; 2004; 2005). The majority of students in biology fail or get degrees of poor quality in comparison to other disciplines like physics and chemistry. The Chief Examiner's reports indicate that more pupils fail in biology because schools do not appear to fix the deficiencies identified in one year (WAEC, 2004 & 2006). Ineffective teaching techniques used by instructors have been recognized as a major cause in the dismal performance of biological pupils (Ahmed & Abimbola, 2011; Kareem, 2003; Umar, 2011). The traditional style of education mostly involves lectures and instructions for teachers and is held in the classroom. Conventional teaching is a technique focused on teachers, which always depends on teacher supervision. In this process, the job of students is to listen to and learn from the instructors. Conventional teaching removes interaction and the active participation of students in the course, since the student just pays attention and listens to the lecturer. With this in mind, several scientists

(Ahmed, 2008; Ahmed & Abimbola, 2011; Omar, 2011) caution that traditional methods of education do not promote the acquisition of insights and long-term memory of abstract biological ideas. One approach to tackle these issues is by using a technological education system that encourages meaningful learning. The use of media presentations, Adegoke (2010) and Kuti (2006) suggest that they support visual and verbal forms complemented by images, animations, texts and narratives that may meet the constraints of the traditional way of teaching. The globe today is rapidly changing, as are the many areas of a nation's growth. Education is one of these areas and the national development instrument per excellence likewise goes along in the same direction. In order to encourage academical quality and enhance student performance and retention in learning, the educational stakeholder must be concerned with methods of enhancing teaching and learning owing to its social advantages. Noted that multimedia usage may play a practical role in this area, this research examines the effect of multimedia on the academic achievements and retention in Bosso, Minna, Niger.

1.3 Aim and Objectives of the Study

This study investigates the impact of multimedia on the academic achievement and retention of secondary school students in Bosso, Minna, Niger State. The study also aims at achieving the following objectives: To;

1. Determine the impacts of multimedia on students' achievement in secondary schools.
2. Identify the influence of gender on students' achievement when taught using multimedia.
3. Find out the impact of multimedia on student's retention in secondary schools.
4. To Examine the influence of gender on students' retention when taught using multimedia

1.4 Research Questions

The following research question were formulated to guide this study:

1. What is the impacts of multimedia on students' mean achievement scores in secondary schools?
2. What is the influence of gender on students' mean achievement scores when taught using multimedia?
3. What is the impacts of multimedia on students' mean retention scores?
4. What is the influence of multimedia on gender retention scores?

1.5 Research Hypotheses

The following research hypotheses were tested in the study

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

HO_2: There is no significant difference between the achievements mean score based on gender of students taught using multimedia instruction.

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

HO_4: There is no significant difference between the retention mean score based on gender of students taught using multimedia instruction.

1.6 Significance of The Study

The result of this research will be of immense importance or benefit to teachers, students, parents, government and the society at large.

The findings of this study will help students to overcome the challenges or difficulties they are facing in learning many concepts in Biology.

It will also help teachers in selecting the desirable instructional material; animations to be specific to use during teaching.

The result of this research will be of immense benefit to parents and the society at large since parents will realize the importance of multimedia and how it directly stimulates their wards and provide efficiency during learning and also to the society since it will improve literacy level and build adequate comprehension and understanding skills.

Furthermore, this research work will serve as reference source to the government when formulating and implementing policies that will improve teacher's competency with a view of making learning easier and enhance national growth.

1.7 Scope of The Study

This study will be carried within the confines of Bosso, Niger State. Biology is the chosen subject for this study and will be carried out amongst SSI classes as the topic to be taught (Skeletal system) fell under the SSI syllabus. The independent variable is the multimedia package, the dependent variables are achievement and retention while the moderating variable is gender. This study lasted for four weeks.

1.8 Operational Definition of Terms

Multimedia: is the combination of texts, graphics, animations, videos and sounds that are spun into a content and presented in different ways or forms.

Academic achievement: Academic achievement connotes performance in school subject

Retention: retention is the ability to reproduce the learnt concept when the need arises.

CHAPTER TWO

2.0 REVIEW OF RELATED LITERATURE

The major areas reviewed under this project work have been classified under

- Conceptual framework
- Theoretical framework
- Empirical study
- Summary of Literature Reviewed

2.1 Conceptual Framework

2.1.1 Concept of Teaching and Learning

Learning may be strengthened by various teaching and learning materials since they excite, motivate and concentrate students' attention for a time (Saidu & Garba, 2015). Multimedia teaching and learning tools are very essential in teaching and learning, since they encourage and inspire students by drawing attention and making the process of learning tangible because they convert words and writings into vivid representations.

Multimedia is defined resources for teaching and learning that may be created locally or commercially. The sensory organs are attractive to nearly all senses, from sight, hearing, and touch; they are distinguished by a mix of texts, images, animations, videos and sounds that are spun into content and delivered in many formats, such as TV, computers, multimedia projection systems, etc. Multimedia resources are essential teaching and learning tools for teaching and learning.

Theoretically, multimedia has shown promise for teaching and education because of its stimulating, engaging and motivating elements, but its impact on teaching and learning in the

classroom needs to be investigated in reality, and therefore this study aims at practicing the impact of multimedia on the academic output of students.

2.1.2 Instructional media concept

Media means channels via which information is transmitted. The word 'educational media' refers to any kinds of teaching and learning tools or aids, whether they visual or auditory elements utilized to transmit messages (instructions) to the students.

Saidu and Garba (2015) stated that teacher media refers to "everything that a teacher may utilize as communication medium in order to convey information in a manner that enhances curricular material and therefore enhances the education process." He also explains that these materials could include simple living things and non-living things such as stone, sheets, concrete mixers, aggregates, chalkboards and printed materials such as charts, maps, designs, designs, designs, photoographs, models and real stuff, as well as sophisticated audio and video machines, projectors and computers. Visits to locations in and out of the school may also be considered as educational media. If it is complemented by experience, learning will probably be meaningful and enduring. The World Bank (2004) said that ICT should be explored for educational purposes for the aim of strengthening curricula, strengthening teaching and learning, and improving learning. Similarly, the United Nations Secretary-General (2005) emphasizes the fact that "we must guarantee that ICT'S is utilized for the unlocking of educational doors." That is why commercial sectors, in particular ICTs, have come up with the Millennium Development to expand education possibilities and unblock education doors. Saidu and Garba (2015) suggested that students who have the benefit of being taught through well-selected and intelligently used educational media learn more than students with just spoken instructions. Sugapriya and Ramachandran (2011) felt that the usage of educating materials will "strengthen the pupils' memory by the facts of discovery." They also

emphasized the following aspects on the efficacy of educational materials. He suggested that a well planned, imaginative use of visual aids for teaching should do much to banish apathy, supplement the inadequacy of books and at the same time stimulate the interest of the student by giving them something practical to see and to do and helping them to think things themselves.

2.1.3 Multimedia Elements and Classification

The power of the multimedia message is related to the way individuals recall information. Researchers have noticed that individuals recall just 20% of what they say, 40% of what they see and hear, and 75% of what they see, hear and do (2014). A significant impact can thus be observed on computer-mediated communication and a contemporary approach to educational techniques.

Multimedia Elements

1. Text

2. Graphics

3. Audio

4. Video 5. Entertainment.

1. Text: The form in which the text may be saved might vary considerably. In addition to ASCII files, text is usually saved for more generic multimedia items in processor files, spreadsheets, databases and annotations. With the availability and spread of GUIs, text typefaces become sophisticated and enable unique effects to be achieved (color, shades...).

2. Graphics: There are big variations in storage quality and size (image file formats) for still pictures (Bitmap - gif, jpg, bmp) (Vector - svg, pdf, swf, ps). Digitalized pictures are the pixel sequence representing an area on the graphical display of the user.

3. Audio: The Audio data type (audio file format) is becoming used in most applications. It's very spatially intense. Up to 2-3 Mbs of sound may take one minute. Several methods are used in the appropriate format for compressing it.

4. Video: Digitalized video is one of the most space demanding multimedia data kind. The digital videos are kept as a frame sequence. A single frame may take up to 1 MB depending on its resolution and size. Also, realistic video reproduction requires a constant transfer rate for transmission, compression and decompression of the digitalized system.

