EFFECTS OF MULTIMEDIA AND ADVANCED ORGANIZER ON UPPER BASIC SCIENCE STUDENTS' PERFORMANCE AND MOTIVATION IN CHEMICAL CONCEPTS, ZARIA METROPOLIS, KADUNA STATE, NIGERIA

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A DISSERTATION SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES, AHMADU BELLO UNIVERSITY, ZARIA IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER DEGREE IN SCIENCE EDUCATION

DEPARTMENT OF SCIENCE EDUCATION,

AHMADU BELLO UNIVERSITY,

ZARIA, NIGERIA

MARCH, 2021

DECLARATION

I hereby declare that this Dissertation titled Effects of Multimedia and Advanced Organizers on Upper Basic Science Students Performance and Motivation in Chemical Concepts, Zaria Metropolis, Kaduna State, Nigeria was written by me under the supervision of Prof. I. A. Usman and Prof. S.S. Bichi. It is a record of my own research work and has not been presented in any previous application for a higher degree in any institution. All citations and sources of information are fully acknowledged in the list of references.

Aliyu, ABDULLAHI ____________________

P17EDSC8032 **Signed and Date**

CERTIFICATION

This Dissertation titled Effects of Multimedia and Advanced Organizers on Upper Basic Science Students Performance and Motivation in Chemical Concepts, Zaria Metropolis, Kaduna State, Nigeria by Aliyu, ABDULLAHI with registration number P17EDSC8032, meets the regulation governing the award of Masters Degree in Science Education, Ahmadu Bello University, Zaria and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This Dissertation is dedicated in memory of my late grandmother Malama Asma'u Abubakar, may almighty Allah continue to encompass her with his mercy, Amen.

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ABBREBIATIONS

ACP	Academic Performance
AO	Advanced Organizers
BSPT	Basic Science Performance Test
CLT	Central Limit Theorem
DCTM	Dual Coding Theory of Multimedia
DI	Discrimination Index
FI	Facility Index
GTM	Generative Theory of Multimedia
IM	Instructional Media
MM	Multimedia
MTV	Motivation

OPERATIONAL DEFINITION OF TERMS

Academic Performance - Changes in observable behaviour of a learner after been exposed to new knowledge.

Advanced Organizer – Information presented to the learners before introduction of new lesson usually when previous knowledge is lacking and there is need to link the existing knowledge and the new incoming one.

Basic Science - A science taught at lower school level which remove the traditional boundaries among scientific disciplines or subjects (Biology, Chemistry and Physics) and view science as a unified whole.

Graphic Advanced Organizer – Advanced organizer presented in the form of combination of pictures with text.

Multimedia – Combination of two or more media of transmitting information, such as visual, audio and audio-visual

Upper Basic Science – Basic science taught at Junior Secondary School level

Zaria Metropolis – The Ancient City of Zaria (the area surrounded by the old city wall)

ABSTRACT

This study investigated the effects of multimedia and advanced organizers on upper Basic science students' performance and motivation in chemical concepts, Zaria metropolis, Kaduna State, Nigeria. The population comprised 7,302 JSSII students. Sampled of 263 students from 3 public coeducational junior secondary schools were purposely selected from the 9 Junior secondary schools in Zaria metropolis. The study adopted the pretest, post test non-randomization quasi experimental and control group design. The students in experimental group I were taught Chemical concept using multimedia (video); experimental group II were taught chemical concept with advanced organizers (graphic), while those in control group were taught the same concept using lecture method for the period of 5 weeks. The instruments used for data collection were BSPT and BSMQ with reliability coefficient of 0.74 and 0.89 respectively. Eight research questions and eight null hypotheses were formulated and tested using independent t-test, Mann-Whitney (U-test), ANCOVA and Kruskal- wallis at 0.05 level of significance. The major findings from the study include: Significant difference exist between the mean academic performance of male and female students taught chemical concept with multimedia, advanced organizer and lecture method; Significant difference exist between the motivation level of male and female students taught chemical concept using multimedia, advanced organizers and lecture method. Based on the findings it was recommended that multimedia and advanced organizers should be used by Basic science teachers to teach Basic science in Junior Secondary Schools for effective teaching and learning.

CHAPTER ONE

THE PROBLEM

1.1 Introduction

Science is an intellectual activities carried out by scientists designed to discover information about the natural world in which we live and to discover ways in which this information can be organized to benefit human race (Bichi, 2002). Usman (2007) also posits that, we live in a world where science and technology has become an integral part of our culture and any country that overlooks this significant truism does so at the risk of remaining backward in an advancing world. Hence, the world is in the age of science and technology and all human activities are being controlled and fashioned by science with the ultimate gold of transforming our society in to a scientific and technological one so that it members can live conveniently in the modern age (Muhammad, 2017). Mulemwa (2002) points out that, the fast changing applications of science and technology and the global reliance on its processes and products in all areas of human endeavor have made them invaluable that any society or country without them risks being alienated from the global village. This means that for an individual to be well-grounded in science, and competent enough to face the challenges of life in his society, he or she must have gone through a science programme that is well planned, assessed and implemented.

Basic science formally Integrated Science is not a new name in many parts of the world. However, it is relatively new in some developing countries where general or rural science has been stressed over the years. For instance, General science has been introduced to Nigerian Schools since 1878, whereas integrated science became popular only between 1957 and 1969 (Abdullahi in Abdullahi, 2018). This period was characterized by activities generated in many parts of the world to develop new and suitable science curricula for the primary and junior secondary schools. For example, the Russians launched their space ship, the Sputnik-1, in 1957, while the Americans put the first man on the moon in 1969. The first International Conference on Integrated Science teaching took place in Warna (Bulgaria) in 1968. The first publication of the Nigerian Integrated Science Project (N.I.S.P) was in 1970. It spelt out the objectives of Integrated Science and since that time this aspect of science has been better imbibed by relevant cadres of our educational system. Originally meant for the first two years of the secondary school, afterward integrated science was taught in primary and junior secondary schools in Nigeria, the latter being of three years duration. This is in line with the National Policy on Education, which adopted the 6-3-3-4 system and later known as Basic Science.

The Basic science education programme is regarded as a reinforcement of the 9-3-4 National Policy on Education rather than a new policy in itself. The New Basic Science curriculum was approved by the National Council of Education (NCE) in December 2005. There is no doubt that the curriculum is the bedrock of any educational reform of which emphasized the need to basic education and Basic Science is not an exception. The main objectives of the Basic science programme according to the National Policy on Education (FRN, 2014) include to prepare students to acquire adequate laboratory and field skills, inculcation of meaningful and relevant knowledge in Basic Science, the ability to apply scientific knowledge to everyday life in matters of personal and community health, and agriculture. However, observation from Basic science classrooms reveals that most teachers do not use instructional techniques and strategies that could stimulate students' motivation and performance also other problems are attributed to insufficient man-power, lack of equipment, poor attitude of students and poor understanding of the concepts involve in science (Olorukooba & Lawal, 2010). In the case of Zaria Metropolis, Jibrin and Zayum (2012), found that poor teaching method is the genesis for students' poor academic performance in science subjects.

Ayodele (2006) identified the use of inappropriate and non effective teaching methodology as a major factor hindering students understanding and achievement in science. The teaching and learning of science do not require theoretical and lecture approaches. Many teachers teach science as an abstract thereby making science lessons boring and students find it difficult to grasp some scientific concepts and skills. Presently the statistics on the students' academic performance in the Junior Secondary School Certificate Examination (JSSCE) in Kaduna state tend to show that the teaching and learning of Basic science as a subject at the junior secondary school level is still inadequate. For example Table 1.1 shows the trend performance of students in Basic Science in the JSSCE in Kaduna State from 2011 to 2017

Table 1.1: Results of Students in Basic Science, Kaduna State from 2011 to 2017.

Year	No of students that sat for the exam	No. of Students pass with (A1-C6)	% of Students that Pass (A1-C6)	No. of Students that Failed (D7-F9)	% of Students that Failed (D7-F9)
2011	367562	120560	33%	247002	67%
2012	659132	204330	31%	454802	69%
2013	791227	245280	31%	545947	69%
2014	866616	251319	29%	615297	71%
2015	289520	84520	29%	205000	71%
2016	182759	39225	21%	143534	79%
2017	428034	80233	19%	347801	81%

Sources: Ministry of Education, Kaduna State of Nigeria (2018)

From Table 1.1, it can be deduced that the performance of the junior secondary school students in Basic science in Kaduna State was very poor. This status may be attributed to lack of media instruction such as the use of multimedia and advanced organizers which may motivate students to improve academic performance. This assertion was observed by Akinoso (2018) that students' performance and motivation improve with the aid of multimedia.

Although, the questions from chemical concepts in the JSCE Basic science examination were not enough to conclude that the failure in the national examination was due to failure in the concepts, but it might contribute to the failure, and the relevance of chemical to everyday life become necessary to teach students in a way that they will understand better about the concepts and its consequences in the environment, this attracted the researcher to make use of multimedia and advanced organizers in teaching the students chemical concepts.

Chemical as defined by Akintelure, Kuku, Ohiro and Mahmud (2015) is a substance that is either an element or a compound, usually produced by chemical process which lead to the formation of new substances and the changes are not easily reversible. Therefore, this study seeks to investigate the Effects of Multimedia and Advanced Organizers on Upper Basic Science Students' Performance and Motivation in Chemical Concept, Zaria Metropolis, Kaduna State, Nigeria.

Multimedia according to Mayer (2005) is a way of presenting words such as spoken text or printed text combined with pictures such as illustrations, photos, animation or video. Alberk (2011) defined multimedia as the exciting combination of computer hardware and software that allow one to integrate video, animation, audio, graphic and text resources to develop effective presentations. According to Muhammad (2017) multimedia is an integration of multiple media element (audio, video, graphic, text and animation among others) in to the string and unified whole that results is more benefits for the end user than any of the media elements can provide individually.

Multimedia instructional message According to Mayer (2003) is “a presentation consisting of words and pictures that is designed to foster meaningful learning. According to Mayer, meaningful learning in a multimedia environment consists of the learners “selecting words and selecting images from the presented material, organizing words and organizing images into coherent mental representations, and integrating the resulting verbal and visual representations with one another”. The uses of multimedia make the learning of abstract concepts become more concrete and easier to understand. Where previous knowledge is lacking, sometimes multimedia act as advanced organizers as observed by Muller (2008) that students with different levels of prior knowledge were better able to learn with misconception-based multimedia, in which they also invested more mental effort to the understanding of the new lesson.

Advanced organizer according to Mayer (2003) is information presented prior to learning that can be used by learner to organized and interpret new incoming materials. Ausubel as cited by Kirman and Shaw (2007) defined advanced organizers as appropriate, relevant and inclusive introductory materials introduced in the beginning of new lesson and presented as a higher level of abstraction, generality and inclusiveness. Atomatofa (2013) observed that, students are able to build more complex cognitive structures and deepen their understanding of scientific concepts when teachers help them link old knowledge with new ones by giving students Advance Organizers in addition to text materials and the lesson itself. The existence of relevant anchoring ideas in the cognitive structures is a pre-requisite for subsequent meaningful learning which promote academic performance in Basic science.

Academic performance as observed by Shu’aibu (2017) is the exhibition of knowledge attained or skills developed by students in a subject designed by test scores assigned by teachers. It is influenced by a number of factors such as instructional materials available, class size, qualification and experience of science teacher, teaching strategies employed among others (Salisu, 2016). According to Akintola (2012), academic performance can be described as the scholastic standing of a student at a given moment. It refers to how an individual is able to demonstrate his or her intellectual abilities. This scholastic standing could be explained as the grade obtained in a course or group of courses; and the way in which a student has attained the grade including the time he / she passed the examination. Lawal (2009) defined academic performance as overall measure of academic achievement of students in a given test after a period of instruction and teaching, usually weighed as a score. In another definition, Obeka, Bichi and Yusuf (2012) considered academic performance as the display of knowledge attained or skill developed in school subjects designed by test and examination scores or marks assigned by subject teacher. A study conducted by Atomatofa (2013) found out that advanced organizer improve Physics students academic performance. Also, Liu, Olmanson and Horton (2011) found out that multimedia learning environment impact positively students motivation in scientific concepts.

Motivation according to Cook and Artino (2016) can be defined as path that lead to behaviour, or to the construct that trigger someone to desire to replicate behaviour and vice – versa. Motivation is a kind of feeling that always finds ways to go down and cultivate anxiety and tension in human mind and thoughts indeed, with the positive motivation; one can revive the positivism energy and apply it in performing tasks (Cook & Artino, 2016). Also, Ross, Parkins and Bodey (2016) posit that individual with self-motivation always can find a motive and intensity without expecting external encouragements to complete a task even though the task is challenging. According to Skinner and Belmont as cited in Gopalan, Abu Bakar, Zulkifli, Alwi and Che Mat (2017) observed that students' level of motivation reflects on their engagement and contribution in a learning environment. Active and highly motivated students will be spontaneously involve in activities without expecting any external rewards. Meanwhile to encourage a low motivated student, external rewards are needed to convince students to participate in activities. Jeamu, Kim and Lee (2008) asserted that Motivation is able to initiate to succeed in students' choices and at the same time lack of motivation can initiate to major barrier that prevents the success. However, Legault, Green-Demers and Pelletier (2006) posit that; due to lack of motivation, the feeling of frustration and annoyance can hinder productivity and wellbeing and several reasons that influence the motivation level in learning such as the ability to believe in the effort, the unawareness of the worth and characteristic of the academic tasks.

Motivation to learn is of particular importance for science learning, which requires a deep level of engagement with new material for conceptual change to occur (De Backer & Nelson, as cited in Schulze & Van Heerden, 2015). Thus, Zimmerman (2008) maintained that students' apparent lack of motivation to learn science requires some investigation. Law and Jin (2009) found out that, learners who have the opportunity to use multimedia resources were highly motivated and multimedia technology together with a certain type of course design lead to elevated motivation and superior learning performance. Also, Schulze and Van Heerden, (2015) found out that motivation goal has positive effects on gender. This motivation could be of high level if multimedia or advanced organizers are being utilized where necessary.

Gender according to Bichi (2002) is the amount of masculinity or femininity in an individual. Several researches on the effects of students' gender on academic performance have been carried out as some findings indicated that gender can influence students' achievement especially in science-oriented subjects while other findings showed that gender factor had no impact on the academic performance of students. Akinoso (2018) pointed out that both male and female students taught with multimedia aid had higher mean achievement in mathematics than those taught using lecture method. Additionally, students' motivation and participation increased among the students that were taught using multimedia. However, Abubakar (2017) observed that male students achieved very slightly higher than the female students and this can be attributed to the use of advanced organizers. While Agbenyeku (2012) found out that, girls actually performed slightly better when advanced organizer was used. This finding is similar to the finding of Ogunboyede (2003) who found out on the study of sex difference and subject achievement that boys are not better than girls in terms of educational achievement. Therefore, it was conclude that one of the reasons for the observed difference is that girls are more susceptible to the use of advance organiser than boys, and that advance organiser is gender friendly. The present study also wants to find out the effects of multimedia and advanced organizer on gender in term of academic performance and motivation.

Hence, this study investigates the Effects of Multimedia and Advanced Organizers on Upper Basic Science Students' Performance and Motivation in Chemical Concept, Zaria Metropolis, Kaduna State, Nigeria.

1.1.1 Theoretical Framework

This study is guided by three theoretical frameworks. The theory of meaningful learning by Ausubel (1960); Generative theory of multimedia proposed by Mayer (2001) and ARCS Model of motivation founded by Keller (2008). According to Ausubel (1960), in designing instructional materials much thought and care should be given to choosing the best way of preparing students for, and introducing them to new and different learning materials, these introductions have been termed advanced organizers. Ausubel (1963) stated that the purpose of advanced organizers is to relate the potentially meaningful materials to be learned to the already existing cognitive structure of the learner. Ausubel assumes that the full learning potential of materials can only be reached when the learner possesses a cognitive structure to which substantive aspects of the new knowledge can be related. When the students already possesses adequate background knowledge for the new task, Ausubel suggests that advance organizers probably facilitate learning and retention by mobilizing whatever relevant anchoring concepts already exist. These concepts then take on the role of subsumers. The new material is made more meaningful as it is assimilated by relevant forerunners ideas. Advance organizers at the appropriate level of inclusiveness ensure that subsumers are specifically and explicitly relevant to new ideas (Ausubel, 1968). When students lack adequate background knowledge, they do not have directly relevant subsumers already available. Advance organizers then provide the relevant subsumers. The need for rote memorization of unfamiliar material is lessened (Ausubel, 1968). Advance organizers, then, either activate knowledge already acquired which can be used to subsume new information or provide the subsumers for the new information. However, advanced organizer is an independent variable in this study; therefore, the study was hinged on Ausubel's meaningful learning theory.

Cognitive Theory of Multimedia Learning (CTML) according to Mayer (2005a) is a theory describing how the mind works when processing multimedia instructional messages (such as instructional videos). It relies on three assumptions about the mind which include:

a. The dual-channel assumption assumes that humans have two separate channels for processing visual and auditory information (Mayer, 2002; Paivio, 1991).
b. The limited capacity assumption assumes that the amount of information human beings can process in each channel at one time is limited (Baddeley & Hitch, in Hofstsd, 2017; Mayer, 2002).

c. The active processing assumption assumes that humans learn actively by attending to relevant information, organizing the selected information into coherent mental representations and integrating the mental representations with their previous knowledge (Mayer, 2002; Wittrock, as cited in Hofstad, 2017).

These assumptions, are trying to reduce the learner's cognitive load, i.e. the amount of cognitive processing devoted to learning the material. So that the amount of cognitive processing needed does not exceed the learner's cognitive processing capacity, when exceeded, the learner experiences a cognitive overload (Clark & Mayer, 2011). Cognitive overload is created when the cognitive load generated by the educational material exceeds the processing capacity of the cognitive system, which is the working memory, which has been shown to negatively influence students' learning (Mayer & Moreno, 2003). Working memory refers to a cognitive systems ability to hold and process information at any given time (Baddeley & Hitch, as cited in Hofstad, 2017). Cognitive overload could happen for instance, if the instructional video presents too much text and animations, so that the visual channel is overloaded. If the visual channel is overloaded the learner will not be able to process any auditory information contained in the video, since the working memory is overloaded by the visual information (Mayer & Moreno, 2003).