5. Animations: A computer animation is a computer animation that uses graphical tools to produce visual effects (Shakya, 2018). Musa et al. (2013) observed that animation creates the appearance of movement by shooting a series of individual drawings in successive film frames. It is an image presentation that refers to moving images that depict the movement of drawn things

2.1.4 Animation to improve learning

Animation helped reduce the time to obtain long-term memory information and then to rebuild it in short-term memory. Zhu (2004) stated that animations encourage organisation, facilitating the reconstruction process. Barak and Dori (2011) noted that computer animation may be utilized to enhance scientific knowledge. Finding also showed that when both verbal and visual systems were used, pupils scored better on memory and problem solving tests. In his research, Chuang (1999) discovered that students of various types of gender and education (field dependency / field independence) are capable of solving learning difficulties. Text assistance animation has decreased the cognitive burden of a pupil (Mayer, 1996). His study has shown that, supplemented by a written explanation, it is possible for pupils to use their capacity to absorb information on two levels by activating the visual system and decreasing the burden put on the verbal processing system. This re-shuffling of data into working memory enables them to make sense of the information in

preparation for long-term storage. The inclusion of the accompanying written explanation alongside the animation significantly decreased cognitive strain and increased performance (Lai, 2000). Students are led to study by checking the appropriate facts and may link new learning to real world circumstances (Stoney & Oliver, 1999)

2.1.5 Multimedia, Academic Achievement and Retention

Multimedia provides an alternate learning medium for the present learning process. The element of interaction and exploration in multimedia learning boosts the monotony of passive learning. teachers and students may regulate their own learning rates depending on their abilities (Sousa, 2017). Multimedia teaching, both words and images meant for learning may be described as words written (e.g. text on a screen) or spoken (e.g., narration). The image may be static (e.g., images, charts, charts, photographs or maps) or dynamic (e.g., animation, video, or interactive drawings) (Victor, 2011).

Mayer (2000) defines multimedia as the representation by both visual form and vocal form, such as spoken and written text of the learning content. It may contain movement, speech, text, graphics and still pictures (Pavithra, 2018). Animation, defined as pictures in motion, is an essential mix of media (Dwyer & Dwyer, 2003). Animation capabilities are advances that may stimulate learning. The flexibility of animated learning permits a broader variety of incentives so that student commitment to learning increases. Kearsley (2002) research indicate pupils with higher self-esteem and drive who learn through animation. His findings also indicate that pupils may retain knowledge and maintain an increased learning process. Ansyari (2017) found that animation learning may excite more than one sense at a time, which can attract more attention and focus more attention. A prominent example of teaching and learning multimedia education is computer-based

animation, animations being one promising approach to addressing educational challenges involve multimedia presentations in visual and verbal formats, such as the presentation of computer-generated animation, synchronized with narrative or on-screen text. However, multimedia today offers an excellent teaching and learning tool to the educational system. The usage of multimedia may have a beneficial impact on education when it's developed in line with conventional academic accomplishment, multimedia, as well as easy and objective learning, makes the student engaged and everyone contributes his or her quota and makes learning enjoyable (Akinoso, 2018).

Nevertheless, Adegoke (2010) said multimedia is increasingly being used in many developed countries including Nigeria due to the benefits of, inter alia, multimedia instructions. Complicated themes may be better explained and understood with the support of photos, graphs, animations and simulations (Neo & Neo, 2001). Research reveals important connections between multimedia teaching and academic performance of students. Schools who utilize multimedia education have increased attendance and a reduced drop-out rate, leading to better academic results and retention (Maha, 2008). Academic accomplishment refers to school subject performance as represented by a performance test score. Academic performance measures student success in different academic fields. Teachers and authorities usually evaluate performance in classrooms, graduation rates and standardized test scores (Lamas, 2015). Academic performance is an indicator of the pupils' retention skills. Osemmwinyen (2009) showed that the success and retention of students may be stimulated and sustained by the use of suitable educational medium such as multimedia. In addition, Aloraini (2012) demonstrated that multimedia training improves the retention level of the learner.

Nigerian governments spend enormously each year in the education sector with the primary goal of influencing student knowledge and the development of character. However, in Nigeria, the

performance of pupils in exams was never promising. The chief examiners' report of NABTEB stated that the automechanical failure rate in 2011 and 2012 was attributable to the absence of training methods and the lack of student exposure to practical or media teaching (NABTEB, 2011 and 2012). Furthermore, it has been shown that the continuous low academic performance and learning retention is due to improper teacher teaching techniques (Ogbuanya and Owodunni, 2013).

The research is thus centered on the effect of multimedia teaching on the academic performance of students, particularly high school students, compared to their colleagues who benefit from the same curriculum using the traditional mode of instruction.

2.1.6 Multimedia Importance

There is a great deal of basic significance for teaching and learning in multimedia. Oyesola (1991) mentioned visual and auditory elements which represented the phenomena of teaching ideas.

Multimedia's significance for learning is that the brain uses its ability to link verbal and visual interpretations of information to a better understanding that essentially helps the transfer from learning to different settings. All of this is essential in schools today, as we educate future pupils where higher-level thinking, problem solving and collaboration abilities are required. Sensory perception is a major part of the human brain. The use of images, movies and animations along with text so stimulates the brain, increases the attention and retention of pupils. In these circumstances, students can identify and solve issues in a digital learning environment more easily than if instruction is available solely through textbooks. Students are more equipped than ever to

seek and find the information they need using their computers, tablets, cellphones and the Internet. A survey showed that 95% of students who have internet access utilize it to search for online information. Information sharing and participation in class discussions is made more confident since access to information is as easy as it is now (Chioran, 2016). Multimedia helps students to generalize what is taught in their classroom to influence their experience and perception of global events. For the generality of the classes, mental stimulation and 3D visuals are essential, and the enormous benefits of learning of these aids cannot be ignored by students with reading and hearing difficulties. Multimedia software may also be utilized as an information source. Multimedia software may be developed to enhance learning and facilitate student and teacher interaction. By incorporating digital examples, the lesson is more attractive for readers. Interactive applications enhance user experience and make it simpler for learners to understand material when presented in a range of ways. Multimedia apps are utilized to attract the attention of students and to generate excitement throughout their learning process. It will improve the student's content and learning method. Multimedia applications enable students to enhance their material recall and to boost in-depth learning with regard to traditional instructor methods. Multimedia applications for teaching will help make learning pleasant and reduce anxiety and tension on such fearful subjects. Teachers are always looking for more effective methods to capture the attention of their students during classes and enhance learning results for students. People are more aware of words and pictures than words alone. For these reasons, educational multimedia apps only utilize a combination of multimedia components to convey and emphasize important topics, making them simpler for students to focus on than on static textual learning materials. Students frequently divide their attention if they are required to concentrate far apart material, or if it is given simultaneously at two different places. Therefore, when the corresponding information is given, the learning result

is stronger in words and images at the same time. Research found that students would participate in classes more successfully when instructors integrate interactive multimedia in the learning experience and pay more attention to teachings that are more relevant (Fen, 2017).

2.1.7 Factors Militating Against the Use of Multimedia in Teaching and Learning

A teacher's professional task is not only to educate his pupils, but to modify and create materials that fit the students' learning styles, strengths and abilities. The teacher has a duty to bring forth innovation in education by using visual resources effectively. Antonietti and Giorgetti (2006) pointed out that some instructors felt that multimedia fulfilled the requirements of the student and therefore altered their views on the role of teachers and students in the learning process. On the other hand, another instructor believed that multimedia was primarily utilized for the promotion and encouragement of classes; he was skeptical about the possible significant impacts on education and indicated that computers might distract classrooms. Others have stated that computers in their classrooms are capable of teaching according to their own pedagogical principles. Sabitu and Nuradeen (2010) saw that the effectiveness of any educational and learning process that constantly affects the academic performance of pupils relies on how efficient and effective instructors are. The knowledge of the teacher plays an important role in schools since it may influence the choice of teachers' teaching materials throughout the teaching process. Abdullahi (1997) further underlined this view by arguing "sensibly using educational media with appropriate technology to manage them may help scientific and technical instructors inefficiently achieve their teaching goals." Sofowora and Egbedokun (2010) decided to assist address the difficulties in the teaching of the topic by using suitable teaching materials. Indeed, educational technology has long believed that instructional resources are crucial for successful teaching and learning. Lawal, Dora and Julius (2014) claimed that the attrition of secondary school pupils to subjects was attributable to

inappropriate instructors and incompetent professors. They stated that the severe lack of competent instructors was one of the main causes for student's backwardness or low performance in high school. Abdullahi (1997) noted that "the availability in our classrooms of media software and hardware was extremely disappointing. The absence or misuse of these medium is currently a significant issue that may easily create anxiety among technical instructors."

Parette and Blum (2013) stressed several variables that influence the usage of multimedia

• Failure to learn and/or train

The training of teachers has historically been unfortunate in developing skills relevant to technology integration into the early childhood curriculum. However, until most instructors acquire technology integration knowledge and abilities in the classrooms, they continue to depend on consultants' and/or technology experts' advice and professional development after they have graduated.

The attitudes of teachers may also impose obstacles to the adoption of early childhood education technology. Some instructors may just believe that the conventional method to teach and deliver the curriculum is superior than innovative ways of doing things. For example, an interactive e-book with built-in voice may choose to display and read aloud from a book. The usage of an interactive whiteboard may be preferable by writing on a chalkboard. Differences amongst instructors in their capacity to embrace technological education methods may also be recognized. Early adopters want to utilize technology, acquire new knowledge and abilities in its usage, and integrate it easily into their teaching practices. Late adopters tend to hesitate more with technology; they may slowly acquire new technological knowledge and abilities and integrate them into their teaching practices. It is promising that many of today's instructors are technologically advanced

and are therefore likely to be more responsive to their incorporation into the classroom. Furthermore, as a DAP, the NAEYC and Fred Rogers Center (2012) should provide instructors advice and promote change of attitude within the discipline.

• Budget restrictions

Teachers often have limited resources for the acquisition of consumer and technology to supplement their curriculum (Judge, 2006). With limited economic means, organizations and schools may only buy materials typically used in classroom settings or items known to the instructor in the preparation of his or her care. This issue is exacerbated by a dynamic and always changing array of technologies that early childhood programs evaluate, which may become outdated by the time the purchase can be completed if technologies are postponed until finances are available! Therefore, today's instructors must be ready to utilize a free and affordable toolset that can complement the curriculum (Hourcade et al.,, 2010).

2.2 Theoretical Framework

2.2.1 Behavioral Learning Theory

Graham (2010) states that behaviourist understands learning as a process in which environmental experience leads to a generally constant behavioral change or the possibility of behavioral changes. Behaviourism is a psychological theory which concentrates on behavior that can be seen and needs an objective, observable attitude that demonstrates a mind or learning state. It emphasizes that behavioral measurements corroborate and witness psychological occurrences. It rejects internal learning experience and concentrates on learning as nothing else than a new and visible habit. For behavioralists, "learning takes place when new modifications in behavior arise as a consequence

of an individual answer to the preceding and consequential stimuli. The external environment influences the behavior of the person by providing historical cues that strengthen the behavior" (Cognitive Design Solution, 2003). The Stanford Philosophy Encyclopedia (2014) outlines three fundamental commitments of behavioral theory:

1. Psychology is a behavioral psychological science. 1. Also, psychology is not mind philosophy.

2. The behavior may be defined and analyzed without reference to underlying psychological experiences or processes. The conduct is external (environmental) and not internal (interior) (in the mind).

3. Whether mental terms or principles are employed to describe or justify behavior either, in the course of theoretical development of psychology:

i. These words or ideas should be removed or replaced by behavioral terms or ii. They may be translated into behavioral concepts or paraphrased in them.

This indicates that the behavioral theory mainly concerns behavioral ideas rather than cognitive or psychological ones. The idea of behavioralism was established by B. F. Skinner's work in 1951. (the theory of Operant Conditioning). Conditioning occurs when reinforcements are employed to teach a stimulus response. A skinner box was created to teach the pigeons to behave by rewarding activities as was natural until the pigeons reacted with the reward behaviors to the stimuli. Classical Conditioning Theory of Ivan Pavlov is another important behavioral theory (1927). The Principle of Classical Conditioning deals with natural biological responses and cue reflexes. The incentive introduced does not teach new conduct, it is utilized to encourage existing behaviour. Pavlov (1927) utilized salivating dogs to establish his basic conditioning theory while seeing food.

Cognitive Design Solution (2003) emphasized the significance of behavioral theory, noting that many educational arrangements appear 'contributable,' but that nothing is incorrect. It is the duty of the instructor to create circumstances under which pupils learn. It was always the goal of formal education to establish conduct that would be helpful or pleasant for a student's life. The behaviors that the instructor wants to promote are enhanced by positive stimulation or the elimination of negative stimuli. If behavior follows a favorable stimulus, it is more likely to be repeated in the expectation that the same positive sensation is generated. Teacher must be uniform. The teacher should also award pupils for their good and poor conduct, privileges or qualifications. The behavior theory was utilized by MCNeeley (2007) to give pupils lessons on milk production. The processes and methods she took are as follows:

"The instructor starts the lesson with the students gathering on big tapestry during group time. As pupils sit on the bigger teacher tapestry alone, he or she delivers Gail Gibbons' book 'The Milk Makers.' The students exclusively face the instructor, to prevent unwanted strengthening that might distract them from the objective of the instruction"

"The teacher utilizes the image book to explain the subject, since the students use the visual material when the instructor tells the images. When the youngsters hear the tale, the information they are supposed to absorb is summarized. After the instructor reads the tale, he or she re-explanates the four milk production phases.

"As the instructor sums up the material, he distributes drawings to each kid. The instructor assesses children's comprehension by keeping the photos in sequence."

According to McNeeley (2007), this evaluation was based on both classical and operational conditioning. When the instructor called for a particular card, the unconditioned stimulus, each kid

would take up a picture. The positive feedback from the instructor, a conditioned stimulus, will encourage the decision according to the instruction. Operational conditioning is used because stickers and selected activities encourage the youngsters. During the teacher's evaluation, the pupils take one image at the time. The children face the instructor so that each kid focuses on a suitable image and comments from the teacher. Every kid with the right image gets a star. When a kid gets four stars in a row, the youngster may leave the group area for an activity selected. The instructor tests the rest of the kids until they grasp the materials.

The behavioral hypothesis merely concentrated the child's attention on the items shown by his instructor. The instructor must also stay focused in order to prevent distractions. The teaching phase of the computer tourist, the motivation of programmed instruction, the individual's approach for instruction, computer-assisted instruction and the system approach are fundamental versions of what education and computers can do at the moment. According to Ebert (2009), the machine might be compared with a box on the student's desk, which could be used by each individual student to record responses to some suggested question. The student refers to the numbered items in a multi-choice exam while utilizing the gadget. He clicks the button for his first response option. If it's correct, the gadget will go on to the next item, if it's wrong, the mistake is counted, and it has to keep choosing until it's right. The example of Ebert (2009) further reinforces the claim that the Skinner Teaching Machine is comparable to the current instructional computer software intended to enhance student conduct. In Cognitive Design Solution (2003), Skinner (1974) refers to the teaching machine as "technologies that provide optimum self-institution conditions."

2.2.2 Theory of Technology Acceptance

The Technology Acceptance Model (TAM) is regarded as an information systems theory which shapes how people accept and utilize technology, and stresses how everyone needs to use technology. It should be emphasized that a behavioral intent (BI), which leads to individuals utilizing technology, must be present. Proponents of this approach observed that beahavioural intent (BI), which is regarded as the technology overall impression, is affected by attitude (A).

The model indicates that a variety of variables affect the choices taken to utilize the new technology when consumers are offered new technology. Some of them include:

• Perceived usefulness (PU): This is seen as the duration that a person considers to improve his or her work performance utilizing a specific technology. This means that students who may be using cellphones will evaluate the usefulness of a specific assignment.

• Perceived ease of use (PEOU) - This element shows how easy or less difficult a particular technology would be to use. When a technology is usually simple to use, people will show favorable views about this technology. For example, smartphone users often use their phones or apps in them if they are simple to use and are not difficult to use.

Other variables such as social impact, age and sex may affect the usage and overall perception of technology by people.

2.3 Empirical research

Ilhan and Oruc (2016) conducted a research designed to describe the impact of multimedia on social studies students' academic performance. Experimental design was utilized in the study with the control and experimental groups of this research in two sections (both 4th degree –Section I as control group and Section II as experimental group). The research included 67 4th grade students

in social studies in Kayseri, Turkey. A performance test was utilized to gather data, which was produced using expert opinions and tested as a pilot. The results of the performance test were examined using the SPSS programme. At the conclusion of the research, the multimedia method was shown to enhance students' academic performance in social studies in comparison with conventional teaching.

Akinoso (2018) has also studied multimedia efficiency in mathematics for pupils. Two schools from District V were randomly chosen. Intact courses were deliberately taught and tested. Almost experimental design has been used. Mathematics Achievement test was utilized with a reliability of 0.81 with KR-20. The obtained data have been examined using ANCOVA. There is no significant impact between treatment and mathematical performance, the average achievement score of experimental groups was greater than control. Significant treatment and gender effects did not present, although males had a higher middle performance score (A=57.50) than women (A=54.13). The academic performance of mathematics students was favorably impacted by multimedia.