Instructional content generates three types of cognitive loads, Intrinsic, extraneous and germane:

Intrinsic load is the cognitive load inherent to the learning material, i.e. the more complex the theme is, the higher the intrinsic load (DeLeeuw & Mayer, 2008).

Extraneous load is the cognitive load exerted by activities that do not support learning, such as superfluous text or pictures (DeLeeuw & Mayer, 2008).

Germane load is the cognitive load generated by the effort the learner exerts to process the new information and integrate it with existing knowledge (DeLeeuw & Mayer, 2008).

In the implementation of multimedia it is accepted that the human mind is a two-channel system of information processing with limited capacity. It has visual/pictorial and verbal/auditory processing channels (Mayer, 2003). Once the human mind receives information for cognitive processing, it selects, organizes and integrates the mental representations promoting meaningful learning. Mayer (2003) posited that the cognitive processing by the learner is believed to cause learning and not the media environments. According to Emuzumuh (2017), using multimedia in classroom instructions in about all subject increase students understanding and provide them with powerful cognitive and emotional impact of powerful learning outcome. In this study, the researcher want to investigate whether multimedia could improve the academic performance and motivation of Basic science students in Zaria metropolis.

Keller in 1987 founded ARCS Model of Motivation, which is based upon the idea that there are four key elements in the learning process which can encourage and sustain learners' motivation.

According to Keller (1987), ARCS model is a systematic way to determine and deal with learning motivation. ARCS abbreviated from Attention, Relevance, Confidence and Satisfaction attributes. Firstly, catch the attention of students is very crucial to gain and sustain the students' engagement in learning. Secondly, students' experiences and the needs related relevance. Then, Confidence related to the students' emotion and anticipation. Lastly, the positive feeling regarding the learning process and the gained knowledge leads to satisfaction as completing the whole learning process. According to Wlodkowski as cited in Gopalan *etal* (2017), students can be motivated directly by grabbing the students' attention through the use of attractive and stimulating medium or learning material. It is important to sustain and arouse the student's attention and curiosity in the learning process. However, this study wants to find out whether the use of multimedia and advanced organizer could improve Basic science students motivation.

It is therefore based on these facts that the present study adopted the Mayer and theory of Multimedia, Ausubel theory of advanced organizer and Keller's ARCS model of Motivation in teaching Basic Science concepts to investigate the Effects of Multimedia and Advanced organizers on Performance and Motivation of Upper Basic science Student in Chemical Concept in Zaria Metropolis, Kaduna State, Nigeria.

1.2 Statement of the Problem

The importance of Basic Science as the bedrock for other science subjects and technological development of the nation cannot be over emphasized. Usman (2007) observed that Students' performance in science subjects have genesis from the Basic Science in Junior Secondary Schools classes. However, Usman (2007) affirmed that transition from Junior Secondary School to Senior Secondary School is challenging because they face a lot of stress associated with science learning. Also, Lawal (2010) posited that academic performance in Basic Science has generally been in the declined. However, Igwebuike (2013) suggested that it was unfortunate that students' academic performance based on the examination results of Junior School Certificate Examination (Junior NECO, JSCE) in upper Basic Science was very poor, as shown in table 1.1. Several researches carried out to improve students' performance and motivation in Basic Science were on students study habit, class size, schools location, teachers characteristics among others, but the poor performance still persist. Researchers such as Lakpini (2006) ; Ivowi, Okebukola, Oludotun, and Akpan (2004) suggested that the reason for the poor academic performance in science subjects is over dependent on traditional lecture method by the science teachers and recommended that appropriate teaching method should be adopted by the science teachers to improve academic performance of the students. A study on Basic science was carried out in

Zaria metropolis by Jibrin, Zayum and Abba (2014), their findings revealed that poor teaching strategy and lack of learning resources contribute to poor performance in Basic science.

However, Salawu (2009), conducted a study on instructional media in Ibadan and found it effective in improving learning outcome. Wu and Tai (2016) observed that Multimedia information technology instruction could promote learning motivation and enhance academic performance. Abubakar (2017) conducted a study in Jigawa and Bukar, (2016) carried out a study in Yobe, and they both found out that advanced organizers were effective in enhancing students' academic performance in scientific concepts when compared with traditional lecture methods. Most of the studies conducted on multimedia and advanced organizers were not carried out in Basic science and based on the knowledge of the researcher none was conducted in Zaria metropolis.

Due to these reasons, this study intend to investigates whether Multimedia and Advanced organizers improve Performance and Motivation of Upper Basic Science Students' in Chemical Concepts, Zaria Metropolis, Kaduna State, Nigeria.

1.3 Objectives of the Study

The objectives of this study are to:

i. Determine the effects of multimedia on upper Basic science students academic performance in chemical concepts;

ii. Examine the effects of advanced organizers on upper Basic science students' academic performance in chemical concepts.

iii. Find out the effects of multimedia on upper Basic science students motivation level in chemical concepts;

iv. Investigate the effects of advanced organizers on upper Basic science students motivation level in chemical concepts;

v. Determine whether difference exist between performance of male and female upper Basic science students in chemical concepts when taught using multimedia and advanced organizers;

vi. Find out whether there is difference between male and female upper Basic science students motivation level in chemical concepts when taught using multimedia and advanced organizers.

1.4 Research Questions

The following research questions are formulated to guide the study:

i. What is the difference between the mean academic performance scores of upper Basic science students taught chemical concepts using multimedia and those taught the same concepts using conventional lecture method?

ii. What is the difference between the mean academic performance scores of upper Basic science students taught chemical concepts using advanced organizers and those taught the same concepts using conventional lecture method?

iii. What is the difference between the mean academic performance scores of upper Basic science students taught chemical concepts using multimedia and those taught the same concepts using advanced organizer?

iv. What is the difference between the motivation level of upper Basic science students taught chemical concepts using multimedia and those taught the same concepts using conventional lecture method?

v. What is the difference between the motivation level of upper Basic science students taught chemical concepts using advanced organizers and those taught the same concepts using conventional lecture method?

vi. What is the difference between the motivation level of upper Basic science students taught chemical concepts using multimedia and those taught the same concepts using advanced organizer?

vii. What is the difference between mean performance scores of male and female upper Basic science students in chemical concepts when taught using multimedia, advanced organizers; and those taught the same concept using lecture method?

viii. What is the difference between motivation level of male and female upper Basic science students in chemical concepts when taught using multimedia; advanced organizers and those taught the same concept using lecture method?

1.5 Null Hypotheses

Based on the objectives and research questions stated above, the following null hypotheses were formulated for testing at $P \leq 0.05$: level of significance.

HO1: There is no significance difference between the mean academic performance scores of upper Basic science students taught chemical concept using multimedia and those taught the same concepts using conventional lecture method.

HO2: There is no significant difference between the mean academic performance scores of upper Basic science students taught chemical concepts using advanced organizers and those taught the same concepts using conventional lecture method.

HO3: There is no significance difference between the mean academic performance scores of upper Basic science students taught chemical concept using multimedia and those taught the same concepts using advanced organizer.

HO4: There is no significant difference between the motivation level of upper Basic science students taught chemical concepts using multimedia and those taught the same concepts using conventional lecture method.

HO5: There is no significant difference between the motivation level of upper Basic science students taught chemical concepts using advanced organizers and those taught the same concepts using conventional lecture method.

HO6: There is no significant difference between the motivation level of upper Basic science students taught chemical concepts using multimedia and those taught the same concepts using advanced organizer.

HO7: There is no significance difference between mean performance scores of male and female upper Basic science students in chemical concepts when taught using multimedia, advanced organizers and those taught the same concept using lecture method.

HO8: There is no significance difference between motivation level of male and female upper Basic science students in chemical concepts when taught using multimedia, advanced organizers and those taught the same concept using lecture method.

1.6 Significance of the Study

The findings of this study will hopefully be beneficial in the following ways:

Basic Science Students: It will help the students to develop more interest in the Basic science subject as a result of the use of multimedia and advanced organizers which may make learning more meaningful and attractive. It may perhaps motivate students to develop interest in basic science subjects.

Basic Science Teachers: The findings from this study would benefit Basic science teachers in equipping them with teaching facilities and how to enlighten them on the need to teach students difficult concepts in Basic science using multimedia and advanced organizers to promote effective teaching and learning.

Schools Administrators: The findings of this study would benefit junior secondary schools management to provide teaching resources on multimedia and advanced organizers available for the Basic science teachers and train them how to use it effectively.

Professional Bodies: The findings would be useful to Science Teachers Association of Nigeria (STAN) who are in need or concerned with the research findings including those on instructional materials and specifically multimedia and advanced organizers.

Curriculum Planners: The findings will also remind curriculum developers such as the NERDC role of multimedia and advanced organizers on the teaching of Basic science, which would lead them to modification in the curriculum where necessary.

Researchers: The findings of this study will also benefit other researchers as it will contribute to review of the literature on the multimedia and advanced organizers and stimulate further researches from which new findings would be made.

Parents: the findings of this study will help the parents to understand the role of multimedia and advanced organizers on teaching of Basic science. Therefore, the PTA will emphasize more on financing the schools with the necessary learning facilities.

Educational Administrators: the findings of this study will help educational administrators from State Ministry of Education, Science and Technology to put the use of multimedia and advanced organizers in to consideration when establishing new schools, renovating the existing ones and financing them with learning facilities.

1.7 Scope of the Study

The study comprised all JSS2 Basic science students in public junior secondary schools in Zaria Metropolis of Kaduna State, Nigeria. The schools include both single-sexed and coeducational schools in the metropolis. The samples used for this study were three (3) public coeducational junior secondary schools purposively selected from the nine (9) public junior secondary schools in the Zaria Metropolis. In addition, the concept of chemical was chosen for this study. The topics chosen under Chemical concept are as follows:

1. Meaning of chemicals;
2. Classes of chemicals;
    (a) Chemical Based on use:
        - Pharmaceutical/cosmetics chemicals
        - Nuclear chemicals
        - Agrochemicals
        - Industrial chemicals and Laboratory chemicals

    (b) Chemical Based on their hazardous nature:
        - Highly hazardous and toxic chemicals
        - Moderately hazardous and toxic chemicals
        - Non-hazardous and non toxic chemicals
3. Safety measures when using chemicals:

All these topics fall within the scheme of work of JSS2, the reason for chosen these topic is that Basic science students fail at JSCE as reported by chief examiner from 2011 – 2017. The reason for selection of JSS2 is that JSS1 are newly introduced in to upper section of Basic science subject and JSS3 are preparing for their final JSCE examinations and therefore may not concentrate on the study. Also, multimedia (video) and advanced organizer (graphic) were used as treatments to the experimental groups.

1.8 Basic Assumptions

This study has the following basic assumptions:

1. That all the schools under study operate the same curriculum
2. Basic Science teachers are qualified in all the schools under study.
3. The students under study have solid foundation of Basic science.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

This study investigates the Effects of Multimedia and Advanced Organizers on upper Basic Science Students' Performance and motivation in Chemical Concept, Zaria Metropolis, Kaduna State, Nigeria. This chapter reviews relevant and related literature on the study and are presented in the following sub-headings:

2.2 Historical Development of Basic Science Education in Nigeria;

2.2.1 Philosophy and Objectives of Basic Science;

2.3 Academic Performance in Basic Science

2.4 Motivation in Basic Science

2.5 Concept of Multimedia;

2.5.1 Multimedia and Academic Performance in Basic Science;

2.5.2 Multimedia and Motivation in Basic Science;

2.6 Concept of Advanced-Organizer;

2.6.1 Advanced Organizers and Academic Performance in Basic Science;

2.6.2 Advanced Organizers and Motivation in Basic Science;

2.7 Overview of Similar Studies;

2.8 Implication of Related Literature for the Present Study.

2.2 Historical Development of Basic Science Education in Nigeria

Basic Science formally known as Integrated Science is not a new name in many parts of the world. However, it is relatively new in some developing countries where general or rural science has been stressed over the years. For instance, General science has been introduced to Nigerian Schools since 1878, whereas integrated science became popular only between 1957 and 1969 (Abdullahi in Abdullahi 2018). This period was characterized by activities generated in many parts of the world to develop new and suitable science curricula for the primary and junior secondary schools. For example, the Russians launched their space ship, the Sputnik, in 1957, while the Americans put the first man on the moon in 1969. The first International Conference on Integrated Science teaching took place in Warna (Bulgaria) in 1968. The first publication of the Nigerian Integrated Science Project (N.I.S.P) was in 1970. It spelt out the objectives of Integrated Science and since that time this aspect of science has been better imbibed by relevant cadres of our educational system. Originally meant for the first two years of the secondary school, integrated science is then taught in primary and junior secondary schools in Nigeria, the latter being of three years duration. This is in line with the National Policy of Education, which adopted the 6-3-3-4 system. What happens to integrated science is similar to the case of integrated social studies, both of which resulted from the new "broad field curriculum." National Policy on Education (FRN, 2007) proposed 9:3:4 system of education and title ‘Integrated science’ was changed to Basic science.

2.2.1 Philosophy and Objectives of Basic Science

Basic science formally known as Integrated Science is a subject taught at both public and private schools at Junior Secondary School level. The main reason for teaching basic science is that it widens the knowledge of the students which enables them to appreciate the unity among science subjects. Furthermore, the recipients may gain the commonality of approach to solve problems of scientific nature (Bajah in Abdullahi, 2018). According to the Science Teachers Association of Nigeria (STAN, 1970) as pointed in Newsletter No. 1 spelt out the specific skills desirable for learners of Integrated Science now Basic Science who follow the NISP. These include the ability to:

1. Observe carefully and thoroughly;
2. Report completely and accurately;
3. Organize information acquired;
4. Generalize on the basis of acquired information;
5. Predict as a result of the generalization;
6. Design experiments (including controls, where necessary to check the prediction);
7. Use models to explain phenomena, where appropriate and;
8. Continue the process of inquiry when new data do not conform to predictions;

To achieve these objectives, it is suggested that the teaching and learning of Basic Science should involve the use of innovative methods in teaching; methods like discovery, problem solving, open ended field trip and laboratory method among others.

According to Atadoga (2008) Child-centered approach should be employed, in order to stress its importance. It was suggested that the following three strategies should be used which are:

a. Use of discovery teaching strategies;

b. Inclusion of problem solving activities;

c. The involvement of learners in open-ended laboratory exercises;

In the learning of Basic Science, there are three types of skills that the learners can acquire which are:

a. Process skills such as observing, measuring, collecting, sorting, recording, reporting, analyzing, predicting, etc.

b. Manipulative skills which include: drawing, cutting, coupling, dissecting, fitting equipments, painting, fixing, etc.

c. Social skills such as: socializing, relating, cooperating, sharing etc.

All these skills are easily acquired during the learning of Basic Science when strategies which are child-centered and full of activities are employed. Learners are grouped together, which draws them together and closer. Skills for manipulation can be developed when they are allowed to carry out simple laboratory exercises and outdoor activities (Atadoga, 2008). According to Federal Ministry of Education (FME, 2013) Integration in science were also provided which were intended to produce among other things a course which: Is relevant to the learners' needs and experiences; Stresses the fundamental unity of science; Lays adequate foundations for future specialist careers in science and technology and; Adds a cultural dimension to Science Education.

Therefore, this study investigates the Effects of Multimedia and Advanced Organizers on upper Basic Science Students' Performance and Motivation in Chemical Concepts, Zaria Metropolis, Kaduna State, Nigeria.

2.3 Academic Performance in Basic Science

Basic science teaching can only be focused on results when students are willing and the teachers are favorably encouraged, using the appropriate methods and resources in teaching the students. With the current increase in scientific knowledge globally, much demand is placed, and emphasis laid on the teacher, the learner, the curriculum and the environment in the whole process of teaching and learning of science. Mutum (2017) posited that, despite the importance of science to mankind and the effort of researchers to improve on its teaching and learning, the performance of students in Basic science remains low in Nigeria. Among the factors that have been identified are, poor methods of instruction (Lawal, 2010), laboratory in-adequacy and poor science background (Ray & Patrick, 2007). Hoban and Zizzman (2006) stated that, the value of audio-visual material is function of their degree of realism; this may improve teaching and learning. Shaibu (2005) observed that for effective and meaningful learning to take place, three factors are indispensable, namely: the teacher, the pupils and the instructional materials alongside the conducive - environment. Poor achievement of students may not be separated from unavailability and in adequate use of instructional materials as observed by Oladejo et al. (2011). However, researchers such as Ogunleye (2000), Okonkwo (2000), Mkpanang (2005) and Obiaha (2006) reported that there were inadequate resources for the teaching of science subjects in secondary schools.

The affective behaviours on the classroom are strongly related to performance, and science attitudes are learned (Patrick, Ray & Kaplan, 2007) the teachers play a significant role during the learning process and they can directly or indirectly influence the students' performance toward science. Students' performance toward the learning of Basic Science is a factor that has long attracted attention of researchers. Igwebuike (2011) and Adesokan (2007) asserted that in spite of realization of the recognition given to Basic Science among the science subjects, it was evident that students still showed negative attitude towards the subject, thereby leading to poor performance and low enrolment. Lawal (2010) observed that, the performance of students in chemistry is also reported to be causally influenced by the previous experience of the students in Basic Science. Also, Igwebuike (2011) emphasized that a student cannot learn chemistry effectively without going through some experiences in Basic Science. Other factors that may have causal relationships with students' academic performance in science, particularly, Basic Science include teacher attendance at workshop, laboratory adequacy, class size and school location (Igwebuike, 2013). One of the major problems confronting Basic science teaching today is lack of professional teachers. Some teachers who have been employed in the past decades have been doing the same thing, the same way all along. They have no knowledge of the current ideas and innovations that have taken place in the educational field in the recent past. What account, for this is that teachers have not been given the opportunity for re-training (Peter, 2010). He therefore recommended that teachers should be encouraged to go for workshop training in their areas of specialization. Laboratory adequacy which is a school environment factor has been reported to affect the performance of students in Basic Science (Okoh, 2011). Peters (2010) argued that students tend to understand and recall what they see more than what they hear as a result of using laboratories in the teaching and learning of science.

However, a study conducted in Islamic studies by Abubakar (2014) revealed that multimedia facilities have a significant role on the performance of junior secondary school students. But in a study conducted by Akinoso (2018) found no significant difference between the mean achievement scores of male and female students taught secondary school students using multimedia materials. Also, Shihusa and Kiraro (2009) found out that students taught using advance organizers had a higher level of motivation than those taught using conventional teaching method. In another study conducted in Biology by Abubakar (2017) found that students taught using advanced organizers performed significant better than those taught without advanced organizers.