Cyril (2015) examined the impact of multimedia education on the memory and performance of fundamental mechanical engineering abilities. The research was place at four chosen technical universities in Adamawa and Taraba, Nigeria. There were 252 National Technical Certificate (NTC) students. 2. A sample of 156 people was taken following the formula of Yaro Yamane. The research was experimental in design. The sample was split into control groups and experimental groups. Multimedia teaching was given to the experimental group while the control group was taught via demonstrative methods. The instrument was designed by three specialists and verified for data collection and was used for instructional video files and lesson plans, teacher's tests for pretest and posttest. There have been two research questions and two hypotheses. Mean and

standard deviation have been utilized to answer questions from the study. The t-test statistics were employed to assess the 0.05 significance level of the hypotheses. The results of the study showed that the mean performance of the students in the experimental group is significantly different from those in the control group. The students in the experimental groups fared better than the students in the control group on mechanical and retention tests. Multimedia instructions thus have a greater impact on the acquisition and retention of skills in the craft sector. The research suggested that a multimedia training tool should be an efficient method to improve teaching and learning of mechanical skills.

"Effects of E-Learning on retention and performance among basic science students in Minna, Niger state," studied Saidu et al. (2020). The research design used for the study was a virtual experimental control group design that used the experimental and control groups for tests, post-tests and post-tests. The study population included 4,870 JSSII students from 41 schools in Minna. Four schools with a total of 200 pupils were chosen for the research. The tools utilized for the research were the Basic Science Performance Test (BSPT) with a reliability factor of 0.89. Two specialists from the Department of Science Education, Federal University of Technology, Minna verified the instrument. Intact JSSII courses were utilized for the research. Four research questions have been addressed using descriptive middle and standard deviation statistics, while four research hypotheses have been developed and evaluated with P T 0.05 meaning. One hypothesis addressed was that the performance level of students who taught the basic science idea using e-learning and those who taught by the lecture method is not significant. Key results of the research showed that the usage of e-learning had a favorable impact on retention and performance by students in basic sciences. Based on the research findings, it was recommended to encourage basic sciences teachers of junior high schools in Minna to use e-learning in education and learning of basic sciences as a

means of improvement of student performance, and to organize workshops, seminars and lectures for fundamental science teachers, both in the State and in the Federal Government, on how they can use it.

Aloraini (2012) studied the effect of multimedia on student academia at King Saud University College of Education. An experiment was conceived of two comparable groups, one of them is experimental and the other one is controlled by 20 female students. The lecture was delivered to the first group by means of an experimental multimedia presentation program, and to the second group by utilizing the conventional way of the dialog and discussion technique. The second group gave the identical lecture. Both groups were exposed to pre- and post-testing in the lecture. The results of the study revealed no statistically significant differences, which demonstrate the equality of the two groups in turn. The results of the post-test analysis revealed, however, that statistically significant differences exist between the experimental group and the control group at a level of 0.05 to the interest of the experimental group. Both groups have been pre-testing and post-testing the topic of the presentation. There were no statistically significant differences in the analysis outcome, which in turn demonstrate the equality of the two groups. Meanwhile, the analysis results from the post test revealed the following: there are statistically significant variations in the interest of the experimental group between the experimental group and the control group at a significance level of 0.05.

Similarly, Shah (2015) examined the comparative impact on the academic performance and attitude of students at primary level in science education using multimedia-aided teaching (MAT). A random sample of 60 students was split into two groups. For this research, design of the pretest-post-test control group was chosen. The experimental group was taught via multimedia presentations, while the control group was conventionally handled. The therapy was conducted for

20 weeks. As data collecting methods, accurate and trustworthy questionnaires were utilized. The attitude of the two groups before and after therapy was measured using a Towards Science Scale (ATSS). The independent t-test sample was utilized for the analysis of the data. The findings showed that MAT is more effective than the conventional. The attitude of students towards science improves more by using the MAT approach compared with the conventional teaching method.

The student learned that despite the usefulness of multimedia in improving the academic performance of secondary school pupils. It still seems that many instructors don't utilize them. While some claimed that multimedia would lead to distractions in the instructor and in the learning process, others advocated for the use of multimedia in the classroom. This left individuals with relevant concerns about the effect of multimedia on kids' academic achievement. To this end, the current study attempts to bridge the gap with a special reference to the influence of multimedia on the academic performance of high school models FUT.

2.4 Literature summary reviewed

The researcher sheds insight on the idea of instructional media, multimedia and animation from the literature examined. Previous study literature has shown that animations may improve academic performance and retention. In most schools, educational technologies are now used globally, and this has led to study on their effect on teaching and learning. There were two theories to support the study: the behavioral theory and the technology acceptance model (TAM) and behavioral theory, which described how learning transforms behaviour, habits or perception. Technologies like multimedia may bring such changes to a person that might be called "learning." The Technology Acceptance Model (TAM) explains how people perceive a technology to be used when a technology is seen to be simple and productive. The Computer Animation Instructional Package (CAIP) should be developed so that users are easily accessible and accessible. Finally,

the empirical research showed that animation and multimedia were in a position to enhance learning, which stimulated and stimulated pupils to study.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Introduction

This chapter presents the research methodology employed by the researchers and therefore, provides information on the research design, population and sample size, sampling technique, data collection instrument, procedure for data collection, procedure for data analysis.

3.2 Research Design

The researcher used the quasi-experimental design, specifically the pretest, posttest, non-equivalent control group design was used. This implies that, intact classes (non-randomized group) participated in the study. Egbule and Okobia (2012) noted that quasi-experimental design allows

for the use of intact classes so as to avoid disruption of normal classroom activities in the school. The quasi-experimental design is therefore considered appropriate for this study since intact classes were used. In studying the impact of an independent variable (a computer representation program using multimedia) on dependent variable (academic achievement and retention), a comparison was made between the experimental group who were taught by using a Computer Animation Instructional Package (CAIP) which uses multimedia along with a teacher, and the other group is the control group, who were taught using the conventional method of discussion and dialogue, along with a teacher. The variables were controlled, which mean that both groups are equivalent in terms of specialty, academic level, teacher and teaching location and the two groups have undergone a pre and post academic achievement tests.

3.3 Population of the Study

The population for this study consists of all the first year secondary school (SSI) students in Bosso Local Government Area of Niger state with a total population of (2170) students which constitute the population of the study (Niger State Educational Data, Senior Secondary Education Board (NSSEB) while the target population comprises students who offered Biology in the two selected secondary schools (Federal University of Technology Minna Model secondary school, Bosso and Ahmadu Bahago secondary school, Bosso) in Niger State.

3.4 Sample and Sampling Technique

A sample refers to a small group of elements drawn through a definite produce from a specific population. Shapiro (2008) refers sample as the "number of units that were chosen from which data were gathered" A sample size of 82 students was drawn from the two schools. To produce the sample, intact classes was employed as the students were sampled as they were in their classes meanwhile two classes from the two purposively selected schools, balloting was used to represent

the experimental and control groups. The sample for the experimental group of one of the selected schools was used as experimental group and the other as the control group. SSI A of FUT Model secondary school, Bosso with a class population size of thirty-seven (37) students which formed the experimental group while SSI A of Ahmadu Bahago secondary school, Bosso with a class population of forty-five (45) students formed the control group.

Table 3.1: Sample Size

S/N	Name of School	Population	Male	Female	Total
1	FUT Model Secondary School	37	26	11	**37**
2	Ahmadu Bahago Secondary school	45	20	25	**45**
Total		**82**	**46**	**36**	**82**

The experimental group were taught using the Computer Animation Instructional Package (CAIP) and the control group were taught using conventional method.

3.5 Research Instrument

The researcher designed a Computer Animation Instructional Package (CAIP) which uses multimedia to present "The Skeletal System" and the presentation included sound, images, animations and video clips. The researcher constructed a test instrument; Biology Achievement Test (BAT) and Biology Retention Test (BRT) used for data collection. The instrument was constructed by the researcher and it consists of Twenty (20) items drawn from past West African Examination Council (WAEC) questions on skeletal system. The achievement test and retention test consist of multiple-choice questions with four (4) options (A-D) out of which one serves as the correct answer based on the topic taught (The Human Skeleton). However, at the second face (posttest) the options were interchanged likewise the numbering method (reshuffled). Each score per correct answer is one (1) mark. The questions were selected to determine effects of multimedia.