As a result of this, this study investigates the effects of multimedia and advanced organizers on upper Basic science students' performance and motivation in chemical concepts in Zaria metropolis, Kaduna State, Nigeria.

2.4 Motivation in Basic Science

Knowing how to teach science at elementary level is quite different from teaching science at the middle and high school levels. According to Butler (2009), elementary students' attitude towards science is as important as the science content and scientific skills they must learn. Study on motivation to learn according to Butler (2009), shows that students at lower level are attracted to ideas that address both their cognitive and affective needs. Young children are already interested in natural phenomena, the environment and how things work. It serves elementary science teachers well to take advantage of the students' interests as a source for engaging and motivating students to high levels of achievement. Motivation can be a forerunner to an outcome of learning. Thus, students must be interested and motivated to learn before learning will take place and this success can lead to motivation to learn more (Turner & Patrick, 2008).

Young children's daily realities are fertile ground for helping them observe and understand the world around them. Students' "funds of knowledge" (i.e., the information and experiences they bring with them to school) can be tapped to encourage and engage them in the science they need to know and be able to do (Butler, 2009). The science young children must learn has to be rigorous enough to afford the students the opportunity to move forward in their understanding of key scientific concepts (Butler & Nesbit, 2008). The Student Inquiry Books, according to Butler (2009) build on making science relevant to students. They are tied to the unique experiences of children. When looking through the books, students connect to both the text and pictures. The book is seen as relevant to the students' lives and thus becomes a source of motivation for wanting to know more about particular science concepts.

Mastery goals according to Schulze and Van Heeden (2015) are linked to the intrinsic value of learning. Such intrinsic motivation "is the motivation to engage in an activity for its own sake – for the pleasure and satisfaction derived from its performance" (Vedder-Weiss & Fortus, 2012). Students who exhibit a mastery goal focus for science learning are therefore interested in learning science for the sake of acquiring new knowledge and skills involving a broad range of emotional, cognitive, adaptive and behavioural outcomes (Vedder- Weiss & Fortus, 2011). These students generally have positive self-efficacies and are unconcerned with how other people regard them. They tend to enjoy challenging tasks and only request assistance when necessary (Koballa & Glynn, 2007). However, Schulze and Van Heeden (2015) observed that these students compare their performance with those of other students because they need to show that they are quicker or better in science than the others. Performance goals thus emphasise comparison and public competition. Ramnarain (2013) observed that students at many public schools tended to be motivated by external goals associated with competition and rewards. Schulze, Van Heerden (2015) pointed out several factors that may be related to the motivation to learn science including the personal attributes of students such as; their self-efficacies, learning strategies, and their perceptions of the value of science; the educational settings in which they study such as teachers' teaching methods and the school culture; and moderator variables (e.g. racial group, gender and age).

However, Nkweke etal (2010) found out that Multimedia equipment, when used in instructional delivery process, motivates student's interest to learn and have positive effects on science students' academic performance. In another study, Shihusa and Keraro (2009) found out that students taught using advance organizers had a higher level of motivation than those taught using conventional teaching methods. Therefore, this study investigates the Effects of Multimedia and Advanced Organizers on Upper Basic Science Students' Performance and Motivation in Chemical Concepts, Zaria Metropolis, Kaduna State, Nigeria.

2.5 Concept of Multimedia

The term multimedia describes any system that combines two or more media into a single product or presentation, such as a software program or a Web page. Although interactive multimedia capabilities are continuously changing due to advancement in technology and have become very popular among educators in recent years, the body of research on interactive multimedia as an instructional approach is not yet extensive (Alessi & Trollip, 2001; Lockard & Abrams, 2004). According to Mayer (2003), a multimedia instructional message is a presentation that contained words and pictures which is designed to foster meaningful learning. Thus, the definition contained two parts: (a) the presentation contains words and pictures, and (b) the presentation is designed to foster meaningful learning. Mayer (2003) and others (Brouwer, Muller, & Rietdijk, 2007; Thompson, 2007) have emphasized the unique contributions of multimedia to the learning experience. Mayer (2005) viewed multimedia as a way of presenting words such as spoken text or printed text combined with pictures such as illustrations, photos, animation or video. Therefore, multimedia can further be describe as a computer-based presentation of content that blends or mixed text in written or verbal forms, sound and graphics into a discrete learning package.

Multimedia instruction provides a number of possible advantages over other instructional formats and can offer instructional designers unique opportunities not necessarily found in traditional instruction (Clark & Mayer, 2003). For example, multimedia instructional modules can be reused as needed by both the instructor and the learner. Assuming the necessary equipment is available (e.g., a computer or Smartphone) the learning module can be reused at a time and place convenient to the learner, or can be inserted into a course as needed by the instructor. A second possibility afforded to the instructional designer is the ability to standardize instruction. In this situation, the instructor creates one standardized instructional module that can be delivered with exactly the same content, formatting, and sequencing for all learners.

The theoretical frame works for learning in multimedia environments have been built within the following theories of multimedia learning:

a. Dual Coding Theory (Paivio, 1986),

b. Cognitive Load Theory (Chandler & Sweller, 1991) and

c. Generative Theory (Mayer, 1997).

The Dual Coding Theory of multimedia maintains that cognition is served by two interdependent systems one of which is specialized for dealing with verbal information (i.e. text and speech), while the other one processes nonverbal information (i.e. graphics and animation). By interdependent, Paivio (1986) means that those systems are interconnected, but can function independently. The theory focuses on how the material is represented in human memory and cognition rather than how it is perceived by the learner.

The Cognitive Load Theory according to Kuzu, Akbulut and Sahin (2007), focuses on the learners' cognitive effort employed during learning. The basic premise of the theory is that it is easier to learn new information and make it involuntary if the teaching method can reduce the demands on learners' working memory. Van Merrienboer and Sweller (2005) observed that, it is possible to store seven items at a time in the working memory three of which remaining unprocessed whilst four of which were processed for approximately twenty seconds. However, Gerjets and Scheiter (2003) observed that the long-term memory is almost limitless. Thus, effective transfer of the information from the beginning of the learning (i.e. short-term memory) to the long-term memory is the center of the theory. The implicational purpose of the theory is to design a variety of novel instructional materials following the assumption that the short-term memory load should be minimized and schema construction should be encouraged. The theory maintains that the working memory load can be affected by either the intrinsic nature of the material (i.e. intrinsic cognitive load), or by the manner in which the material is presented, or the types of activities students were exposed to (i.e. extraneous cognitive load). Intrinsic cognitive load cannot be modified through instructional interventions because it is intrinsic to the material being used.

Cognitive theory of multimedia learning according to Sorden (2011) was popularized by the work of Mayer and other cognitive researchers who argue that multimedia supports the way that the human brain learns. They assert that people learn more deeply from words and pictures than from words alone, which are referred to as the multimedia principle (Mayer 2005a). In addition to this, Mayer (2005b) define multimedia as the combination of text and pictures; and suggest that multimedia learning occurs when build mental representations from these words and pictures. The words can be spoken or written, and the pictures can be any form of graphical imagery including illustrations, photos, animation, or video. Multimedia instructional design attempts to use cognitive research to combine words and pictures in ways that maximize learning effectiveness.

The Generative Theory of multimedia learning according to Mayer (2001) integrates all the other theories of multimedia in a way that focuses on presenting information in dual mode without increasing the cognitive load. Mayer and Moreno (2003) summarize the principle of the Generative Theory, which are dual-channel assumption, limited-capacity assumption and active processing assumption. As the names suggest, the dual-channels assumption is based on the Dual Coding Theory of Paivio (1986) claiming that human beings possess two separate but interdependent systems for processing verbal and pictorial material. The limited-capacity assumption is based on the Cognitive Load Theory of Chandler and Sweller (1991) maintaining that each channel is limited in the amount of material that can be processed by learners at one time. The final assumption, active processing, states that meaningful learning involves the cognitive process of actively building connections between verbal and pictorial representations.

Generative Theory of Multimedia contributes to the understanding that "meaningful learning occurs when learners **select** relevant information from what is presented, **organize** the pieces of information into a coherent mental representation, and **integrate** the newly constructed representation with others" (Mayer, 1997). Also, Dual Coding Theory of Multimedia explains that "cognitive processes occur within two separate information processing systems: a **visual** system for processing visual knowledge and a **verbal** system for processing verbal knowledge (Mayer, 1997). The elements of Generative Theory of Multimedia (GTM) and Dual Coding Theory of Multimedia (DCTM) are evident in the graphic representation of Mayer's theory of meaningful learning in a multimedia environment in Figure 2.1. According to Mayer, meaningful learning in a multimedia environment consists of the learners "**selecting words** and **selecting images** from the presented material, **organising words** and **organising images** into reasonable mental representations, and integrating the resulting verbal and visual representations with one another"

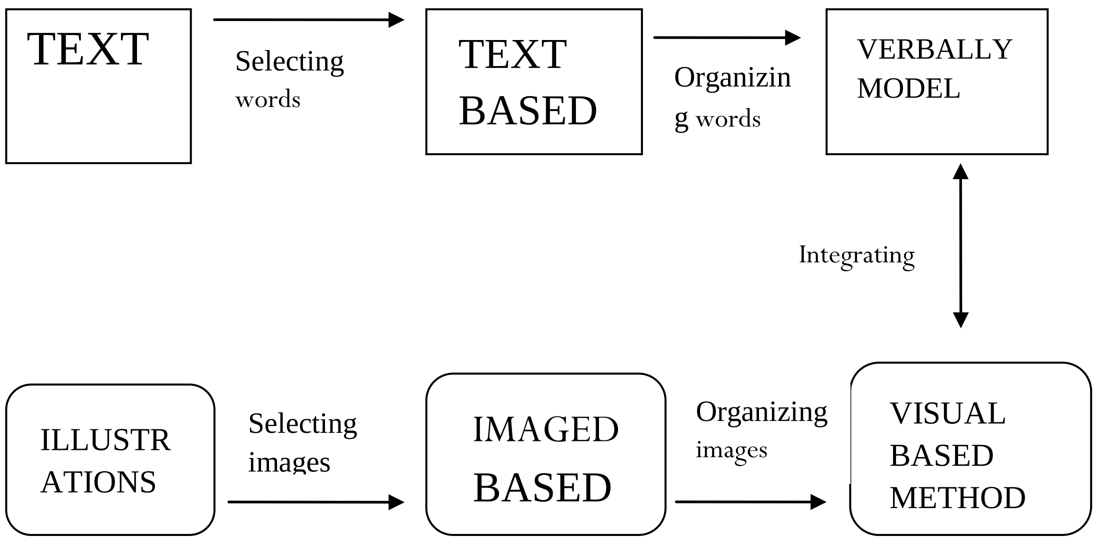

Figure 2.1: A Generative Model of Multimedia Learning Adopted from Mayer (1997)

Mayer's theory has been well supported in an extensive series of experiments with various materials (Mayer, 1997). While Mayer's work provides some insight learning in instructional multimedia, he also acknowledges that technology is advancing faster than knowledge of how people learn from the technology. (Stemler in Diezmann & Watters, 2002) also distinguishes between the learning process and the technology in multimedia but argues strongly that 'interactive multimedia is a process, rather than a technology, that provide learning potential to new learners. Mayer's model point out how learner is sensitive to the sensory environment and how specific information is represented, organised, and retrieved.

The suggestion for designers of Instructional Multimedia (IM), are that the learning process should be foremost in the design process, and the technology should be used selectively to enhance the learning process. According to Stemler in Diezmann and Watters (2002), successful Instructional Multimedia (IM) (a) gets the learner's attention, (b) helps the learner to find and organise pertinent information, and (c) helps the learner to integrate information into his or her knowledge base. This process of **attending, organising,** and **integrating** is closely aligned with Mayer's model of **selecting**, **organising** and **attending**. Stemler in Diezmann and Watters (2002) opined that multimedia supports these processes through five features of multimedia: (a) screen design (visual elements: colour, text, graphics, and animation), (b) learner control and navigation, (c) use of feedback, (d) students' interactivity, and (e) video and audio elements. His literature review provides extensive guidelines for the design of various types of instructional multimedia using these features. The main principles identified by Stemler are shown on Table 2.1.

Table 2.1: Features of Multimedia and Associated Design Principles

Multimedia Features	**Principles**
1. Screen Design (Stemler, 1997)	• Focus the learner's attention • Develop and maintain interest • Promote processing • Promote engagement between the learner and lesson content • Help learners find and organize information • Facilitate lesson navigation
2. Interaction (Orr, Golas, & Yao, 1995 cited in Stemler, 1997)	• Provide opportunities for interaction • Chunk the content and build in questions and summaries • Ask questions but avoid interrupting the instructional flow • Use rhetorical questions to get students' to think about content and to stimulate curiosity • Provide for active exploration in the program rather than a linear sequence
3. Feedback (Orr, Golas, & Yao, 1995 cited in Stemler, 1997)	• Keep feedback on the same screen as the response • Provide feedback immediately following a response • Provide feedback to verify correctness • Tailor feedback to the individual • Provide encouraging feedback • Allow students' to print feedback
4. Navigation (Stemler, 1997)	• Clearly defined procedures for navigation and support • Consistency in screen structure and location of keys • Use of familiar icons on control panels • Progress map or chart to show location within a program • Help segments with additional information to allow a learner to follow interests and construct his or her own learning experiences
5. Learner control (Jones, 1995 cited in Stemler, 1997)	• Provide selectable areas for users to access information • Allow users to access information in a user-determined order • Provide maps so students can find their locations and allow students to jump to locations • Provide feedback if there are to be time delays on accessing information • Arrange information so users are not overwhelmed by the quantity of information • Provide visual effects and give visual feedback

6. Colour (Stemler, 1997)	• Use colour sparingly and consistently with a maximum of 3 to 6 colours per screen • Use brightest colours for most important information • Use neutral colours for backgrounds and dark colours on a light background for text • Avoid combining complementary colours (e.g. red/green) • Use commonly accepted colours for particular actions (red for stop) • Avoid hot colours on the screen as they appear to pulsate
7. Graphics (Stemler, 1997)	• Graphics include photos and scanned pictures • Icons and photos enhance menu screens • Information is better understood and retained when supplemented with graphics • Avoid graphics for decoration or for effect • Use graphics to indicate choices (e.g. left/right arrows)
8. Animation (Stemler, 1997)	• Can be motivational and attention getting • Useful for the explanation of dynamic processes • Subtle benefits by highlighting key information, heightening interesting, and facilitating recall
9. Audio elements (Orr, Golas, & Yao, 1995 cited in Stemler, 1997)	• Use audio when the message is short and audio rather than text for long passages • Do not let audio compete with text or video presentation • Provide headphones for in-class use • Tell students what is relevant and chunk the message with other instructional activities
10. Video elements (Stemler, 1997)	• Use video as an advance organizer or a summation • Synchronize video with content, and reinforce/ repeat the concepts being presented

Source: Adopted from Diezmann and Watters (2002)

This study investigates the Effects of Multimedia and advanced Organizers on Upper Basic Science Students Performance and Motivation in Chemical Concepts, Zaria Metropolis, Kaduna State, Nigeria.

2.5.1 Multimedia and Academic Performance in Basic Science

Multimedia in education is an instructional package use by the tutor to enrich the teaching and learning environment thereby, making the learning more meaningful and effective. A study which implemented multimedia materials carried out by Chang, Quintana and Krajcik (2010) on the effects of multimedia on students' performance in science class. The study focused on three different groups of students and concluded that learning was more effective in the group taught with multimedia applications. In their study on learning physics, Gunel, Hand and Gunduz (2006) stated that the group presented with multimedia application was more successful than the groups taught with traditional lecture methods. There are various studies in literature regarding multimedia applications (Neo & Neo, 2001; Norhayati & Siew, 2004; Kim & Gilman, 2008; Neo & Neo, 2009; Tsai, 2009; Chien & Chang, 2012). In addition to studies which stress the positive effects of multimedia applications on learning, there are also studies that state the opposite (Guan, 2009; Montazemi, 2006; Rasch & Schnotz, 2009). Multimedia addresses general theories and strategies that guide the learner and provide insights into children's learning within a constructivist framework. Theories about children as learners are numerous with no less than fifty relevant to teaching (Kearsley, 2002). Given that the central role of teaching is to enable the child to become a learner (Fenstermacher in Diezmann etal, 2002). The endorsement of the multimedia resources by the profession was critical because these products are designed to assist students to become members of the professional community and need to be authenticated as representative models of practice (Flinders & Eisner, in Diezman etal, 2002). Sun, Lin and Yu

(2008) identified in their research that web-based virtual laboratory applications increased students' academic achievement more than traditional methods. Similarly, a study conducted by Hwang, Wu and Ke (2011) found that web-based teaching methods enriched by concept maps positively affected student achievement and attitudes towards science. According to Wang's (2004) study emphasized that multimedia software are effective in raising students' content awareness of the related subject. In their study, Dunsworth and Atkinson (2007) determined that multimedia learning environments used in science education positively contributed to learning via their visual content and animated educational agents. Another reason that multimedia applications positively affect students' performance may be because they create correct mental models or images in learning complex and abstract science concepts. Similar studies in literature show that multimedia software affects the development of students' attitudes towards science (Su, 2008; Hwang, Wu & Ke, 2011).

Therefore, this study investigates the Effects of Multimedia and Advanced Organizers on Upper Basic Science Students Performance and Motivation in Chemical Concepts, Zaria Metropolis, Kaduna State, Nigeria.

2.5.2 Multimedia and Motivation in Basic Science

According to Liu, Olmanson and Horton (2011), there are two complementary ways to motivate students: through improving students' belief in their probability of success – known as self-efficacy (Bandura, 1986), and increasing the intrinsic/interest value of the task. Intrinsic/interest value describes the enjoyment of performing a task. When a students' values a task, they can be said to be intrinsically motivated. Understanding the dynamics of intrinsic motivation has been the focus of much motivational research (Liu, Olmanson & Horton, 2011).

Research has also documented a notable decline in students' motivation to learn during the middle school years, especially in science (Eccles & Wigfield, 2002; Osborne, Simon, & Collins, 2003; Lepper, Iyengar, & Corpus, 2005). However, Liu etal (2011) found out that Multimedia have contributed significantly to improve students' motivation in science. But, despite the efforts of researchers such as; Astleitner and Hufnagl, (2003); Gao and Lehman, (2003); Keller and Suzuki, (2004), motivation in multimedia learning , research in multimedia learning at large has not taken motivational issues into account. Instructors may be consider that multimedia material and associated operations are more interesting (e.g., text + pictures + sound) or more accessible (e.g., e-learning at the user's convenient time) than conventional methods. The underlying assumption is that learners who have the opportunity to use multimedia resources should be highly motivated.

In a study conducted by; Zamani, Saidi and Saidi (2012), 'the effectiveness and sustainability of multimedia effects on self-efficacy and motivation in mathematics education in Izeh city'. They found significant difference in self efficacy and academic motivation after training the experimental group compared with the control group. Thus, the results indicate a positive impact of multimedia on the efficacy and academic motivation. Ghasemi, Bayani and Asadi (2011) conducted a study on the impact of Researcher made multimedia on learning physics the first year of high school of Malayer city. The results showed that the use of Researcher made training multimedia has a positive impact on learning on students in high school physics. Bolliger, Supanakorn and Bogg (2010) conducted a study on Impact of multimedia (podcasting) on student motivation in the online learning environment. Their findings indicate that students were moderately motivated by the use of podcasts in their online courses. Statistically significant differences in students' motivation based on gender, class standing, and prior online learning experience were found .The findings suggested that learners had very positive attitude toward podcasts multimedia and had very high motivation. Therefore, this study investigates the effects of multimedia and advanced organizers on upper Basic science students' performance and motivation in chemical concepts, Zaria metropolis, Kaduna State, Nigeria.

2.6 Concept of Advanced Organizers

The concept of advanced organizer is information presented to the learners at the beginning of a lesson when there is no linkage between the present and previous learning materials. Mayer (2003) defined advanced organizers as the information presented prior to learning that can be used by the learner to organize and interpret new incoming material. Advanced Organizer refers to information presented by an instructor that help the students organize new incoming information (Mayer & Richard, 2003). Ausubel as cited in Kirman and Shaw (2007) defined advanced organizers as appropriate, relevant and inclusive introductory materials introduced in the beginning of new lesson and presented at a higher level of abstraction, generality and inclusiveness. The organizers serve to provide the knowledge foundation for the stable incorporation and retention of the more detailed and differentiated materials that follow. Ausubel (1968) also explained that advanced organizers are not the same as summaries or overviews, which comprise text at the same level of abstraction as the material to be learned, but rather are designed to bridge the gap between what the learner already knows and what he needs to know before he can successfully learn the task at hand. An advanced organizer is a statement of inclusive concepts to introduce and sum up material that follows (Woolfolk, 2011). An advanced organizer is information that is presented prior to learning that can be used by the learner to organize and interpret new incoming material (Mayer, 2003). According to Kirkman and Shaw (2007) there are two categories of advanced organizers: expository and comparative organizers. Expository organizers function to provide the learner a conceptual framework for unfamiliar materials and comparative organizers are used when the knowledge to be acquired is relatively familiar to the learner. Hence, familiarity with the new materials is a key to determining which type of organizers you will want to use. Dell (2007) pointed out that advanced organizers whether expository or comparative can take many forms these includes text-based advanced organizers, visual or graphic advanced organizers. According to Woolfolk, Winnie, Perry and Shapka (2010) advance organizers are of different types these include:

Expository advance organizer: an expository advance organizer may simply provide students with the meaning and purpose of what is to follow, presents students with more detailed information of what they will be learning especially the information that may be difficult to understand: by given straightforward descriptions of new content emphasizing important content through a graphic organizer that is already filled in at the beginning of a unit to prepare them for what they will learn (inspirational).

Graphic advance organizer: Graphic advance organizer also provides students with guidance on what the important information is in a lesson or unit. They give students direction and also provide a visual representation of the important information. It is easy to see what is important and relationship between the ideas and patterns in the information where they exist

Narrative advance organizer: A narrative advance organizer takes the form of a story. Here the teacher provides essential ideas of a lesson or unit he plans to teach by telling a story that incorporates the ideas. Such stories should make a personal or real-world connection with the new content like using Power Point to share stories.

Skimming advance organizer: When a teacher asks students to skim, glance or peruse learning materials, he provides them with the opportunity to preview the important information that they will encounter later by focusing on and noting what stands out in headings, subheadings, highlighted information, and captions-highlighted or bold text in expository information. Insert a scanned page from a text book into a power point slide-use pointer tools to circle and teach students what to skim and to skim.

From various researches, advance organizers come at the beginning of a lesson or during the statement of lesson objectives before the new learning. Advance organizers can be compared with a meeting permeable where the agenda outlines the meeting deliberations. Advance organizers help students prepare their brains to receive and make sense of the new information. Successful advance organizers forecast or access the prior knowledge to discern what is important in the lesson and learning it to the point of recall.

In constructing Advanced Organisers basic questions an instructor needs to ask while preparing an advance organizer includes the following among others:

1. How will this organizer;

• engage students?

• Help students connect to prior learning or existing cognitive structures?

• discern what is important in the lesson?

• organize content from the lesson?

2. How will I reference this organizer during or after instruction?

3. How will the advance organizer be implemented in advance?

Advance organizers work best when there is no prior knowledge involved because an advance organizer becomes the students‟ prior knowledge before learning the new material, an advance organizer is material that is introduced before an unfamiliar content so as to facilitate its assimilation. They are therefore; act as an anchor for the reception of new content (Oloyede, 2011).

An advance organizer model is an indispensible tool for teachers to help students for better understanding and effective learning of Basic science concepts. Advance Organiser Model according to Mohanty (2016) is highly useful in the process of transferring knowledge. Therefore, advanced Organizer model in her research study for the effectiveness of Advance organizer model developed by Weil and Joyce (1978) was adopted in this study. This Advanced Organizer Model has the following phases.

Phase – I: Presentation of advance organizer

The teacher clarifies aims of the lessons, presents organiser, Identifies defining attributes, gives examples, and provides multi-context, repeats prompt awareness of learner's relevant knowledge and experience in learners' background.

Phase – II: Presentation of the learning task

The teacher presents material to students, maintains attention, make organisation explicit, and make logical order of learning material explicit.

Phase – III: Strengthening cognitive organization

The teacher uses principles of integrative reconciliation, prompt active reception learning, elicit critical approach to subject matter and clarify.

However, this study investigates the Effects of Multimedia and Advanced Organizers on Upper Basic Science Students' Performance and Motivation in Chemical Concepts, Zaria Metropolis, Kaduna State, Nigeria.

2.6.1 Advanced Organizer and Academic Performance in Basic Science

Using advance organizers has been regarded as an effective strategy to activate schema by stimulating students' prior knowledge, focusing students' interests, and setting goals for further instruction (Ausubel, 1968). Schema activation refers to "various methods designed to activate students' relevant knowledge prior to a learning activity" (Bruning etal., 2003). Study by Corkill in Abdullahi (2018) compared the effects of concrete and abstract advance organizers on students however, generated quite inconsistent results. It was expected that both organizers would facilitate learning and performance, but the results showed that only the concrete organizer treatments had a positive effect on students' performance. In another study, Bastick (2001) used vote counting to test the effectiveness of using lists of instructional objectives as advance organizers at the start of a lesson. Students were asked to recall the instructional objectives stated before instruction and differentiate the unused objective in the instruction. The finding shows that using instructional objectives alone could be defined as true advance organizers.

Kang (2002) synthesized 14 graphic organizer intervention studies for students with learning disabilities. The overall finding indicated the effect of graphic organizers on learning from text materials that graphic organizers used before and after reading facilitated initial and subsequent learning of students with learning disabilities. In another study, Zittle (2001) on his research on participatory organizers compared the use of a text organizer, a completed concept map, and a structured concept map in a study with distance based education. All three groups read the problem text first. Then three instructional strategies were administered. The text group studied the key points of the problem in text form. The concept map group studied the same points in the form of a constructed concept map. The third group filled out a partially-blank concept map by themselves. The number of hints required for solving the second problems was the dependents variables. The result revealed that those using a participatory organizer required little time to correctly solve the problems than the other two groups.

McManus (2000) conducted a study in a Web-based hypermedia learning environment Short prose paragraphs were used as expository organizers to link the new lesson with students' preexisting knowledge structure. Possible interactions between nonlinear presentation, advance organizers and learner self-regulation in an introductory level technology class were searched. The results did not reveal any effects or interactions. Also, Tseng, Wang, Lin, and Hung (2002) administered one experiment on computerized advance organizers designed with Macromedia Flash and Microsoft PowerPoint. In the study, students were divided into two learning environments; one using computer assisted learning systems and the other using traditional teaching method. In each learning environment, subjects were further divided into one control group and two experimental groups, respectively, using organizers designed with multimedia computer software, Macromedia Flash and Microsoft PowerPoint. The results of the study suggest that the students that used computerized advance organizers evidently demonstrated higher academic performance than those without advanced organizers.

Calandra (2002) tested the use of both 'textual' and 'text and graphic' advance organizers in Web-based classroom instruction, and compared the effectiveness of these two types of organizers. The text-only organizer consisted of abstractions of seven components of a Timeline from the course content. The 'text and graphic' organizer was composed of the same text as the text-only organizer, combined with graphics reflecting the historical events along the Timeline. The results of both of the two groups of students indicate that the use of advance organizers before a one-time, Web-based activity on history did not significantly improve users' knowledge on that subject or their attitudes towards traditionally marginalized groups as compared to a control group without advance organizers.

Another study according to Hale (2003) investigated the effects on students learning performance and computer anxiety of Navy enlisted personnel using two different forms of concept maps as graphic organizers in computer-based training sessions. There were one control group and two experimental groups using spider and hierarchical concept maps respectively. Both advance organizers were composed of important concepts drawn from the material-to-be-learned. The spider map consisted of a central concept with related concepts branching off in many different directions. The hierarchical map indicated a more linear relationship between the central concept and the sub-concepts. The study was implemented in three locations in networked computer training centers. A significant relationship was found to exist between the number of high school science courses taken and the posttest scores, but there was no any effect associated with graphic organizers on students' academic performance.

Minchin Jr. (2004), in his participatory action research, using document analysis, survey and focus group strategies, to investigate the facilitative effect of graphic organizers in introductory information technology classes as part of his dissertation. The findings of his study supported the use of graphic and advance organizers in the classroom with positive feedback from both students and the teachers. The results indicate that using graphic organizers is helpful for increasing students' academic performance. This study also investigates the Effects of Multimedia and Advanced organizers on upper Basic Science Students Performance and Motivation in Chemical concepts, Zaria metropolis, Kaduna State, Nigeria.

2.6.2 Advanced Organizers and Motivation in Basic Science

Several researchers have studied on the effect of Advance organizer Model on the Achievement and Motivation of students at primary level (Mohanty, 2016). Researchers such as Shihusa and Keraro (2009), found that positive effect existed when using Advanced Organizer Models on student's motivation to learn biology. Oloyed (2011) found that Advanced Organizers Model has significant effect on secondary school chemistry students. The findings revealed that the positive effect of pictorial and written Advanced Organizers motivate the performance of secondary school Chemistry students.

In his study, Mohanty (2016), found that Advance organizer model has significantly positive effect on the motivation of the students. His findings also revealed that the mean motivation scores between boys and girls do not differ significantly from each other and concluded that Advance organizer Model is equally effective for the development of motivation of boys and girls in social science. In their study, Kigo, Oke, Maghanga and Chemwei (2018) found out that science process skill advanced organizer can be used to motivate students in the learning of Physics. The results of their study indicated that there exists a relationship between science process skills advance organizer and students' motivation orientation in the learning of electric current physics taught in secondary schools. The motivation orientation seems to be determined by the source and also the level of engagement of the student in the learning activity.

Therefore, this study investigates the Effects of Multimedia and Advanced Organizers on upper Basic Science Students Performance and Motivation in Chemical Concept, Zaria Metropolis, Kaduna State, Nigeria.

2.7 Overview of Similar Studies

In his study Abubakar (2014). “The effect of multimedia facilities on the academic performance of JSS Students in teaching Islamic studies content of the curriculum”. The specific objectives for the study were:- To investigate the effects of multimedia facilities in teaching JSS Islamic Studies, to find out how the use of multimedia facilities in teaching JSS Islamic studies enhances the performance of male and female students and to compare the performance of students taught using multimedia facilities at pre-test and post-test and those taught using traditional method of teaching. Three (3) research questions and three (3) null hypotheses were formulated to serve as guide for this study. Samples of 100 students were proportionally selected out of 2162 population and were placed into experimental and control groups. The study made use of a standardized achievement test items as the instrument for data collection, the scores obtained were analysed using the t-test statistical method. Quasi-experiment design involving the pre-test and post-test was employed for the purpose of this study. The result obtained in this study showed that out of the three (3) null hypotheses formulated and tested at 0.05 level of significance two were rejected while one was retained, the rejection was attributed to the exposure of multimedia facilities to experimental group which indicated that t-value is greater than t-critical in the first Ho and third Ho while in the second Ho its retention indicated a similar result in the t-value and in t-critical. The findings revealed that multimedia facilities have a significant role on the performance of JSS Students. In view of the above findings it is concluded that effective use of multimedia facilities in teaching should be employed as it will enhance student’s performance of in JSS level of education. However, for the sake of the present study, the researcher investigates the Effects of Multimedia and Advanced Organizers on Upper Basic

Science Students Performance and Motivation in Chemical Concepts, Zaria Metropolis, Kaduna State, Nigeria.

A study carried out by Barzegar, Farjad and Hosseni (2012).The technique of multimedia and network of using new computerized methods in education and teaching had so many positive effects. The technique has built a creative environment for learners through twofold and interactional relation. Their study compared the effect of new teaching model and traditional models on learning. In other word, the study compared the amount of learning, according to new and traditional models of teaching. The research method is descriptive and the necessary data and information has been gathered by questionnaire. The population includes all students of guidance schools in Tehran city and nearly, 234 students have been selected through clustering method of sampling. The results of study showed that by using the teaching model based on multimedia and network, the amount of students learning has significantly higher than the situation in which traditional teaching methods were used. In addition, the student's activity, participation, interest and creativity have been increased through using multimedia and network methods of teaching. Furthermore, the change of students learning method, their spent time for learning and optimizing of teaching structure are some of the advantages for teaching according to multimedia and network. This study investigates the Effects of Multimedia and Advanced Organizers on Upper Basic Science Students Performance and Motivation in Chemical Concepts, Zaria Metropolis, Kaduna State, Nigeria.

Liu, Olmanson, and Horton (2011), conducted a study which examines middle school students' learning and motivation as they engaged in a multimedia enriched problem-based learning (PBL) environment for middle school science. Using a mixed-method design with both quantitative and qualitative data, we investigated the effect of a multimedia environment on sixth graders' science learning, their levels of motivation, and the relationship between students' motivation and their science learning. Participants were 220 sixth graders in regular education from a public school in a southwestern US city (*n*female = 119, 54 %; *n*male= 101, 46 %). Students used Alien Rescue as a self-paced science curriculum unit for three weeks in their daily 45-minute classes. They engaged in the learning activity in groups of two or three with each student having a computer. The analysis of the results showed that: Students significantly increased their science knowledge from pretest to posttest after using the PBL program, they were motivated and enjoyed the experience, and a significant positive relationship was found between students' motivation scores and their post science knowledge scores. Findings were discussed within the research framework. Therefore, this study investigates the Effects of Multimedia and Advanced Organizers on Upper Basic Science Students Performance and Motivation in Chemical Concepts, Zaria Metropolis, Kaduna State, Nigeria.

Another study conducted by Thomas and Israel (2014). 'The effects of animation and multimedia teaching on academic performance of students in sciences'.100 students were randomly selected from four secondary schools in Ado Ekiti Local Government Area of Ekiti State. The research design employed for this study was quasi- experimental research design of two groups' pre test, post test control design. The study lasted for the period of six weeks due to the experimental nature of the research. The pre test was administered to all the participants in other to be sure of their homogeneity. The treatment was administered to the experimental class with the use of cartoon style animation and multimedia teaching and the second group was taught with conventional teaching approach. The pre-test and post-test scores of the students in the conventional and multimedia teaching group were used for the purpose of data analysis. The results were analysed using t-test, three hypotheses were postulated. The result showed that (i) t-calculated (1.89) < t-table value (2.01), (N=100, x (19.50, 20.26), SD (5.02, 5.79), Df= 98) which confirmed the homogeneity of the two groups at the pre-test (ii) t-calculated (6.12) is greater than the t-table (1.98), (N=100, x _(23.92,50.66), SD (4.73, 6.43), Df= 98) which confirmed the effectiveness of the treatment of animation on the performance (iii) t- calculated (0.09) is lesser than the t-table value (2.00),(N=50, x _(23.42, 23.92), SD (3.86, 4.73), Df= 48) which confirmed no significant difference in the performance of male and female students at 0.05 level of significance,. The findings therefore revealed that there was a significant difference in the performance of students exposed to cartoon style multimedia teaching and those that are conventionally taught. It was therefore recommended that the use of cartoon style animation and multimedia teaching should be encouraged so as to complement other methods of teaching science in schools and colleges.

This study investigates the Effects of Multimedia and Advanced Organizers on Upper Basic Science Students Performance and Motivation in Chemical Concepts, Zaria Metropolis, Kaduna State, Nigeria.

In a study carried out by Nozari and Siamian (2015). The study aimed to address whether utilizing podcast multimedia training system has an effect on the motivational achievement and students learning of the Arabic course in high school. Descriptive and quasi-experimental study, pre- and post-test method in control and experiment groups was used. Researchers used simple random sampling method to form the groups using the sample of 30 students for experimental group and 30 students for control group. Results: The results showed the normal distribution of data according to the value of z (0.09) in the pre- and post-tests in both control and experiment groups. Therefore, the data distribution was normal (P>0.925). Significant differences between experimental and control groups in terms of academic level were not observed in the pre-test.

There was no significant difference between the motivational achievement of education in post-test of control and experiment group ($p>0.89$). Conclusion: The results showed that teaching with podcast multimedia systems significantly increased learning of Arabic in the high school level. But of motivation reinforcement between traditional method and system for multimedia podcasts, showed no significant differences. Each variety of multimedia techniques can be beneficial for a specific course. Therefore, more studies on the effectiveness of podcast method in different courses to determine its effects are necessary.