The Biology Achievement Test (BAT) and the Biology Retention Test (BRT) was developed by first constructing a blue print for the different content as shown in table 3.1. the objective of the topic in Senior secondary school biology curriculum served as a guide for developing the questions. The items in the BAT and BRT were constructed and tested by the researcher to ensure the inclusion of all the contents of the lessons covered in the topic. The Biology Achievement Test will be used to assess the students' achievement in Biology while the Biology Retention Test (BRT) will be used to assess the students' retention in Biology.

3.5.1 Procedure for Developing the Multimedia Package

The researcher adopted a vivid and eye-catching animated video to explain the concept of the human skeletal system from YouTube, the researcher then used Microsoft PowerPoint application to develop a series of slides to organize the content to be used in the package. The researcher developed the package using Macromedia Dreamweaver to develop a series of HTML webpages which contained the relevant elements such as text, animations, audio and video. The Computer Animation Instructional Package (CAIP) was finalized by converting the webpages into an executable computer program that can run on any computer for ease of use. The package was developed with the secondary school curriculum contents.

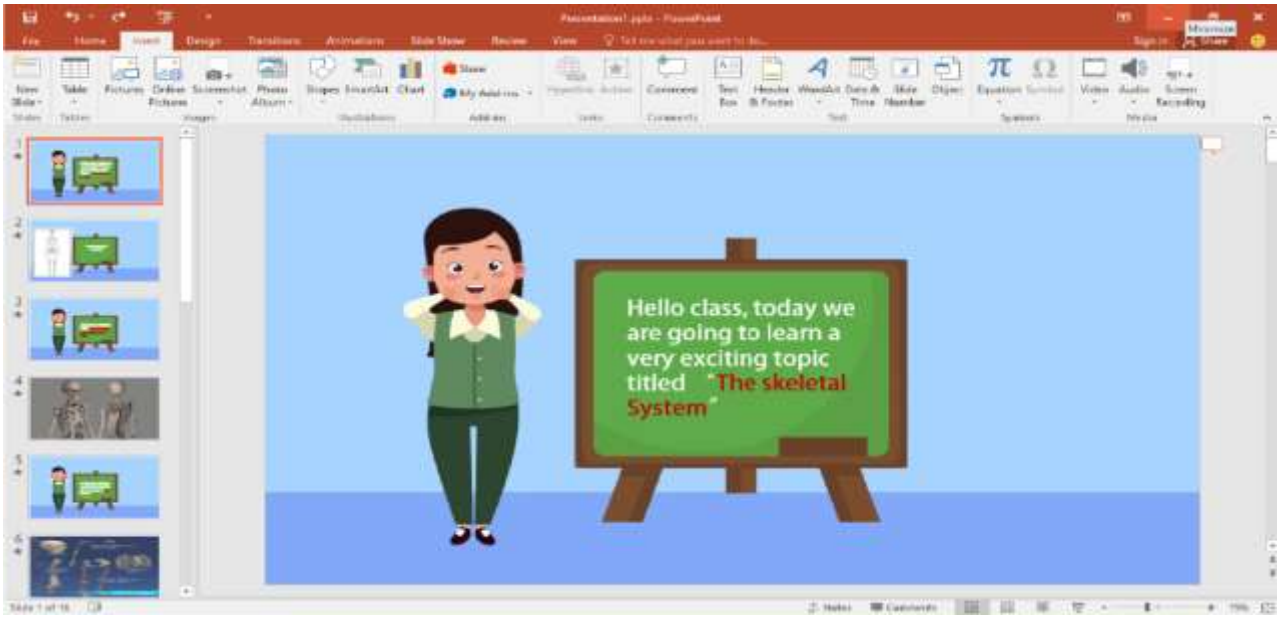

Fig 3.1: Organizing the content into slides

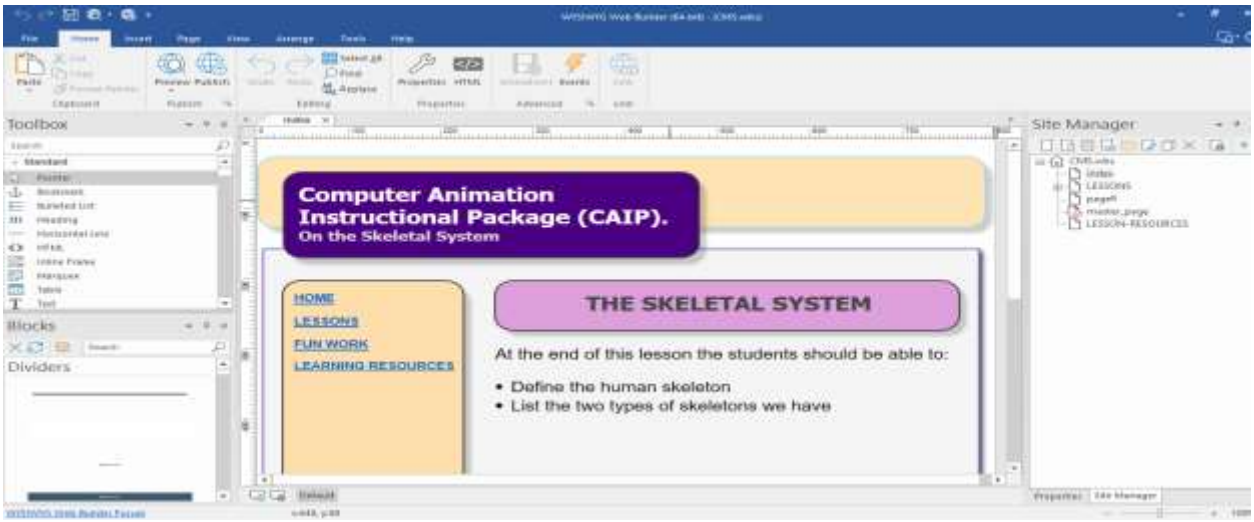

Fig. 3.2: Developing the webpages

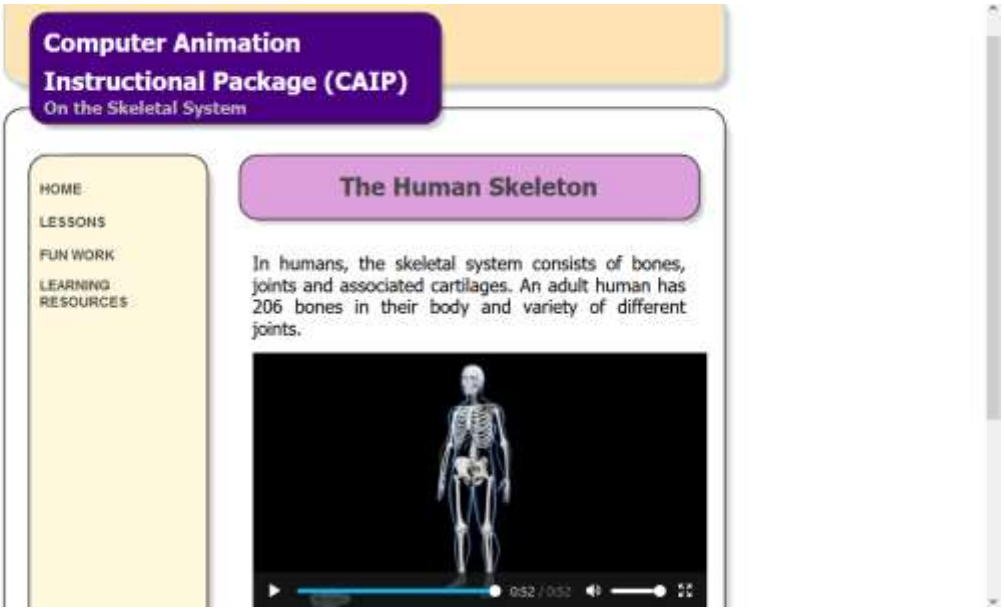

Fig. 3.3: The Computer Animation Instructional Package (CAIP)

3.6 Validity of Instrument

The Biology Achievement Test (BAT) and the Biology Retention Test (BRT), which consists of twenty (20) multiple choice questions was face and content validated by two experts, one (1) expert from the Department of Educational Technology, School of Science and Technology Education (SSTE), Federal University of Technology Minna and a subject expert from FUT Model secondary school. Meanwhile, the Computer Animation Instructional Package (CAIP) was validated by two experts in the Department of Educational Technology. These experts scrutinized the instruments and made necessary corrections and modification to the subject, proper wording of the items, appropriateness and adequacy of the items for the study, structure and adequate timing. The comments and recommendations of these experts helped to identify and correct the items in the instruments.