This study investigates the Effects of Multimedia and Advanced Organizers on Upper Basic Science Students Performance and Motivation in Chemical Concepts, Zaria Metropolis, Kaduna State, Nigeria.

In their study, John, Musa and Waziri (2018). 'effects of multimedia instructional strategy on secondary school students' academic achievement in biology'. Three hypotheses tested at 0.05 level of significance guided the study. The design of the study was quasi-experimental with 286 Senior Secondary students selected purposively from two senior secondary schools in Adamawa state, Nigeria. Instrument used for data collection was an achievement test tagged Biology Achievement Test (BAT) adapted from WAEC tests from 2005-2015. The instrument was content validated by three experts and Cronbach alpha Formula was used for testing its reliability. The reliability coefficient of 0.76 was obtained. The treatment lasted for six weeks and data were analysed using Analysis of Covariance (ANCOVA).The result of the study revealed that, students taught biology with multimedia instructional strategy performed better than those taught with lecture method. Furthermore, male students outperformed their female counterparts. It was recommended that, Federal and state ministries of education should make provision of computers and projectors in secondary schools. State governments and school authorities should organize training and workshops for biology teachers on the use of multimedia instructional packages. Curriculum planners and curriculum development bodies in Nigeria like NERDC should design curriculum and make policies that will incorporate the use of multimedia strategy in teaching and learning biology at Secondary School level. Therefore, this study investigates the Effects of Multimedia and Advanced Organizers on Upper Basic Science Students Performance and Motivation in Chemical Concepts, Zaria Metropolis, Kaduna State, Nigeria.

A study conducted by Movahedi, Khamseh, Ebadi, Hajiamini, and Navidian (2019), 'Comparison of group motivational interviewing and multimedia education on elderly lifestyle'. Many of the problems caused by aging can be delayed and the health of the elderly maintained by improving and applying a healthy lifestyle during old age. Therefore, the researcher has designed and implemented a study aimed "compare the impact of group motivational interviews with multimedia education on improving lifestyle in the elderly." The study is triple blind before and after clinical trial was performed on three groups of thirty (n = 90) of the elderly with mean age 63.41 ± 6.88 who were members of the elderly centers of Tehran city neighborhoods with average to unfavorable lifestyle score. The first test group was subjected to group motivational interviewing during five sessions. The second test group was subjected to distant multimedia training. No training was given to the third group as the control group. After 3 months, the lifestyle questionnaire was completed in three groups. The results were analyzed by these techniques as statistical tests such as mean, standard deviation, relative frequency, and absolute frequency were used. The inferential statistical tests such as paired t-test and one-way ANOVA were used, respectively, to compare the pre- and post-mean scores and in each group and compare the mean scores of lifestyle dimensions in three groups. Both motivational interviewing and multimedia education have been effective in changing the lifestyle of the elderly, but according to the findings, motivational interviewing has a greater impact on elderly lifestyle. The total lifestyle score in four areas such as nutrition, self‑care, mental health, and physical activity was significantly different in the three groups after the intervention ($P < 0.001$). Each educational program can somehow improve behavioral skills in individuals. Effective teaching methods should address the learning difficulties and inability to learn during the aging period. The results of this study can be a step toward the elaboration of strategies for education and promotion of healthy lifestyle in the elderly.

In this study the researcher investigates the Effects of Multimedia and Advanced Organizers on Upper Basic Science Students Performance and Motivation in Chemical Concepts, Zaria Metropolis, Kaduna State, Nigeria.

In his study AbdulKareem (2018). 'The effectiveness of using Multimedia on students learning outcomes in biology'. 180 students were randomly selected from three secondary schools and were randomly divided into three groups. Pretest-posttest control group quasi experimental design was employed for the study. The experimental groups were taught with the help of multimedia presentations whereas the control group was treated traditionally. The treatment was given for a period of 10 weeks. Validated Attitude Towards Biology Scale (ATBS) was tested for reliability using Cronbach alpha which stood at 0.76 and Biology Achievement Test (BAT) which was also validated was tested for reliability using Kuder Richardson (KR,20), yielded 0.89, were used as data collection instruments. The data collected were analysed using descriptive and inferential statistics. The results indicated a statistically significant difference between students learning outcomes and modes of instruction. Students under Multimedia Aided

Instructions had better outcome than their colleagues in traditional teaching method. Therefore, it is recommended that Multimedia Assisted Instruction should be used in the teaching of biology at secondary school to improve students' learning outcomes in the subject. This study intends to investigate the Effects of Multimedia and Advanced Organizers on Upper Basic Science Students Performance and Motivation in Chemical Concepts, Zaria Metropolis, Kaduna State, Nigeria.

A study conducted by Shihusa and Keraro (2009), investigated the effect of using advance organizers on students' motivation to learn biology. The research design used was quasi-experimental design where the nonrandomized Solomon Four group was adopted. The focus was on the topic pollution. The sample comprised of 166 from three (third grade in the secondary school cycle) students in Bureti District, Kenya. Data was collected by using Students' Motivation Questionnaire (SMQ). A t-test, one-way ANOVA and ANCOVA statistical techniques were used to analyze the data. The findings indicate that students taught using advance organizers had a higher level of motivation than those taught using conventional teaching methods. The findings further indicate that following the intervention, male students had a significantly higher level of motivation than their female counterparts. This paper concludes by discussing the implications of these findings on current practice. However, this study investigates the Effects of Multimedia and Advanced Organizers on Performance and Motivation on Upper Basic Science Students in Chemical Concepts, Zaria Metropolis, Kaduna State, Nigeria.

In their study Kigo, Okere, Maghanga, and Chemwei (2018), 'Science Process Skills Advance Organizer and Students' Motivation Orientation in Secondary School Physics'. The study was designed to investigate students' motivation orientation in the learning of electric current circuits in secondary school physics after exposure of Science Process Skills advance organizer. The study adopted the posttest only design. Students were exposed to various electric current circuits making activities using electric current components before a physics lesson which was conventionally taught before being post tested. A students' motivation questionnaire was then administered thereafter. A total of seventy two (72) form two secondary school physics students participated in the study. Data were collected using a six item students' motivation questionnaire (SMQ) with a reliability of 0.799. Principal Component Analysis was used to reduce student's responses of each of the six items to manageable variables for easy interpretation of students' motivation orientation in the learning of electric current circuits in physics. The results of the study indicated that students' exposure to the science process skills advance organizer made them develop confidence in the physics course, they were excited by the activities that had taken place before the physics lessons especially the experiments they engaged in themselves. The results also indicated students were stimulated when they made conclusions of the experiments exposed to them before the lesson and they were happy when they worked through experiments in groups. The study concludes that science process skills advanced organizer can be used to motivate students in the learning of Physics. The study recommends that teachers of Physics be encouraged to construct relevant science process skills advance organizers for other topics of Physics taught at secondary schools. The study also recommends that publishers and physics education experts publish current research on science process skills advance organizers that can be applied in other subjects. Therefore, this study investigates the Effects of Multimedia and Advanced Organizers on Upper Basic Science Students Performance and Motivation in Chemical Concepts, Zaria Metropolis, Kaduna State, Nigeria.

Antoine (2013) conducted a study ‘the effect of graphic organizers on science education: human body systems’. The purpose of his study is to determine whether graphic organizers foster better student achievement in science classrooms than guided note taking with PowerPoint presentations. The study was quantitative. Using approximately 69 high school Biology I students, two body systems were taught using graphic organizers as the main lesson plan tool and two body systems were taught only using a guided notes lecture with PowerPoint. A pre-test and a post-test were administered for each body system studied. Students test scores were evaluated to determine whether knowledge gains differed between the two types of lessons. It was found that the use of graphic organizer instruction was significantly better for students achievement when compared to the use of PowerPoint instruction and that there was much more interaction between students and teacher during the graphic organizer lessons. The delivery of the lesson by the use of graphic organizers seemed to promote more students success than the use of the PowerPoint lesson. This study seeks to investigate the Effects of Multimedia and Advanced Organizers on Upper Basic Science Students Performance and Motivation in Chemical Concepts, Zaria Metropolis, Kaduna State, Nigeria.

In a study carried out by Conley (2008), the study investigated the effect of graphic organizers on the academic achievement of high school students receiving instruction in United States History via online blended learning environment. With 60 participants in the study, the students were equally divided into two groups of 30 participants each. Group I was designated as the treatment group, while Group II formed the control group. A two-tailed t-test was used to determine that the means of the two posttests were not significantly different at a probability level of .05. Therefore, the results of the study indicated that high school students who received instruction in United States History in an online blended learning environment using graphic organizers did not perform significantly higher on the End-of-Course Test than high school students who did not receive instruction using graphic organizers.

Therefore, the intent of this study is to investigate the Effects of Multimedia and Advanced Organizers on Upper Basic Science Students Performance and Motivation in Chemical Concepts, Zaria Metropolis, Kaduna State, Nigeria.

Atomatofa (2012) conducted a similar study, 'effects of advanced organizers on attainment and retention of students' concept of gravity in Nigeria'. The study was carried out to find out the efficacy of using advanced organizers to teach students the concepts of gravitation, weightlessness and space travels which are topics the students of junior secondary one have not been previously taught. 80 junior secondary one students from two secondary schools in Delta state Nigeria were used for the study. The students were grouped into two; the advanced-organizer and control group. The exercise took place in six weeks. The advanced organizers were given before each of the four lessons to those in the experimental groups while those in the control had no organizers; they were only taught lessons same with the students in the experimental groups. The dependent variables are the students' attainment and students' retention of the concept of gravity while the independent variable are the advanced organizers. Two research hypotheses and two research questions were stated. Using simple descriptive statistics and t-test statistical analysis the two hypotheses were rejected because there were significant differences in the attainment and retention of concepts of gravity by students in favor of the advanced organizer group. Based on the results educational implications and conclusions were stated. This study investigates the Effects of Multimedia and Advanced Organizers on Upper Basic Science Students Performance and Motivation in Chemical Concepts, Zaria Metropolis, Kaduna State, Nigeria.

In a similar study carried out by Mondal (2013).The objective of the study is to compare the relative effectiveness of Inductive Thinking Model (ITM) and Advance Organizer Model (AOM) in teaching chemistry under two different boards/councils in relation to level of cognitive achievement of the students on the criteria of immediate learning and retention. The sample consists of 200 students from eight sections of four randomly selected schools situated at Purulia, Birbhum, Malda and Hoogly. The (2 × 2 × 3) factorial design was used for the study. At the beginning, an entry level test (ELT) has been administered to cheek the homogeneity of the groups and to categorize the students on the basis of their cognitive achievement. After administering the entry level test, four treatment groups have been formed. Gr I and Gr III have taught with AOM whereas Gr II and Gr IV taught with ITM for eight weeks. After experimentation, common standardized CRTs (post test) viz. CRT II and CRT III has been administered to all the sections. In order to test retention of the learnt knowledge, CRT IV, which is the combination of CRT II and CRT III has been administered after 15 days from the date of post test. Results indicate that both ITM and AOM are equally effective on the criteria of immediate learning but AOM group establishes superiority than the ITM group on retention. Therefore, this study investigates the Effects of Multimedia and Advanced Organizers on Upper Basic Science Students Performance and Motivation in Chemical Concepts, Kaduna State, Nigeria.

In his attempt to investigate the effect of advanced organizers, Lisa (2013): Advance Organizers in Secondary Special Education Resource Classrooms: Effects and Students Engagement

Behaviors. Research suggests that proactive engagement strategies and interventions can have a greater effect on overall classroom behaviors than negative consequences. A single case experiment measured the effects of expository advance organizers on academically engaged behavior, respectful behavior, and disruptive behavior in the special education self-contained resource classroom. The single-case A-B-A-B design for the study evaluates these components of student engagement during academic instruction over a four-week period. Three secondary special education small-group resource Language Arts classes from a Northeast Georgia high school comprised the subject for this study. The Direct Behaviour Rating (DBR) Form: 3 Standard Behaviours instrument was used to collect and analyze data. Hypotheses stated that the expository advance organizer strategy has an impact on students' academic engagement behaviours, students' respectful behaviors and student disruptive behaviors in the special education resource classroom. This study investigates the Effects of Multimedia and Advanced Organizers on Upper Basic Science Students Performance and Motivation in Chemical Concepts, Zaria Metropolis, Kaduna State, Nigeria.

In their study on Advanced Organisers, Lin and Chen (2007), "Reading Authentic EFL Text Using Visualization and Advance Organizers in a Multimedia Learning Environment": The study was compared the effects of different types of computer-generated visuals (static versus animated) and advance organizers (descriptive versus question) in enhancing comprehension and retention of a content-based lesson for learning English as a Foreign Language (EFL). Additionally, the study investigated the interactive effect of students' existing reading proficiency level and the above-mentioned treatments on their reading comprehension achievement. Students from two EFL reading sections (N = 115) were tested on their reading proficiency and then randomly assigned to one of four computer-based instructional modules-static visual alone, animation alone, animation plus descriptive advance organizer, and animation plus question advance organizer. Once having interacted with their respective instructional materials, students then took four criterion tests immediately afterward and again four weeks later. The results showed that the animation group outperformed the static visual group in one of the four tests, and that animation embedded with a question advance organizer had a marginal effect among the four treatments in facilitating the acquisition of L2 reading comprehension both for the immediate and the delayed posttests.

Therefore, this study investigates the Effects of Multimedia and Advanced Organizer on Upper Basic Science Students Performance and Motivation in Chemical Concepts, Zaria Metropolis, Kaduna State, Nigeria.

In his study, Abubakar (2017): Effect of Advanced Organizers on Retention and Performance in Conservation concept among Secondary Biology Students, in Jahun, Jigawa State, Nigeria. The study adopted the pretest, post test and post-post test quasi experimental and control group design. The students in experimental group were taught using lecture method enriched with advanced organizers while those in control group were taught using lecture method for the period of six weeks. The topic taught was conservation of natural resources from senior secondary school curriculum. The instrument used for data collection was Conservation Concept Performance Test (CCPT) with reliability coefficient of 0.89. Four Research questions and four null hypotheses were formulated and tested using independent t-Test at 0.05 level of significance. Pictorial and textual advanced organizers were developed, also a lesson plan was developed for experimental and control groups. The major findings from the study include: obtaining a significant difference between the mean academic performance scores of students taught conservation concepts with advanced organizers and those taught without advanced organizers in favour of the former. Therefore, this study investigates the Effects of Multimedia and Advanced Organizers on upper Basic Science Performance and Motivation in Chemical Concepts, Zaria Metropolis, Kaduna State, Nigeria.

Another related study conducted by Agbenyeku (2008): Effects of Advance Organizers on Performance and Retention of Ecology Concepts among Senior Secondary School Students in Giwa Educational Zone. The study examined the effect of advance organisers on the performance and retention of ecology concepts among senior secondary school students in Giwa educational zone. The study was conducted using a population of 145 students from G.S.S Kwangila (n=70) and G.S.S Basawa (n=75), using intact classes. A Quasi-experimental non-equivalent control group of pretest, post-test and delayed post-posttest design was used. The subjects were taught for six weeks using advance organisers and lecture methods for the experimental group and lecture method only for the control group. For the pretest, post test and delayed post posttest, the instrument used was the Ecology Concept Achievement Test (ECAT). Four null hypotheses were tested t-test statistics was used to determine the level of significance of the two groups at $P< 0.05$. The major findings from the study indicated that: there is a significant difference in the mean academic performance scores of the experimental and control groups. There is a significant difference in the retention level of the students taught using advance organisers compared to those taught using lecture method only. Hypothesis 3 and 4 regarding gender issues; the use of advance organizers also favoured female students over the male students and female students slightly retained more than male students.

This study investigates the Effects of Multimedia and Advanced Organizers on upper Basic Science Students Performance and Motivation in Chemical Concepts, Zaria Metropolis, Kaduna State, Nigeria.

A study conducted by Mohanty (2016) 'Study on the Effectiveness of Advance Organizer Model of Achievement and on the Development of Motivation in Social Study' the study employed quasi experimental design, adopting purposive sampling technique. The sampled of the study included 107 students (55 boys and 52 girls) studying in government school for both boys and girls. The sample has been selected from four primary schools of district Jajpur of Odisha. The sampling units for the present study were selected by adopting purposive sampling technique. The study found advance organizer model is more effective of achievement and development of motivation in social study than traditional approach. It also found that the treatment advance organizer model is effective for the achievement of primary school students in social study.

Therefore, this study investigates the Effects of Multimedia and Advanced Organizers on upper Basic Science Students Performance and Motivation in Chemical Concepts, Zaria Metropolis, Kaduna State, Nigeria.

Another study carried out by Mustafa (2012) 'Adaptation Study of Motivation Toward Science Learning Questionnaire for Academically Advanced Science Students' the purpose is to adapt "Motivation toward science learning questionnaire" for academically advanced science students. The survey method was used for the study and examination of reliability and validity of the scores on the instrument was conducted after the data collection. The study was conducted on 75 advanced science students. The "principle component analysis" with "varimax rotation" was used at the beginning of the study. Then, considering high communalities and loading of the majority of the items on one factor, confirmatory factor analysis with "maximum likelihood method" on one-factor solution was conducted. The results of the study showed that the adapted instrument was valid and reliable to use for the measurements of motivation toward science learning in the context of advanced science classrooms. Also, this study investigates the Effects of Multimedia and Advanced Organizers on upper Basic Science Students Performance and Motivation in Chemical Concepts, Zaria Metropolis, Kaduna State, Nigeria.

In a study conducted by Kuzu, Alakbulut and Sahin (2007). ‘Application of Multimedia Design Principles to Visuals Used in Course-Books: An Evaluation Tool’. The paper introduces an evaluation tool prepared to examine the quality of visuals in course-books. The tool is based on Mayer’s Cognitive Theory of Multimedia Learning (i.e. Generative Theory) and its principles regarding the correct use of illustrations within text. The reason to generate the tool, the development process along with the theoretical procedures followed, reliability studies and users’ manual of the instrument are provided within the study. The type of the picture is marked with the initials of decorative, representational, organizational and explanative. Two units of a randomly selected computer course-book for K-8 students were evaluated by 6 academicians and 8 graduate students at an IDT department in Turkey. Grades each picture got were entered into SPSS 14.0 for windows to investigate the internal consistency of the instrument (i.e., Cronbach’s Alpha). In the study, decisions of the observers in terms of the type of visual were entered into SPSS, and the Cronbach’s Alpha was calculated. The alpha (α =0.8740) was higher than the suggested ideal alpha (i.e., .70). This indicates that observers interpreted the operational definitions of picture types consistently. If the picture does not meet the criterion, it is given zero point. In this respect, a perfect picture meeting 7 criteria gets a total score of fourteen. The Cronbach’s Alpha for the evaluations of our observers in this part was very high again (α =0.8922). The current study investigates the Effects of Multimedia and Advanced Organizers on upper Basic Science Students Performance and Motivation in Chemical Concepts, Zaria Metropolis, Kaduna State, Nigeria

Sorden (2010) wrote a similar article, 'Cognitive Theory of Multimedia Learning'. Multimedia learning is a cognitive theory of learning which has been popularized by the work of Richard E.Mayer and others. Multimedia learning happens when we build mental representations from words and pictures. The theory has largely been defined by Mayer's cognitive theory of multimedia learning. Generally, the theory tries to address the issue of how to structure multimedia instructional practices and employ more effective cognitive strategies to help people learn efficiently. Baddeley's model of working memory, Paivio's dual coding theory, and Sweller's theory of cognitive load are integral theories that support the overall theory of multimedia learning. The theory can be summarized as having the following components: (a) a dual- channel structure of visual and auditory channels, (b) limited processing capacity in memory, (c) three memory stores (sensory, working, long-term), (d) five cognitive processes of selecting, organizing, and integrating (selecting words, selecting images, organizing work, organizing images, and integrating new knowledge with prior knowledge), and theory-grounded and evidence-based multimedia instructional methods. Important considerations for implementing the theory are discussed, as well as current trends and future directions in research.

This study investigates the Effects of Multimedia and Advanced Organizers on upper Basic Science Students Performance and Motivation in Chemical Concepts, Zaria Metropolis, Kaduna State, Nigeria

Similarly, in his article Anderman (2004), 'Students Motivation across Subject- Area Domains'. The notion that students achievement motivation varies across different subject-area domains is not a new one. Indeed, research demonstrating that students report differences in terms of how interesting, difficult, and valuable they perceive various school subjects to be, as well as their perceptions of their own competence in those subjects, has been available for some time. Despite such evidence, however, researches on students motivation often has been conceptualized in more general terms with little attention being paid to the particular content or instructional contexts in question. The articles in this Special Issue reflect a growing trend away from such generalizations and toward a greater consideration of motivational processes within the context of different subject-area domains. The need for a closer examination of motivational beliefs and processes within subject areas arises in part from a similar movement in researches on students' cognition and learning. Current research in those areas recognizes the domain specificity of many cognitive processes, and it has become common to discuss different subject-area domains as constituting distinct cultures and classrooms as "communities of learners". As theories of students learning and cognitive processing become more contextualized, the need for a parallel shift in motivational theory and research becomes salient. That focus also reflects a more general trend in the field of educational psychology toward consideration of the importance of various types and levels of social contexts, including the study of instructional contexts of classrooms, school-level structures, peer groups, and larger societal contexts. That is, much research and theory in educational psychology is moving from the consideration of individual differences alone to a greater focus on the person within a context. The articles in this Special Issue also reflect that focus. This study investigates the Effects of Multimedia and Advanced Organizers on upper Basic Science Students Performance and Motivation in Chemical Concepts, Zaria Metropolis, Kaduna State, Nigeria

Another study carried out by Malik and Zaman (2012)The effectiveness of Graphical Organizer (GO)Teaching Model on Student's Learning Achievement in General Science at Elementary School Level. Graphic Organizer Teaching Model helps teachers to make their content understandable for their students. The objectives of the present study were to assess the effect of

GO Teaching Model on students' learning and explore the understanding of student. It was an experimentally study. The experiment was conducted at an Elementary School. Pre-test posttest control group design was adopted for conducting the experiment for the study. The sampled of the study comprised 40 students in which 20 students were chosen as the experimental group and 20 students were chosen for control group. Difference in achievement of students (in control and experimental group) in General Science was checked through comparison of their performance in Post-test. Data analysis revealed that students of experiment group who were taught through GO teaching got more marks than students in control group. Findings depicted that GO Model proved an effective instructional strategy. The result reported that students learning achievement was improved through the use of GO in General Science. It was recommended that teachers may be trained in how to design and use GO in teaching. The findings of the study have implication for teachers, curriculum developer's educationists and researchers. This study investigates the Effects of Multimedia and Advanced Organizers on upper Basic Science Students Performance and Motivation in Chemical Concepts, Zaria Metropolis, Kaduna State, Nigeria

A study carried out by Akinoso (2018) 'effectiveness of multimedia on students' performance in mathematics'. Two schools were randomly selected from Educational District V. Intact classes were purposely assigned into experimental and control. The sampled of the students comprised 60 students selected from 2 schools. Quasi experimental design was adopted. Mathematics Achievement Test with reliability coefficient of 0.81 using KR-20 was used. Data collected were analyzed using ANCOVA. No significant effect exists between the Treatment and achievement in mathematics, the mean achievement score of experimental group was higher than that of control. Also, significant effect did not exist on treatment and gender, but, male have higher achievement mean score (X=57.50) than female counterparts(X=54.13). Multimedia positively influenced the academic performance of students in mathematics. Therefore, this study investigates the Effects of Multimedia and Advanced Organizers on upper Basic Science Students Performance and Motivation in Chemical Concepts, Zaria Metropolis, Kaduna State, Nigeria

Similarly, Wu and Tai (2016) conducted a study, titled ‘Effects of Multimedia Information Technology Integrated Multi-Sensory Instruction on Students’ Learning Motivation and Outcome’ under the waves of the Internet and the trend of era, information technology is a door connecting to the world to generate the multiplier effect of learning. Students’ learning should not be regarded as the tool to cope with school examinations. The frequent contact with computers, networks, and relevant information allow students enjoying the colorful life. Some knowledge is broad on the Internet or TV media that the attraction of learning environments and teaching materials for students’ interests to achieve the teaching effect becomes a primary issue. With the design of experiments, the quasi-experimental research is preceded in this study. Total 92 students in two classes in Fuzhou No.1 High School in Fujian are preceded the designed teaching program of multi-sensory instruction in math for 4 months. The results show significant correlations between 1.learning motivation and learning outcomes, 2.multi-sensory instruction and learning motivation, and 3.multi-sensory instruction and learning outcomes. The study expects to understand the effects of multimedia information technology integrated multi-sensory instruction on students’ learning motivation and outcomes as well as provide reference for teachers applying information technology integrated instruction and the promotion of relevant education units. Therefore, this study investigates the Effects of Multimedia and Advanced Organizers on upper Basic Science Students Performance and Motivation in Chemical Concepts, Zaria Metropolis, Kaduna State, Nigeria

2.8 Implication of Related Literature for the Present Study

In the literature cited, from this study, the results obtained from the several research studies conducted in the area of Multimedia, Advanced Organisers, Academic Performance and Motivation. The literature gave detail explanation on the concept of multimedia and advanced organizers. Abdul kareem (2018) conducted a study on the effectiveness of using multimedia on students learning outcomes in Biology. His finding indicated that students under multimedia aided instructions had better outcome than their colleague in traditional teaching method. Movihedi etal (2019) carried out a study on comparison a group motivational interviewing and multimedia education on elderly life style. Their findings revealed that both motivational interviewing and multimedia education have been effective in changing the life style of the elderly but motivational interviewing had greater impact on elderly life style. John, Musa and Waziri (2018) conducted a study on effect of multimedia instructional strategy on secondary school students' academic achievement in Biology. The result of the study revealed that students taught using multimedia instructional strategy perform significantly better and male student outperformed their female counterpart. Nozari and Siamian (2015) carried out a study to address whether utilizing podcast multimedia training system has an effect on motivational achievement and students learning of Arabic courses in high school. The finding showed significant differences in term of academic achievements were not observed and there was no significant difference between the motivational achievement of education in both the experimental and control group.

Abubakar (2017) conducted a study on the effects of advanced organizer on retention and performance in conservation concepts among Secondary school Biology students in Jahun, Jigawa State, Nigeria. His findings revealed that significant difference exist between the mean academic performance scores of the experimental group and the control group, in favour of the experimental group. In a study conducted by Abenyeku (2008) ‘effects of advanced organizer on performance and retention of ecology concept among senior secondary school students in Giwa educational zone’ the finding revealed that students taught using advanced organizer perform significantly better than those taught using conventional lecture method and the use of advanced organizers favour female students than male students. Kigo etal (2018) conducted a study on science process skills advanced organizer and students motivation orientation in secondary school Physics. The result of their study indicated that science process skills advanced organizer motivate students in learning Physics. Antoine (2013) carried out a study on effects of graphic organizer on science education: human body system. The finding showed that students taught using graphic advanced organizer instruction achieved significantly better than the students taught with use of power point instruction and there was much more interaction between the students and the teacher during the graphic organizer lesson.

From all the literature reviewed, it was observed that multimedia and advanced organizers are used improve academic performance and motivation of students at various educational level and different field of studies. Moreover most of the researchers used only textual advanced organizers with few using graphic organizers. However, it has also been observed that most of the study reviewed use different types of multimedia such as animation, podcast, web-based among others. Also, the literature reviewed used different advance organizers such as science process skills advanced organizer, textual, expository and comparative advanced organizers among others. For the sake of this study video was used as multimedia and graphics as advanced organizers, this is because very few researches on multimedia used videos and also most of the advanced organizers used by the previous researchers were not graphics. Also, majority of the studies reviewed were from outside Nigeria and in different subjects rather than Basic science. Majority of the studies reviewed were on performance and achievement test with very few on motivation and most of the study did not capture gender most especially in term of multimedia and motivation.

The reviewed also revealed that the research design mostly used by majority of the researchers was quasi experimental design because mostly intact classes were used with few adopting survey and correlation research design.

This study therefore, used multimedia (video) to teach chemical concept to upper Basic science students as experimental group I and advanced organizer (graphic) to teach chemical concept as experimental group II, while the control group will be taught chemical concept using conventional lecture method. Quasi experimental design was also used and t-test, Mann-Whitney (U-test), ANCOVA and Kruskal-wallis statistical tools were used in analyzing the data. During the course of instruction, the researcher used the blended learning which involved combination of instructional technology with face-face learning in the class room as instructed by (Kerres & Witt, 2003). Also, Joyce and Weil (1978) advanced organizer model was used to taught the group exposed to advanced organizer.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The focus of this study is to investigate the Effects of Multimedia and advance organizers on upper Basic science Students Performance and Motivation in Chemical Concepts, Zaria metropolis, Kaduna State, Nigeria. The focus of this chapter is to examine the methodology used in conducting the study. Specifically, the chapter is presented under the following sub-headings:

3.2 Research Design

3.3 Population of the Study

3.4 Sample and Sampling Techniques

3.5 Instrumentation

3.5.1 Validity of the Instrument

3.5.2 Pilot Testing

3.5.3 Reliability of Instruments

3.5.4 Item Analysis

3.6 Administration of Treatments

3.7 Data Collection Procedures

3.8 Procedure for Data Analysis

3.2 Research Design

The research design employed for this study was pre-test, post-test non randomization quasi experimental design. JSSII Basic science intact classes were used for the study. The study used three groups: two experimental (Group using multimedia and group using advanced organizers) and one control group (group taught using conventional lecture method). The experimental groups were exposed to Experimental Treatment; that is teaching using multimedia (video) (X1) and teaching using advanced organizers (graphic) (X2). While the control group (CG) was taught using lecture method (X0). This design was prescribed by Kerlingar (1973). The three study schools (both experimental and control schools) were selected from the four (4) pretested schools from the population. The essence of this was to select schools with equivalence in their abilities level in term of academic performance, before the treatment. Basic Science Performance Test (BSPT) and Basic Science Motivation Questionnaire (BSMQ) were administered to JSS II Basic science students. Both the experimental and control groups were taught Chemical Concepts for the period of five (5) weeks, based on the content of the concepts. Post tests (O2) was administered after treatments to examine the effect of multimedia and advanced organizers on upper Basic science students' performance and motivation in chemical concepts.

The research design of the study is presented in figure 3.1

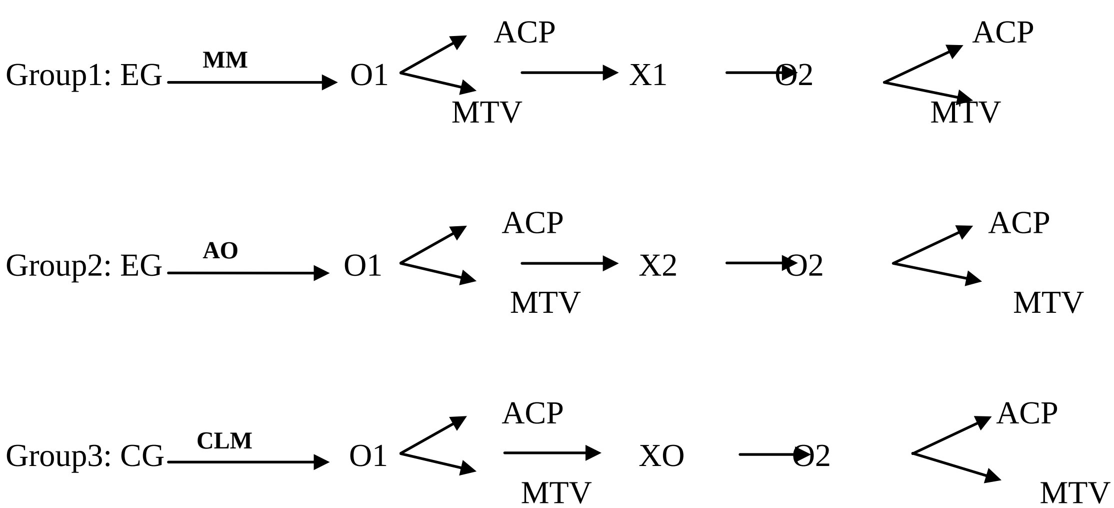

Figure 3.1: Research Design Illustration

Key:

EG: Experimental Group

CG: Control Group

MM: Multimedia

AO: Advanced Organizers

CLM: Conventional Lecture Method

O1: Pretest

O2: Posttest

X1: Treatment Using Multimedia

X2: Treatment Using Advanced Organizers

X0: Taught Using Lecture Methods

ACP: Academic Performance

MTV: Motivation

3.3 Population of the Study

The population of the study comprised all the second year Public Junior Secondary Schools (JSSII) in Zaria Metropolis, Kaduna State of Nigeria. Zaria metropolis was chosen for this study because of the large number of students' enrolment. The metropolis has the total number of nine (9) Public Junior Secondary Schools. The schools are within the ancient city of Zaria (the area surrounded by the old city wall) of Kaduna State, among these schools, eight (8) are day schools, only one (1) school is combining both boarding and day schooling system. Record of enrolment examined showed that there were 7,302 JSS II students in the target population comprising 3,376 boys and 3,920 girls. A summary of the description of the population is presented in Table 3.1.

Table 3.1: Population of the Study

s/no	Name of schools	Schools Types	No. of JSS II Students' Enrolment		Total
			Male	Female	
1	AlhudahudaCollege	Male	700	-	700
2	GJSS R/Doko	Coeducation	555	422	977
3	GJSS K/Jatau	Coeducation	332	497	829
4	GJSS K/Doka	Coeducation	696	294	990
5	GSS Zaria (Jnr)	Male	583	-	583
6	GSS Magajiya (Jnr)	Coeducation	198	143	347
7	GGSS Fada (Jnr)	Female	-	850	850
8	GGSS K/Gayan	Female	-	1515	1515
9	GSS K/Kuyanbana	Coeducation	312	199	511
Total			**3,376**	**3,920**	**7,302**

Source: Kaduna Zonal Education Office, Zaria. (2017/2018)

3.4 Sample and Sampling Techniques

The sample for this study was selected by using purposive sampling technique to select the coeducational schools in order to accommodate gender. Three coeducational schools were randomly selected from the five separated coeducational schools, using hat and drop method of sampling. Intact classes were used in conducting this research, because most of the schools do not allow their students to be randomized and assigned in to different class for the purpose of research work. All the schools were Public Secondary Schools within Zaria Metropolis of Kaduna State. Zaria Metropolis has JSS II population of 7,302 students. To determine the equivalence in terms of academic performance of the students among the schools this was achieved by subjecting the students' scores to the Analysis of variance (ANOVA) and Scheffe's test. The schools selected were found to be relatively similar statistically. One arm among the JSSII Basic science classes was chosen in each sampled school. The total samples of 263 participants were used for the study. This was in compliance with (Usman, 2010), who noted that 263 was in line with Central Limit Theory (CLT) with recommended minimum of 30 sample size. The detail of the sampled schools is presented in Table 3.2

Table 3.2 Sample for the Study

s/no	Types	Schools	No. of JSSII Students Enrolment Male	Female	Total
1	Experimental 1	School A	43	36	79
2	Experimental 2	School B	38	52	90
3	Control	School C	54	40	94
	Total				**263**

3.5 Instrumentations

The instruments for this study were Basic Science Performance Test (BSPT) and Basic Science Motivation Questionnaire (BSMQ). BSPT is a multiple choice items with options to choose one which is the correct answer meant to test the subjects' knowledge of the topic. Section B items on Basic Science Performance Test consist of multiple choice items with options ABCDE and the questions ware adapted from the revised topic syllabus of the Upper Basic Science course (FRN, 2009). The topics were used due to the fact that was reported on high failure rate in the subject. The Instrument covered all the selected topics for this study. Also, BSMQ contained 20 questions to be answered using 4- likert scale such as; Strongly Agreed (SA), Agreed (A), Disagreed (DA), Strongly Disagreed (SD). BSMQ was used to collect data on the students' motivation. Kerres and Witt (2003) multimedia blended learning model and Joyce and Weil (1978) model of advanced organizer.