3.7 Reliability of the instrument

The reliability of Biology Achievement Test (BAT) was determined through the test-retest method by administering the instrument to 20 senior secondary school Biology students after instruction

with Computer Animation Instructional Package (CAIP) in Government Day secondary school, Bosso, Niger State which is not among the sampled schools for the study, a reliability coefficient of 0.91 was determined from the data using Pearson Product Moment Correlation Coefficient (PPMC).

3.8 Method of Data Collection

The school selected was visited by the researcher. Permission was taken from the Principal of the school which was given. The researcher was introduced to the Biology teacher of SS1 students. The aim and mode of research was explained to both the teachers and the students for their maximum cooperation. Thereafter, the students were sampled; the students were sampled from the two (2) schools; pretest was administered to the students in order to assess their entry behavior. The test was administered to the two schools used for experimental and control groups in the first week of the visit to the schools. The Biology Achievement Test (BAT) consists of 20 test questions which were drawn from the "The Skeletal System" in accordance with SSI Biology curriculum. Each question is followed by four multiple-choice optional answers (A-D) and students were expected to choose the correct answer. Each correct answer chosen earn one mark, zero awarded to any wrong answer chosen and overall score is then converted to percentage. The test lasted for thirty (30) minutes, the lesson commenced in all groups in the second week of experiment which was conducted using the regular period allocated to Biology during class hours. The experiment continued for two (2) weeks followed by revision. The two (2) schools were taught skeletal system for this period of two weeks. The experimental group was taught with Computer Animation Instructional Package (CAIP) while the control group was taught without the Computer Animation Instructional Package (CAIP). On the third week, posttest was administered to the two schools to test the achievement of the students for both experimental and control groups. The same items

contained in the pre-test were used but this time around the questions numbering were reshuffled as well as the options. Each correct answer chosen earn one mark, zero was awarded to any wrong answer chosen and the overall score is then converted to percentage and after two weeks another post-test was administered to the same group of students to determine their retention ability in both the experimental and control group respectively. The test lasted for 30 minutes and scripts were collected immediately for scoring.

3.9 Method of Data Analysis

Mean and Standard Deviation were used to answer the research questions while t-test was used to test the hypotheses at 0.05 level of significance. This level of significance formed the basis for rejecting or accepting each of the hypotheses, from which findings, discussions and summary will be arrived at. Computer software Statistical Package for Social Science (SPSS) version 23.00 was used for the analysis.

CHAPTER FOUR

4.0 RESULT AND DISCUSSION

4.1 Result

In this chapter, data for the study were analyzed and presented based on the research questions and hypotheses that guided the study. The research questions were answered using mean and standard deviation while independent statistics was used to test the research hypotheses. All the hypotheses were tested at $P < 0.05$ level of significance.

Table 4.1.1 t-test analysis of pre-test scores of students in the experimental and control group

Group	N	Df	$\bar{x}$	SD	t-value	p-value	Decision
Experimental group	37		12.72	1.09			
		80			-1.18	0.23	NS
Control group	45		13.02	1.11			

NS=Not Significant at P>0.05

Table 4.1.1 shows the t-test analysis of pretest scores of students in the experimental and control group, with a p-value of 0.48 at p>0.05. this implies that there is no significant difference in the pretest scores of students before the treatment.

Research Question One: What is the impacts of multimedia on students' achievement in secondary schools? The answer is shown below on table 4.2

Table 4.2 Mean and Standard Deviation of posttest scores of students in the experimental and control group

Group	N	Pretest		Postest	
		$\bar{x}$	SD	$\bar{x}$	SD
Experimental	37	12.72	1.09	18.70	0.25
Control	45	13.02	1.11	13.64	0.15

Table 4.2 indicates that students taught Biology using Computer Animation Instructional Package (CAIP) has a mean achievement score of 18.40 with a standard deviation of 0.25 at the posttest while those taught using the conventional method had a mean achievement score of 13.64 and a standard deviation of 0.15. from the posttest mean scores, it is revealed that the students that were taught with the Computer Animation Instructional Package (CAIP) scored higher than those taught using traditional method. The level of significance was presented in table 4.6

Research Question 2: What is the influence of gender on students' achievement when taught using multimedia? The answer is revealed in Table 4.3

Table 4.3 Mean and Standard Deviation of male and female achievement scores of students in the experimental group

Group	N	Pretest		Posttest	
		$\bar{x}$	SD	$\bar{x}$	SD
Male	26	12.96	1.11	18.76	1.58
Female	11	12.18	0.87	18.54	1.50

Table 4.3 reveals the influence of gender on the mean achievement scores of students taught using the Computer Animation Instructional Package (CAIP). The male students had a mean achievement score of 18.76 and a standard deviation of 1.58 at the posttest, the female students had a mean achievement score of 18.54 and a standard deviation of 1.50. This indicates that males achieved higher than their female counterparts, although the difference in the mean achievement score is shown in table 4.7

Research Question 3: What is the effect of multimedia on students' retention? The answer is revealed in Table 4.4

Table 4.4 Mean and Standard Deviation of achievement test scores of students in the experimental and control group

Group	**N**	**Posttest**		**Retention**	
		$\bar{x}$	**SD**	$\bar{x}$	**SD**
Experimental	37	18.70	1.54	18.16	1.95
Control	45	13.64	1.06	12.26	1.46

From Table 4.4, reveals that students taught Biology using the Computer Animation Instructional Package (CAIP) had a higher posttest score with a computed mean of 18.70 and standard deviation of 1.54 while the retention score had a mean of 18.16 and standard deviation of 1.95. The control group had a posttest mean of 13.64 and standard deviation of 1.06 while the retention mean score was 12.26 and standard deviation of 1.46. The table indicates that students taught Biology using the Computer Animation Instructional Package (CAIP) retained higher than the students taught using conventional method. Table 4.8 reveals the significant difference in retention scores of the experimental and control group.

Research Question 4: What is the impact of multimedia and gender on students' retention? The answer is revealed in Table 4.5

Table 4.5 Mean and Standard Deviation of male and female retention scores of students in the experimental group

Group	N	Posttest		Retention	
		$\bar{x}$	SD	$\bar{x}$	SD
Male	26	18.76	1.58	18.84	0.54
Female	11	18.54	1.50	16.54	2.97

Table 4.5 presents the influence of gender on the mean achievement scores of students taught using Computer Animation Instructional Package (CAIP). The male students had mean retention score of 18.84 and a standard deviation of 0.54 while the females had a mean of 16.54 and a standard deviation of 2.97. This indicated that the male students retained higher than the females.

4.2 Hypothesis Testing

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

Table 4.6 T-test for the posttest achievement scores of the experimental and control groups

Group	N	df	$\bar{x}$	SD	t-value	p-value
Experimental group	37		18.70	1.54		
		80			17.47	0.00
Control group	45		13.64	1.06		

Significant at $p < 0.05$

The t-test for table 4.6 shows the mean achievement scores of students taught Biology using the Computer Animation Instructional Package (CAIP) and those taught using convention method. There was a significant difference between the mean achievement scores of students taught Biology using Computer Animation Instructional Package (CAIP) and those taught using conventional teaching methods as determined by the t-test analysis with a t-value at 17.47 and a p-value of 0.00 < 0.05. students taught using Computer Animation Instructional Package (CAIP) (M=18.70, S.D=1.54) scoring higher than students taught using the conventional method (M=13.64, SD=1.06). Therefore, the null hypothesis was rejected which implies there is a significant difference in the achievement of the experimental group as compared to the control group.

Hypothesis 2: There is no significant difference between the achievements mean score based on gender of students taught using multimedia instruction

Table 4.7 T-test analysis of male and female students taught Biology using Computer Animation Instructional Package (CAIP)

Gender	N	Df	$\bar{x}$	SD	t-value	p-value	Decision
Male	26		18.76	1.58			
		35			0.39	0.69	NS
Female	11		18.54	1.50			

NS= Not Significant at p > 0.05 level

The t-test for table 4.8 shows the mean achievement scores of male and female students taught Biology using the Computer Animation Instructional Package (CAIP). There was no significant difference between the mean achievement scores of male and female students taught Biology using

Computer Animation Instructional Package (CAIP) as determined by the t-test statistics with a t-value at 0.39 and a p-value of 0.69 > 0.05. Male students (M=18.76, S.D=1.58) while the female students (M=18.54, SD=1.50). Therefore, the null hypothesis was accepted implying there is no significant difference between the mean achievement scores of male and female students taught Biology using Computer Animation Instructional Package (CAIP).

Hypothesis 3: There is no significant difference between the achievement mean score of students taught using multimedia instruction and students taught using conventional instruction

Table 4.8 T-test for the posttest achievement scores of the experimental and control groups

Group	N	Df	$\bar{x}$	SD	t-value	p-value
Experimental group	37		18.16	1.95		
		80			15.60	0.00
Control group	45		12.26	1.46		

Significant at $p < 0.05$ level

The t-test for table 4.7 shows the mean retention scores of students taught Biology using the Computer Animation Instructional Package (CAIP) and those taught using convention method. There was a significant difference between the mean retention scores of students taught Biology using Computer Animation Instructional Package (CAIP) and those taught using conventional teaching methods as determined by the t-test analysis with a t-value at 15.60 and a p-value of 0.00 < 0.05. students taught using Computer Animation Instructional Package (CAIP) (M=18.16, S. D=1.95) scoring higher than students taught using the conventional method (M=12.26, SD=1.46). Therefore, the null hypothesis was rejected which implies there is a significant difference between

the mean retention scores of students taught Biology using Computer Animation Instructional Package (CAIP) and those taught using conventional teaching methods.

Hypothesis 4: There is no significant difference between the retention mean score based on gender of students taught using multimedia instruction

Table 4.9 Retention t-test analysis of male and female students taught Biology using Computer Animation Instructional Package (CAIP)

Group	N	Df	$\bar{x}$	SD	t-value	p-value	Decision
Male	26		18.84	0.54			
		35			3.86	0.00	S
Female	11		16.54	2.97			

S= Significant at $p < 0.05$ level

The t-test for table 4.9 shows the mean retention scores of male and female students taught Biology using the Computer Animation Instructional Package (CAIP). There was a significant difference between the mean retention scores of male and female students taught Biology using Computer Animation Instructional Package (CAIP) as determined by the t-test analysis with a t-value at 3.86 and a p-value of $0.00 < 0.05$. Male students (M=18.84, S.D=0.54) while the female students (M=16.54, SD=2.97). Therefore, the null hypothesis was rejected which implies that there was a significant difference between the mean retention scores of male and female students taught Biology using Computer Animation Instructional Package (CAIP).

4.5 Discussion of Findings

The data analyzed in this chapter were interpreted and discussed on the results derived from four research questions and hypotheses. The main objective of the research is to determine the effect of Computer Animation Instructional Package (CAIP) on student's achievement and retention in the teaching of Biology. The posttest scores in table 4.2 shows that the experimental group (M=18.70, S.D=1.54) had a higher achievement scores than the control group (M=13.64, S.D=1.06). Similarly, the p-value associated with the calculated value of t.val (17.47) in table 4.6 is 0.00 which is less than the level of significance, the null hypothesis was therefore rejected. Hence, there is significant difference in the mean achievement scores of students taught Biology with the use of Computer Animation Instructional Package (CAIP). The use of Computer Animation Instructional Package (CAIP) therefore has a significant effect on student's achievement in Biology as compared to conventional teaching method. This agrees with the findings of Ilhan and Oruc (2016), Shah (2015) and Aloraini (2012) who stated that students taught using Multimedia packages performed better than those taught using conventional methods. Hence, the use of multimedia has a significant effect on student's achievement in Biology than the traditional teaching method.

The experimental retention group scores at the posttest level in table 4.4 shows that the experimental group (M=18.16, S.D=1.95) had a higher achievement scores than the control group (M=12.26, S.D=1.46). Similarly, the p-value associated with the calculated value of t.val (15.60) in table 4.7 is 0.00 which is less than the level of significance, the null hypothesis was therefore rejected. Hence, there is significant difference in the mean retention scores of students taught Biology with the use of Computer Animation Instructional Package (CAIP). The use of Computer Animation Instructional Package (CAIP) therefore has a significant effect on student's retention

in Biology as compared to conventional teaching method. This was in line with the findings of Cyril (2015) who observed that multimedia increases student's retention.

The male students at posttest level (M=18.76, S.D=1.58) achieved higher than the female Biology students (M=18.54, S.D=1.50). Although, the p-value revealed there was no significant difference (p=0.69), in table 4.7 the p-value was greater than the 0.05 level of significance hence, the null hypothesis was accepted. This indicated that there is no significant difference in the mean achievement scores of male and female Biology students. This agrees with the findings of Akinoso (2018) who noted that significant effect did not exist on treatment and gender. Hence there is no significant difference in the achievement scores of male and female students.

The mean retention score of male students exposed to the Computer Animation Instructional Package (CAIP) (M=18.84, S.D=0.54) while the mean scores of female students (M=16.54, SD=2.97). Similarly, the value associated with the value of t (t.val=3.86, df=35, p<0.00). In table 4.9, the p-value is less than the level of significance (0.05), hence the null hypothesis was rejected. This indicates that there is no significant difference in the mean retention score between male and female students taught using Computer Animation Instructional Package (CAIP). This agrees with the findings of Tukura *et al.* (2020) who noted that there was no significant difference in the retention scores of male and female students exposed to multimedia instruction.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The research determines the impact of multimedia on the academic achievement and retention of secondary school students in Bosso, Minna, Niger State . This chapter contains the summary, conclusion, recommendation, major findings of the study, contribution to knowledge, implications of the findings and suggestions for further studies.

5.1.2 Conclusion

Based on the findings and discussion of the study, the following conclusion were drawn;

The effective and adequate use of Computer Animation Instructional Package (CAIP) improves the academic achievement and retention in Biology students. The evidence of the experimental group that use the Computer Animation Instructional Package (CAIP) in teaching enhances student's achievement more than the convention method. The use of Computer Animation Instructional Package (CAIP) has a great significant effect on student's retention level and also on gender achievement in Biology. Emphasis should be laid on the use of Computer Animation Instructional Package (CAIP)s and software for teaching Biology in senior secondary schools.

5.2 Recommendation

In view of this project findings, the following recommendations was made;

1. The teachers should be encouraged to enroll in the study of educational technology whereby they can learn the process of producing Computer Animation Instructional Package (CAIP) and the use of modern instructional media.
2. Seminars, conference and workshops should be organized and put in place for the teachers on the use of Computer Animation Instructional Package (CAIP) as instructional materials
3. There should be adequate reinforcement to hardworking and dedicated teachers through prize awards as a means of appreciation.
4. Government, school administrators should show support and dedication to encourage creativity shown by co-science teachers by providing teaching materials which will promote science and technology in Nigeria.

5.3 Major Findings of the Study

The following findings have been made from the research work

1. There was significant difference between the mean achievement scores of students taught Biology using Computer Animation Instructional Package (CAIP) and those taught using conventional method
2. There was significant difference between the mean retention scores of students taught Biology using Computer Animation Instructional Package (CAIP) and those taught using conventional method
3. There was no significant difference between the mean achievement scores of male and female students taught Biology using Computer Animation Instructional Package (CAIP).
4. There was a significant difference between the mean retention scores of male and female students taught Biology using Computer Animation Instructional Package (CAIP).

5.4 Contribution to Knowledge

The result of the study has contributed to knowledge in the following ways

1. Helping the teacher understand the use of instructional materials and Computer Animation Instructional Package (CAIP) will reduce the abstract nature of Biology concepts thereby making learning interesting.
2. Adequate use of Computer Animation Instructional Package (CAIP) will help save the teacher's time and energy
3. Retention of students during learning activities can be enhanced through the use of Computer Animation Instructional Package (CAIP)
4. It helps to contribute to the existing literature and use to provide platform for further research.

5.5 Implications of the Findings

Various implications have been adopted but the most important is the use of Computer Animation Instructional Package (CAIP) in teaching Biology in senior secondary schools so as to improve student's achievement and retention level in Biology. Therefore, teachers should be encouraged and enlightened on the use of Computer Animation Instructional Package (CAIP) as it creates interaction between the teacher and the students. It can also be used to enhance the student knowledge and enables them to contribute their own quota on whatever they are been taught.