Table 3.3: Item Specification of BSPT Instrument based on Bloom Taxonomy

SN	**Concepts**	**Weight (100%)**	**Knowl (20%)**	**Comp (17.5)**	**Applic (15%)**	**Analy (15%)**	**Syn (17.5%)**	**Eval (15%)**	**Total (100%)**
1.	Meaning of chemicals	22.5%	2(1,10)	2(2,3)	2(33,34)	1(28)	1(16)	1(26)	**9**
2	Chemical based on use	27.5%	2(6,19)	2(5,9)	1(7)	2(8,21)	2(38,40)	2(36,37)	**11**
3.	Chemical based on hazardous nature	25%	2(11,15)	2(4,17)	1(39)	2(12,13)	2(24,30)	1(35)	**10**
4.	Safety measures when using chemicals	25%	2(18,22)	1(14)	2(20,12)	1(27)	2(31,32)	2(25,23)	**10**
	TOTAL	**100%**	**8**	7	6	**6**	**7**	**6**	**40**

Source: Adapted from Bloom Taxonomy (1956)

3.5.1 Validity of the Instruments

Basic Science Performance Test (BSPT) content was validated by a panel of science educators who have experience in test construction in the Science Education Department, Ahmadu Bello University, Zaria. The panel of science educators comprised three senior lecturers with the rank of minimum qualification of Ph.D. Also, BSPT was validated by two Basic science teachers with minimum of BSC(ED) qualification of Science Education from two secondary schools in the study area and having at least ten years working experiences. Basic Science Motivation Questionnaire (BSMQ) was validated by one senior lecture with rank of PhD from Department of Educational Psychology Ahmadu Bello University, Zaria. The purpose for the validation was to:

i. check the language if it goes simultaneously, with the ability level of subjects of the study;
ii. check the clarity of the statements used to avoid ambiguity;
iii. check if the item conform with the subject matter designed to test; and
iv. If the content of the test items is appropriate, and relevant to the objectives of the study.

After the validation of the BSPT, questions number 6 and 8 were dropped because they were found to be very difficult (blow 0.25) scores. Questions number 18 and 29 were dropped because they were found to be very simple (above 0.75) scores. Questions 4, 23 and 40 were modified (see appendix D; Page 134).

3.5.2 Pilot Testing

Pilot testing was carried out in order to determine reliability of instruments as follows:

The target subjects were Junior Secondary School (JSS II) Students of Basic Science in Zaria Metropolis. The purpose of the pilot testing was to further determine the feasibility and reliability of the instruments developed. The pilot test was carried out using thirty-six (36) JSSII students from GSS Kofar Kuyambana. The school was one of the Public Secondary School within the population of the study but out of the sample selected. An introductory letter was collected from the Director, Quality Assurance; Zaria Education Zonal office, Ministry of Education, Science and Technology, Kaduna State and presented it to the principal of the school for the permission of the pilot testing.

3.5.3 Reliability of Instruments

The reliability coefficient of a test is the consistency with which the test repeatedly measures what it is intended to measure. Indices of reliability give an indication of the extent to which a particular measurement is consistent and reproducible (Lakpini, 2006). Reliability coefficient of a test can be determined by several methods such as Guttmen split-half, test-retest, and parallel comparison. BSPT items were administered to the students and instructions on how to answer the questions were read out and explained to the students by the researcher, to ensure that students answered the instrument carefully. The same test was administered to the same set of students after two weeks in line with Tuckman’s (1975) and Sambo’s (2008) recommendations, which suggest a minimum of two weeks indicating that at that period students might have forgotten the content of the first test given. A Pearson Product Moment Correlation Coefficient (PPMC) statistical tool was use for data analysis.

Note: The reliability of BSPT instrument using test-retest method was subjected to PPMC statistics and the reliability coefficient was found to be 0.74. The instrument was consequently reliable and fit for the main study. The reliability of BSMQ was tested using split-half method and Cronbach’s Alpha statistic was used to obtained the reliability coefficient at 0.897. This was a confirmation of test of reliability by Stevens (1986), Spiegel (1992) and Olayiwola (2010).

According to them an instrument is considered reliable if it lies between 0 and 1, and that the closer the calculated reliability coefficient is to zero, the less reliable is the instrument, and the closer the calculated reliability co-efficient is to 1, the more reliable is the instrument. This therefore confirms the reliability of the data collection instruments used as fit for the main study.

3.5.4 Item Analysis

Item analysis was carried out on scores obtained from the pilot testing to determine the difficulty and discrimination indices of the individual items are as follows:

Facility Index (FI)

The facility index or difficulty index show the difficulty of each of the items based on the percentage of subjects who got an item correct. The facility index for the BSPT instrument was determined using Furst (1958) formula:-

$$F = \frac{RU + RL \times 100}{N}$$

Where

F = Facility Index

RU = Number of upper 27% of those who got the items correctly

RL = Number of lower 27% who got the items correctly

N = Total number of subjects in each of the upper and lower groups (not the total respondents of the test)

Items with facility indices of between 0.30 and 0.80 were recommended and considered by Furst (1958), Usman (2000) and Lakpini (2006), as adequate for selecting good test items for achievement test.

Discrimination Index (DI)

The discrimination index for each of the items were computed by subtracting the number of students in the lower group who score the item correctly from the number in the upper group who got the item correctly. The number were divided by half the number of the students.

$$D = \frac{RU - RL}{\frac{1}{2} N} \times 100$$

D = Discrimination Index

RU = Number among upper 27% who score the item right

RL = Number among the lower 27% of subjects who score the items correctly

½ N = Number of subjects in each of the upper and lower groups

According to Furst (1958) and Usman (2008), items in a test with discrimination indices between 25% - 75% (0.25 - 0.75) were considered moderately positive while those with discrimination indices of 0.7 are highly positive and if solely used, the well – informed subjects will get the test items right than the poor ones. (See appendix D; Page 134).

3.6 Administration of the Treatments

Experimental group 1 (group taught using multimedia) were taught chemical concept with the help of research assistance who assist in operating overhead projector which used to showed videos of chemicals. Blended learning was adopted during the conduct of the study; which involve combination of instructional technology with face-to-face learning in the classroom as recommended by (Kerres & Witt, 2003; Rosenbaum, 2012).

The videos used were obtained and gathered using digitalized camera and online videos recorded and downloaded based on chemicals concepts. The recorded videos were synchronized with audio and became audio-visual. The recorded videos were played with Computer which was directly connected to Multimedia Projector using powerful USB Cable, and then signals were sent or projected directly to the White board. Microwave speakers were attached to the Computer in order to amplify the sound, while the Projector Stand serves as tripod or carrier to the projector to avoid shaking and uninterrupted projection. The Pointer was used to point out specific chemical feature on the White board. Then the researcher proceeds to explain the concepts well based on what the students were shown from the media instruction.

Experimental group 2 (group taught using graphic advanced organizers) the researcher present graphics which contains illustrations of the concepts of chemicals to the JSS II Basic science students prior to the lesson to carefully observed the contents of the graphic. The presentation of the advanced organizers was in line with model adopted from Joyce and Weil (1978) which has three phases of activities which are as follow:

Phase I: This includes presentation of the advanced organizers

i. Clarify the aim of the lesson
ii. Present the advance organizers
iii. Prompt awareness of relevant knowledge

Phase II: This include making link to the organizers

i. Present the learning task or learning material
ii. Make organizational and logical order of learning materials explicit

Phase III: Strengthening of cognitive organization

i. Integrative reconciliation and active learning. Example a teacher can ask learner to make summaries, to point out differences or relate new examples with organizers
ii. Elicit critical approaches to subject matter that is to have students link about contradiction or implicit inferences in the learning materials or previous knowledge.

The control group was taught using only conventional lecture method. After 5 weeks of treatment, a post-test was administered to both experimental and control group based on Tuckman (1972) recommendation. Also, Basic science Motivation Questionnaire was administered to the students after one week of the posttest given.

3.7 Procedures for Data Collection

The instruments (BSPT and BSMQ) were administered by the researcher to the students. Subjects were to identify the correct response on the options provided. During the administration of the instruments, the researcher distributed the instruments to the study subjects. The researcher allowed the subjects to read through the written instructions on how to answer the questions. The instructions were explained verbally where necessary. The subjects were given time for the test based on pilot test time frame. The data were collected and recorded for analysis based on research questions and hypotheses formulated.

3.8 Procedure for Data Analysis

The data collected were analysed with the Statistical Package for the Social Sciences (SPSS) IBM Version 21. Statistical tools adopted include Mean, Standard deviations and Mean rank for the research questions. The null hypotheses were tested with independent t-test, Mann-Whitney (U-test), ANCOVA and Kruskal-wallis test at $p \leq 0.05$ level of significant to test the significant effects of Multimedia and Advanced Organizers on upper Basic science students' performance and motivation.

The research questions and null hypotheses are restated as follows:

Research Question 1:

What is the difference between the mean academic performance scores of upper Basic science students taught chemical concepts using multimedia and those taught the same concepts using conventional lecture method?

Mean and standard deviation were used to answered research question 1.

Research Question 2:

What is the difference between the mean academic performance scores of upper Basic science students taught chemical concepts using advanced organizers and those taught the same concepts using conventional lecture method?

Mean and standard deviation were used to answered research question 2.

Research Question 3:

What is the difference between the mean academic performance scores of upper Basic science students taught chemical concepts using multimedia and those taught the same concepts using advanced organizer?

Mean and standard deviation were used to answered research question 3.

Research Question 4:

What is the difference between the motivation level of upper Basic science students taught chemical concepts using multimedia and those taught the same concepts using conventional lecture method?

Descriptive statistics of mean rank was used to answered research question 4.

Research Question 5:

What is the difference between the motivation level of upper Basic science students taught chemical concepts using advanced organizers and those taught the same concepts using conventional lecture method?

Descriptive statistics of mean rank was used to answered research question 5.

Research Question 6:

What is the difference between the motivation level of upper Basic science students taught chemical concepts using multimedia and those taught the same concepts using advanced organizer?

Descriptive statistics of mean rank was used to answered research question 6.

Research Question 7:

What is the difference between mean performance scores of male and female upper Basic science students in chemical concepts when taught using multimedia, advanced organizers; and those taught the same concept using lecture method?

Mean and standard deviation descriptive statistics were used to answered research question 7.

Research Question 8:

What is the difference between motivation level of male and female upper Basic science students in chemical concepts when taught using multimedia; advanced organizers and those taught the same concept using lecture method?

Mean rank descriptive statistics was used to answered research question 8.

The following null hypotheses were formulated for testing at $P \leq 0.05$: level of significance.

HO1: There is no significance difference between the mean academic performance scores of upper Basic science students taught chemical concept using multimedia and those taught the same concepts using conventional lecture method.

Independent t-test inferential statistics was used to analyze null hypothesis 1 at $P \leq 0.05$: level of significance.

HO2: There is no significant difference between the mean academic performance scores of upper Basic science students taught chemical concepts using advanced organizers and those taught the same concepts using conventional lecture method.

Independent t-test inferential statistics will be use to analyze null hypothesis 2 at $P \leq 0.05$: level of significance.

HO3: There is no significance difference between the mean academic performance scores of upper Basic science students taught chemical concept using multimedia and those taught the same concepts using advanced organizer.

Independent t-test inferential statistics was used to analyze null hypothesis 3 at $P \leq 0.05$: level of significance.

HO4: There is no significant difference between the motivation level of upper Basic science students taught chemical concepts using multimedia and those taught the same concepts using conventional lecture method.

Man-Whitney (U-test) non parametric inferential statistics was used to analyze null hypothesis 4 at $P \leq 0.05$: level of significance.

HO5: There is no significant difference between the motivation level of upper Basic science students taught chemical concepts using advanced organizers and those taught the same concepts using conventional lecture method.

Man-Whitney (U-test) non parametric inferential statistics was used to analyze null hypothesis 5 at $P \leq 0.05$: level of significance.

HO6: There is no significant difference between the motivation level of upper Basic science students taught chemical concepts using multimedia and those taught the same concepts using advanced organizer.

Man-Whitney (U-test) non parametric inferential statistics was used to analyze null hypothesis 6 at $P \leq 0.05$: level of significance.

HO7: There is no significance difference between mean performance scores of male and female upper Basic science students in chemical concepts when taught using multimedia, advanced organizers and those taught the same concept using lecture method.

ANCOVA inferential statistics was used to analyze null hypothesis 7 at $P \leq 0.05$: level of significance.

HO8: There is no significance difference between motivation level of male and female upper Basic science students in chemical concepts when taught using multimedia, advanced organizers and those taught the same concept using lecture method.

Kruskal- wallis test non parametric statistics was used to analyze null hypothesis 8 at $P \leq 0.05$: level of significance.

CHAPTER FOUR

DATA ANALYSIS, RESULTS AND DISCUSSION

4.1 Introduction

This study was carried out to investigate the Effects of Multimedia and Advanced Organizers on Upper Basic Science Students performance and Motivation in Chemical Concepts, Zaria Metropolis, Kaduna State, Nigeria. This chapter gives the analysis and presentation of results as well as the discussion of the findings under the followings subheadings:

4.2 Bio-data Analysis

4.3 Data Analysis and Result Presentation

4.3 Summary of Major Findings

4.4 Discussion of Results

4.2 Bio-data Analysis

Table 4.2.1: Group Distribution

GROUP

	Frequency	Percent	Valid Percent	Cumulative Percent
Multimedia	79	30.0	30.0	30.0
Adv Organizer	90	34.2	34.2	64.3
Control	94	35.7	35.7	100.0
Total	**263**	**100.0**	**100.0**	

Table 4.2.1 shows the group of the study; in which multimedia group had the frequency of 79 and percentage, valid percentage and cumulative percentage had value of 30.0 respectively. The advanced organizer group had the frequency of 90 while percentage and valid percentage = 34.2 respectively and cumulative percentage of 64.3. Also, the control group had the frequency of 94,

percent and valid percent of 35.7 respectively and cumulative percent of 100.0. The grand total of all the three groups were 263.

Table 4.2.2: Distribution of Gender

GENDER				
	Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Male	127	48.3	48.3	48.3
Female	136	51.7	51.7	100.0
Total	**263**	**100.0**	**100.0**	

Table 4.2.2 showed the distribution of gender in which male had the frequency of 127 and 48.3 percent, valid percent and cumulative percent respectively. The female had 136 frequency, 51.7 percent and valid percentage respectively, while the cumulative frequency was 100.0. Therefore, the sum total of male and female participants was 263.

4.3 Data Analysis and Result Presentation

The data collected from the study using Basic Science Performance Test (BSPT) and Basic Science Motivation Questionnaire (BSMQ) were analyzed and used to answer the research questions and test the null hypotheses.

4.3.1 Answering the Research Questions

Research Question 1: What is the difference between the mean academic performance scores of upper Basic science students taught chemical concepts using multimedia and those taught the same concepts using conventional lecture method?

Descriptive statistics of mean and standard deviation were used to answer this research question and the summary of the result is presented in Table 4.3.1

Table 4.3.1: Mean and Standard Deviation for Experimental I (Multimedia) and Control Group (Lecture Method)

	Group	N	Mean	Std. Deviation	M.D
Mean Academic Performance	Multimedia	79	45.62	10.02	8.94
	Lecture Method	94	36.68	5.18	.

Result in Table 4.3.1, shows the mean score of the experimental group was 45.62 and a standard deviation of 10.02 while the mean score for the control group was 36.68 and a standard deviation was 5.18. The mean difference of the experimental and control group was 8.94 in favor of the experimental group. This shows that the experimental group had mean score higher than the control group.

Research Question 2: What is the difference between the mean academic performance scores of upper Basic science students taught chemical concepts using advanced organizers and those taught the same concepts using conventional lecture method?

Descriptive statistics of mean and standard deviation were used to answer this research question and the summary of the result is presented in Table 4.3.2.

Table 4.3.2: Mean and Standard Deviation for Experimental II (Advanced Organizer) and Control Group (Lecture Method)

	Group	N	Mean	Std. Deviation	M.D
Mean Academic Performance	Advanced Organizer	90	43.09	7.16	6.41.
	Lecture Method	94	36.68	5.18	

Result in Table 4.3.2, shows the mean score of the experimental group was 43.09 and a standard deviation of 7.16 while the mean score for the control group was 36.68 and a standard deviation was 5.18. The mean difference of the experimental and control group was 6.41 in favor of the experimental group. This shows that the experimental group had mean score higher than that of the control group.

Research Question 3: what is the difference between the mean academic performance scores of upper Basic science students taught chemical concept using multimedia and those taught the same concept using advanced organizer?

Descriptive statistics of mean rank and sum of rank were used to answer this research question and the summary of the result is presented in Table 4.3.3.

Table 4.3.3: Mean and Standard Deviation for Experimental I (Multimedia) and Experimental II (Advanced Organizer)

	Group	N	Mean	Std. Deviation	M.D
Mean Academic Performance	Multimedia	79	45.62	10.01	2.53
	Advanced Organizer	90	43.09	7.16	

The result in table 4.3.3 showed the mean scores of experimental group I (multimedia) as 45.62 and standard deviation of 10.01. While the mean scores of experimental group II (advanced organizer) was 43.09 and a standard deviation of 7.16. The mean difference of experimental group I and experimental group II was 2.53, in favour of experimental group I.

Research Question 4: What is the difference between the motivation level of upper Basic science students taught chemical concepts using multimedia and those taught the same concepts using conventional lecture method?

Descriptive statistics of mean rank and sum of rank were used to answer this research question and the summary of the result is presented in Table 4.3.4.

Table 4.3.4: Mean Rank and Sum of Rank for Experimental I (Multimedia) and Control Group (Lecture Method)

	Group	N	Mean Rank	Sum of Rank	Mann-Whitney	Z	P
Motivation	Multimedia	79	110.44	9497.50	1725.50	-6.13	.001
	Lecture Method	94	63.83	5553.50			

Result from Table 4.3.4 revealed that Mann- Whitney value = 1725.50; Z value = -6.13 and P value = 0.001. The experimental I group (multimedia) had mean rank of 110.44 and sum of rank of 9497.50 while the control group (lecture method) had mean rank of 63.83 and sum of rank of 5553.50. This shows that the experimental I group had mean motivation rank higher than that of the control group.

Research Question 5: What is the difference between the motivation level of upper Basic science students taught chemical concepts using advanced organizers and those taught the same concepts using conventional lecture method?

Descriptive statistics of mean rank and sum of rank were used to answer this research question and the summary of the result is presented in Table 4.3.5.