5.6 Suggestions for further Research

Areas where further research could be done are as follows;

1. The factors that foster the use of Computer Animation Instructional Package (CAIP)
2. Effect of Computer Animation Instructional Package (CAIP) in teaching and its achievement, retention and interest on student's performance in senior secondary schools in Minna Metropolis, Niger State.
3. Further research should not be limited to a specific area, it should cover a wider geographic area

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APPENDIX A

BIOLOGY ACHIEVEMENT TEST (BAT) PRETEST

1. Which of the following is not a function of the mammalian skeleton? It

A) gives the body its shape (B) provides a framework on which internal organs are suspended

(C) protects water (D) provides attachment for muscles

2. The skeleton is referred to as one of the following_____

A) The internal mass of the body (B) the bony framework of the body

C) The external tissues of the body (D) the organ system of the body

3. An adult human has _____number of bone

A) 306 (B) 206 (C) 246 (D) 216

4. the skeletal system gives the ____ a point of attachment

(A) skin (B) Head (C) Muscles (D) ear

5. Humans have____ type of skeleton

(A) exoskeleton (B) Static skeleton (C) Endoskeleton (D) Hind skeleton

6. Insects have ___ type of skeleton

(A) Endoskeleton (B) Exoskeleton (C) Electrostatic skeleton (D) Fore skeleton

7. The endoskeleton is ___ of the body

(A) Outside the body (B) Inside the body (C) Middle of the body (D) None of the above

8. the exoskeleton is the type of skeleton that exists _____ of the body

(A) inside (B) outside (C) middle (D) None of the above

9. the skeletal system consists of bones, _____ and _____

(A) joints and hands (B) Legs and feet (C) Joints and cartilages (D) skull and skin

10. The human skeleton can be grouped into _____ and _____

(A) Cilia and flagella (B) Axial and perpendicular (C) Axial and Appendicular (D) Arial and Axial

11. The axial skeleton is formed around the _____ of the body

(A) inner axis (B) internal axis (C) Center axis (D) Middle axis

12. the axial skeleton includes the following **EXCEPT**

(A) Skull (B) Spine (C) Ribcage (D) Hip girdles

13. The appendicular skeleton is related to the_____

(A) Skull (B) Spine (C) Ribcage (D) Limbs

14. The axial skeleton protects the following **EXCEPT**

(A) Brain (B) Spinal cord (C) Heart (D) Feet

15. The appendicular skeleton consists of the following bones EXCEPT

(A) arms and Legs (B) Shoulders (C) Skull (D) Hip girdles

16. In humans, our bones lie underneath our ____

(A) Teeth (B) Tongue (C) Skin (D) Hair

17. The eyes, ears and nose are protected by the_____ skeleton

(A) Appendicular skeleton (B) Axial skeleton (C) Endoskeleton (D) Exoskeleton

18. The skeleton offers _____

(A) Speed (B) Power (C) Support (D) Light

19. The skeletal system consists of the bones, ____ and_____

(A) Feet and hands (B) Joints and cartilage (C) Lips and hands (D) Legs and skin

20. The following are types of skeleton **EXCEPT**

(A) Endoskeleton (B) Exoskeleton (C) Hydrostatic skeleton (D) Hydraulic skeleton

APPENDIX B

ANSWERS

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

APPENDIX C

BIOLOGY ACHIEVEMENT TEST (BAT) POSTTEST

1. The skeleton is referred to as one of the following_____

A) The internal mass of the body (B) the bony framework of the body

C) The external tissues of the body (D) the organ system of the body

2. An adult human has _____number of bones

A) 306 (B) 206 (C) 246 (D) 216

3. The skeletal system gives the ____ a point of attachment

(A) skin (B) Head (C) Muscles (D) ear

4. The eyes, ears and nose are protected by the_____ skeleton

(A) Appendicular skeleton (B) Axial skeleton (C) Endoskeleton (D) Exoskeleton

5. The skeleton offers _____

(A) Speed (B) Power (C) Support (D) Light

6. The skeletal system consists of the bones, ____ and_____

(A) Feet and hands (B) Joints and cartilage (C) Lips and hands (D) Legs and skin

7. The following are types of skeleton **EXCEPT**

(A) Endoskeleton (B) Exoskeleton (C) Hydrostatic skeleton (D) Hydraulic skeleton

8. Humans have____ type of skeleton

(A) exoskeleton (B) Static skeleton (C) Endoskeleton (D) Hind skeleton

9. Insects have ___ type of skeleton

(A) Endoskeleton (B) Exoskeleton (C) Electrostatic skeleton (D) Fore skeleton

10. The endoskeleton is ___ of the body

(A) Outside the body (B) Inside the body (C) Middle of the body (D) None of the above

11. The exoskeleton is the type of skeleton that exists _____ of the body

(A) inside (B) outside (C) middle (D) None of the above

12. The skeletal system consists of bones, _____ and _____

(A) joints and hands (B) Legs and feet (C) Joints and cartilages (D) skull and skin

13. Which of the following is not a function of the mammalian skeleton? It

A) gives the body its shape (B) provides a framework on which internal organs are suspended

(C) protects soft and delicate parts of the body (D) provides attachment for liquids

14. The human skeleton can be grouped into _____ and _____

(A) Cilia and flagella (B) Axial and perpendicular (C) Axial and Appendicular (D) Arial and Axial

15. The axial skeleton is formed around the _____ of the body

(A) inner axis (B) internal axis (C) Center axis (D) Middle axis

16. the axial skeleton includes the following **EXCEPT**

(A) Skull (B) Spine (C) Ribcage (D) Hip girdles

17. The appendicular skeleton is related to the_____

(A) Skull (B) Spine (C) Ribcage (D) Limbs

18. The axial skeleton protects the following **EXCEPT**

(A) Brain (B) Spinal cord (C) Heart (D) Feet

19. The appendicular skeleton consists of the following bones **EXCEPT**

(A) arms and Legs (B) Shoulders (C) Skull (D) Hip girdles

20. In humans, our bones lie underneath our ____

(A) Teeth (B) Tongue (C) Skin (D) Hair

APPENDIX D

ANSWERS

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

APPENDIX E

LESSON PLAN FOR THE EXPERIMENTAL GROUP

School	FUT Model secondary school, Minna, Niger State
Date	20th May, 2021
Number in Class	37
Sex	Mixed class
Average age	14-17
Subject	Biology
Topic	Skeletal System
Time	10:00 - 10:40
Duration	40mins
Period	1st

Method of Teaching	Discussion, Demonstration
Teaching Techniques	Set induction, Questioning
Instructional materials	Whiteboard, Multimedia Package (CAIP)
Specific Objective	At the end of the lesson students should be able to; a. Define the skeletal system c. Explain the types of human skeleton d. Identify the bones of the axial and appendicular skeleton
Introduction	Teacher introduce the lesson by asking the students the following questions: a. What is a skeleton b. Do you have bones in your body?
PRESENTATION	Teacher presents the lesson by the following steps
Step I	Teacher defined the human skeleton as internal bony framework of the body
Step II	Teacher lists the types of human skeleton as 1. Axial 2. Appendicular
Step III	Teacher explain the three types of skeleton: a. Axial skeleton consists of the skull, vertebrae column and ribcage cage b. Appendicular skeleton consists of bones of the limbs, hip girdles and shoulders
Step IV	Teacher demonstrate with the multimedia package
EVALUATION	Teacher evaluates the lesson by asking the students the following questions. i. What is the human skeleton? ii. Lists two types of skeleton? iii. Explain three bones of the axial skeleton?
Conclusion	The teacher concludes the lesson by summarizing the main point of the lesson
Assignment	Draw and label the diagram of skull
Reference material	Essential Biology for Secondary schools.

APPENDIX F

LESSON PLAN FOR THE CONTROL GROUP

School	Ahmadu Bahago Secondary School
Date	24th May, 2021
Number in Class	45
Sex	Mixed class
Average age	14-17
Subject	Biology
Topic	Skeletal System
Time	10:00 - 10:40
Duration	40mins
Period	3rd

Method of Teaching	Discussion, Demonstration
Teaching Techniques	Set induction, Questioning
Instructional materials	Whiteboard, Multimedia Package (CAIP)
Specific Objective	At the end of the lesson students should be able to; a. Define the skeletal system c. Explain the types of human skeleton d. Identify the bones of the axial and appendicular skeleton
Introduction	Teacher introduce the lesson by asking the students the following questions: a. What is a skeleton b. Do you have bones in your body?
PRESENTATION	Teacher presents the lesson by the following steps
Step I	Teacher defined the human skeleton as internal bony framework of the body
Step II	Teacher lists the types of human skeleton as 3. Axial 4. Appendicular
Step III	Teacher Explain the three types of skeleton: a. Axial skeleton consists of the skull, vertebrae column and rib cage b. appendicular skeleton consists of bones of the limbs, shoulders and hip girdle.
Step IV	Teacher carefully explains the concepts
EVALUATION	Teacher evaluates the lesson by asking the students the following questions. iv. What is the human skeleton? v. Lists two types of skeleton? vi. Explain three bones of the axial skeleton?
Conclusion	The teacher concludes the lesson by summarizing the main point of the lesson
Assignment	Draw and label the diagram of skull
Reference material	Essential Biology for Secondary schools.