Table 4.3.5: Mean Rank and Sum of Rank for Experimental II (Advanced Organizer) and Control Group (Lecture Method)

	Group	N	Mean Rank	Sum of Rank	Mann-Whitney	Z	P
Motivation	Advanced Organizer	90	101.92	9172.50	2752.50	-3.42	.001
	Lecture Method	94	75.64	6580.50			

Result from Table 4.3.5 shows Mann- Whitney value = 2752.50; Z value = -3.42 and P value = 0.001. The experimental II group (Advanced Organizer) had mean rank of 101.92 and sum of rank of 9172.50 while the control group (lecture method) had mean rank of 75.64 and sum of rank of 6580.50. This shows that the experimental II group had mean motivation rank higher than that of the control group.

Research Question 6: What is the difference between the motivation level of upper Basic science students taught chemical concepts using multimedia and those taught the same concept using advanced organizers?

Descriptive statistics of mean rank and sum of rank were used to answer this research question and the summary of the result is presented in Table 4.3.6.

Table 4.3.6: Mean Rank and Sum of Rank for Experimental Group I (Multimedia) and Experimental Group II (Advanced Organizer)

Ranks

	Group	N	Mean Rank	Sum of Ranks	Mann-Whitney	Z	P
Motivation	**Multimedia**	86	100.65	8655.50	2825.50	-3.09	.002
	Advanced Organizers	90	76.89	6920.50			
	Total	**176**					

The result in table 4.3.6 shows Mann- Whitney value of 2825.50, Z value of -3.09 and P value of 0.002. The experimental group I (multimedia) had mean rank of 100.65 and sum of ranks of 8655.50. While the experimental group II (graphic advanced organizer) had the mean rank of 76.89 and sum of mean rank of 6920.50. This shows that experimental group I had motivation level higher than that of experimental group II.

Research Question 7: What is the difference between mean performance scores of male and female upper Basic science students in chemical concepts when taught using multimedia, advanced organizers; and those taught the same concept using lecture method?

Descriptive statistics of mean and standard deviation were used to answer this research question and the summary of the result is presented in Table 4.3.7.

Table 4.3.7: Mean and Standard Deviation for Mean Academic Performance of Male and Female Basic Science Students Exposed to Multimedia, Advanced Organizer and Lecture Method

Dependent Variable: Mean Academic Performance

					Mean Difference		
Gender	**Group**	**N**	**Mean**	**Std. Deviation**	**Multimedia & Advan Organ**	**Multimedia & Lecture method**	**Advan Org & Lecture Method**
Male	Multimedia	39	46.97	8.23			
	Advanced Organizer	36	40.79	5.34	6.18	9.89	3.71
	Lecture Method	52	37.07	5.53			
	Total	127	41.17	7.62			
Female	Multimedia	40	44.30	11.44			
	Advanced Organizer	54	44.63	7.82	0.33	8.09	8.43
	Lecture Method	42	36.20	4.73			
	Total	136	41.93	9.13			
Total	Multimedia	79	45.62	10.01			
	Advanced Organizer	90	43.09	7.15			
	Lecture Method	94	36.68	5.18			
	Total	**263**	**41.5627**	**8.42937**			

Table 4.3.7 result shows ANCOVA between the mean academic performance scores of male and female upper Basic science students taught chemical concepts using multimedia, advanced organizers and those taught the same concepts using lecture method. The finding revealed that male from multimedia (experimental I) group had mean score of 46.97 and standard deviation of 8.23. While the male from the Graphic Advanced Organizer (experimental II) group had mean scores of 40.79 and standard deviation of 5.34 and their counter part from lecture method

(control) group had mean scores of 37.07 and standard deviation of 5.53. The finding also revealed the mean difference of 6.18 between the male from multimedia group and advanced organizer group in favour of multimedia group. Also, male from multimedia group and lecture method (control group) had 9.89 mean differences in favour of multimedia group. Additionally, male from advanced organizer group and lecture method group had mean difference of 3.71, in favour of advanced organizer group. Therefore, it shows that male from the multimedia group have higher mean score than the male from advanced organizer and lecture method groups. Also, male from group exposed to advanced organizer had higher scores than the male from lecture method group. This is attributed to the treatment given to the experimental groups.

The result from Table 4.3.7 also shows that female from multimedia group had mean scores of 44.30 and standard deviation of 11.44, while the female form advanced organizer group had mean scores of 44.63 and standard deviation of 7.82. The female from the lecture method group had mean scores of 36.68 and standard deviation of 4.74. This finding indicate that female from advanced organizer group had higher scores than their counterpart in multimedia and lecture method groups. Also, female from multimedia group had higher score than the female of control group. The finding also revealed that female from multimedia group and advanced organizer group had mean difference of 0.33 in favour of advanced organizer group. Also, female from multimedia group and the group taught using lecture method had mean difference of 8.09 in favour of multimedia group. Female from advanced organizer group and lecture method group had mean difference of 8.43, in favour of advanced organizer group. This is due to the effects of the treatments given to the experimental groups.

Research Question 8: What is the difference between motivation level of male and female upper Basic science students in chemical concepts when taught using multimedia; advanced organizers and those taught the same concept using lecture method?

Descriptive statistics of mean and standard deviation were used to answer this research question and the summary of the result is presented in Table 4.3.8.

Table 4.3.8: Mean Rank for Motivation of Male and Female Basic Science Students Exposed to Multimedia, Advanced Organizer and Lecture Method

Ranks

	Grouping	N	Mean Rank
Motivation	Multimedia Male	46	179.29
	Multimedia Female	40	154.11
	Advanced Organizer Male	35	141.03
	Advanced Organizer Female	55	128.40
	Lecture Method Male	49	80.91
	Lecture Method Female	38	114.25
	Total	**263**	

Result from Table 4.3.8 showed that male from multimedia (video) group had mean rank of 179.29 and their female counter part in the same group had 154.11 mean ranks. While the male from graphic advanced organizer group had the mean rank of 141.03 and the female in the same group had the mean rank of 128.40. Also, the male from control group (lecture method) had mean rank of 80.91 and the female had mean rank of 114.25. This shows that male from multimedia group had highest motivation level then the male from the other groups, while the male from lecture method group (control) had the lowest motivation level. Similarly female from multimedia group had the highest motivation level and the female from lecture method group had the lowest motivation level. Therefore, group exposed to multimedia had the highest motivation level of both male and female, followed by graphic advanced organizers group and the least motivated was lecture method group.

4.3.2 Testing the Null Hypotheses

The null hypotheses stated were tested at $p \leq 0.05$ level of significance:

HO1: There is no significance difference between the mean academic performance scores of upper Basic science students taught chemical concept using multimedia and those taught the same concepts using conventional lecture method.

To test this hypothesis, the mean academic performance scores of students in experimental and control groups were subjected to independent sampled t- test statistic and summary of analysis are shown on Table 4.3.9.

Table 4.3.9: t- test Analysis of Mean Academic Performance Score of Experimental I and Control Group

Variables	Groups	N	Mean	S.D	M.D	Df	t Computed	t critical	P	Remark
Performance	Multimedia	79	45.62	10.01	8.93	171	7.54	1.96	0.001	Sig
	Lecture method	94	36.68	5.18						

Significant at $p \leq 0.05$ level

The result in Table 4.3.9 Shows that the t computed =7.54, t critical = 1.96 and P-value = 0.01 at degree of freedom (df) 171. Since the P-value =0.01 < alpha value = 0.05. It means that there is significant difference in the mean scores of the experimental and control groups. The significant difference is in favour of the experimental group; group taught using multimedia. With this result, therefore null hypothesis one was rejected

HO2: There is no significant difference between the mean academic performance scores of upper Basic science students taught chemical concepts using advanced organizers and those taught the same concepts using conventional lecture method.

To test this hypothesis, the mean academic performance scores of students in experimental and control groups were subjected to independent sampled t- test statistic and summary of analysis are shown on Table 4.3.10.

Table 4.3.10: t- test Analysis of Mean Academic Performance Score of Experimental II and Control Group

Variables	Groups	N	Mean	S.D	M.D	Df	t computed	t critical	P	Remark
Performance	Advanced Organizer	90	43.09	7.15	1.97	182	7.54	1.96	0.001	Sig.
	Lecture Method	94	36.68	5.18						

Significant at $p \leq 0.05$ level

The result in Table 4.3.10 shows that the t computed = 6.98, t critical = 1.96 and P-value = 0.01 at degree of freedom (df) 182. Since the p-value =0.01 < alpha value= 0.05. It means that there is significant difference in the mean scores of the experimental and control groups. The significant difference is in favour of the experimental group i.e group taught using advanced organizer. As a result of this finding, the null hypothesis two was rejected.

HO3: There is no significant difference between the mean academic performance scores of upper Basic science students taught chemical concepts using multimedia and those taught the same concepts using advanced organizer.

To test this hypothesis, the mean academic performance scores of students in experimental group I and experimental group II were subjected to independent sampled t-test statistic and summary of analysis are shown on Table 4.3.11.

Table 4.3.11: t- test Analysis of Mean Academic Performance Score of Experimental I and Experimental II

	Group	N	Mean	S.D	M.D	Df	P	Remark
Performance	Multimedia	79	45.62	10.01	2.53	167	.001	Sig
	Advanced Organizer	90	43.09	7.15				

Significant at p≤ 0.05 level

The result in Table 4.3.11 shows that P-value is 0.001 at degree of freedom of 167. Since the P-value 0.001 is less than the alpha value of 0.05, it means that significance difference exist between the mean academic performance scores of experimental group I (group exposed to multimedia) and experimental group II (group exposed to graphic advanced organizer). The significance difference was in favour of experimental group I, meaning; experimental group I have mean academic scores greater than that of the experimental group II.

HO4: There is no significant difference between the motivation level of upper Basic science students taught chemical concepts using multimedia and those taught the same concepts using conventional lecture method.

To test this hypothesis, the mean rank of motivation level of students in experimental and control group were subjected to Mann-Whitney non parametric statistic and summary of analysis are shown on Table 4.3.12.

Table4.3.12: Mann-Whitney Test on Students' Motivation Level for Experimental Group I and Control Group

	Group	N	Mean Rank	Sum of Rank	Mann-Whitney	Z	P	Remark
Motivation	Multimedia	79	110.44	9497.50	1725.50	-6.130	.001	Sig.
	Lecture Method	94	63.83	5553.50				

Significant at p≤ 0.05 level

The result from table 4.3.12 Shows the mean rank for motivation under group exposed to Multimedia (video) = 110. 44 and group taught using lecture method = 63.83 while the sum of rank of multimedia group is 9497.50 and 5553.50 under lecture method group. The result shows Mann-Whitney value of 1725.50 and Z value of -6.130. the result show significant difference in the motivation level of students between the experimental group I and control group in favour of experimental group Since the p-value =0.01 < alpha- value = 0.05. Therefore, there null hypothesis which stated that there is no significant difference between the motivation level of upper Basic science students taught chemical concepts using multimedia and those taught the same concepts using conventional lecture method was rejected.

HO5: There is no significant difference between the motivation level of upper Basic science students taught chemical concepts using advanced organizers and those taught the same concepts using conventional lecture method.

To test this hypothesis, the mean rank of motivation level of students in experimental and control group were subjected to Mann-Whitney non parametric statistic and summary of analysis are shown on Table 4.3.13.

Table 4.3.13: Mann-Whitney Test on Students' Motivation Level for Experimental Group II and Control Group

	Group	**N**	**Mean Rank**	**Sum of Rank**	**Mann-Whitney**	**Z**	**P**	**Remark**
Motivation	Advanced Organizer	90	101.92	9172.50	2752.50	-3.418	.001	Sig.
	Lecture Method	94	75.64	6580.50				

Significant at p≤ 0.05 level

The result from table 4.3.13 Shows the mean rank for motivation under group exposed to Advance organizer = 101.92 and group taught using lecture method = 75.64 while the sum of rank of graphic advanced organizer group is 9172.50 and 6580.50 under lecture method group. The result shows Mann-Whitney value of 2752.50 and Z value of -3.418. the result show significant difference exist in the motivation level of students between the experimental group II and control group in favour of experimental group II Since the p-value =0.01 < alpha value= 0.05. Therefore, the null hypothesis which stated that there is no significant difference between the motivation level of upper Basic science students taught chemical concepts using advanced organizers and those taught the same concepts using conventional lecture method was rejected.

HO6: There is no significant difference between the motivation level of upper Basic science students taught chemical concepts using multimedia and those taught the same concept using advanced organizers.

To test this hypothesis, the mean rank of motivation level of students in experimental and control group were subjected to Mann-Whitney non parametric statistic and summary of analysis are shown on Table 4.3.14.

Table 4.3.14: Mann-Whitney Test on Students' Motivation Level for Experimental Group I and Experimental Group II

	Group	N	Mean Rank	Sum of Ranks	Mann-Whitney	Z	P	Remark
Motivation	Multimedia	86	100.65	8655.50	2825.50	-3.09	.002	Sig.
	Advanced Organizers	90	76.89	6920.50				
	Total	**176**						

Significant at p≤ 0.05 level

The result from table 4.3.14 Shows the mean rank for motivation under group exposed to multimedia = 100.65 and group exposed to graphic advanced organizer = 76.89 while the sum of rank of multimedia group is 8655.50 and the sum of rank under graphic advanced organizer group = 6920.50. The result shows Mann-Whitney value of 2825.50 and Z value of -3.09. the result show significant difference exist in the motivation level of students between the experimental group I and experimental group II in favour of experimental group I Since the p-value =0.02 < alphs value = 0.05. Therefore, the null hypothesis which stated that there is no significant difference between the motivation level of upper Basic science students taught chemical concepts using multimedia and those taught the same concept using graphic advanced organizers was rejected.

HO7: There is no significance difference between mean performance scores of male and female upper Basic science students in chemical concepts when taught using multimedia, advanced organizers and those taught the same concept using lecture method.

To test this hypothesis, the mean performance scores of male and female students in experimental I and II and control groups were subjected to Analysis of Covariance parametric statistic and summary of analysis are shown on Table 4.3.15.

Table 4.3.15: ANCOVA of Mean Academic Performance Scores of Male and Female Students for Experimental I, II and Control Group

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Remark
Corrected Model	4224.34[a]	5	844.87	15.087	.000	S
Intercept	446410.53	1	446410.52	7971.68	.000	S
Gender	.597	1	.597	.011	.918	NS
Group	3672.43	2	1836.22	32.79	.000	S
Gender * Group	475.69	2	237.85	4.25	.015	Sig.
Error	14391.87	257	56.00			
Total	472938.50	263				
Corrected Total	18616.22	262				

Significant at $p \leq 0.05$ level

Table 4.3.15 showed ANCOVA between academic performance mean scores of male and female upper Basic science students in experimental group I (multimedia), experimental group II (advanced organizer) and control group (Lecture method). Result from the ANCOVA showed that there was significant difference between the academic performance scores of male and female students from the experimental group I, experimental group II and control group (Gender * Group), with P value of 0.015 which is less than the alpha value of 0.05. Hence, the stated null hypothesis 7 was rejected.

HO8: There is no significance difference between motivation level of male and female upper Basic science students in chemical concepts when taught using multimedia, advanced organizers and those taught the same concept using lecture method.

To test this hypothesis, the mean rank of motivation level of students in experimental I, II and control group were subjected to Kruskal- wallis non parametric statistic and summary of analysis are shown on Table 4.3.16.

Table 4.3.16: Kruskal- wallis Test on Male and Female Students' Motivation Level for Experimental I, Experimental II and Control Group

	Grouping	N	Mean Rank	Chi-square	Df	P	Remark
Motivation	Multimedia Male	46	179.29	46.115	5	.001	Sig.
	Multimedia Female	40	154.11				
	Advanced Organizer Male	35	141.03				
	Advanced Organizer Female	55	128.40				
	Lecture Method Male	49	80.91				
	Lecture Method Female	38	114.25				
	Total	**263**					

Significant at p≤ 0.05 level

Table 4.3.16 showed Kruskal- wallis analysis for motivation level of male and female upper Basic science students among the group taught chemical concept using multimedia, advanced organize and those taught using lecture method. The result showed Chi-square of 46.115 with degree of freedom (df) of 5 and probability value of (P value) of 0.001. The mean rank for male in experimental group 1 (multimedia) was 179.29 and the female in the same group had mean rank of 154.11. On the other hand, male from the experimental group II (Advanced organizer) had the mean rank of 141.03 and their female counterpart in the same group had the mean rank of 128.40. While the male from control group (lecture method) had mean rank of 80.91 and the female from the same group had mean rank of 114.25. The result revealed significant difference because P value of 0.001 is less than 0.05 level of significance. This indicates that the treatments (multimedia and advanced organizer) is gender friendly and improve students' motivation as well. As a result of this finding, the null hypothesis 8 stated was rejected.

4.4 Summary of Major Findings

Based on the outcome of the analysis, the followings are the major findings of this study:

1. significant difference exist between the mean academic performance scores of students taught chemical concepts with multimedia and those taught the same concept using lecture method, in favour of the multimedia group.
2. The result showed significant difference between the mean academic performance scores of students taught chemical concepts using advanced organizer and those taught the same concept using lecture method, in favour of advanced organizer group.
3. Significant difference exist between the mean academic performance scores of upper Basic science students taught using multimedia (video) and those taught with graphic advanced organizers. In favour of Multimedia group.
4. The finding showed significant difference between the motivation level of students taught chemical concept with multimedia and those taught the same concept using lecture method, in favour of the former.
5. significant difference exist between motivation level of students taught chemical concepts using advanced organizer and those taught the same concept using lecture method, in favour of advanced organizer group.
6. The finding revealed significant difference between the motivation mean rank of students taught chemical concept with multimedia (video) and those taught the same concept using graphic advanced organizers. In favour of multimedia (video) group.
7. Significant difference exist between the mean academic performance scores of male and female students taught chemical concept with multimedia, those taught using advanced organizer and those taught the same concept using lecture method.

8. Significant difference exist between motivation level of male and female students taught chemical concept with multimedia, those taught using advanced organizer and those taught the same concept using lecture method. This was in favour of male students in multimedia group, male students in advanced organizer group and female students in lecture method group.

4.5 Discussion of Results

The objective of this study was to investigate the effects of Multimedia and advanced organizers on upper Basic science students' performance and motivation chemical concept in Zaria metropolis, Kaduna State, Nigeria. To achieve this aim, students in experimental group I were taught chemical concept with Multimedia (video), students in experimental group II were taught chemical concept using advance organizers (graphics) while students in control group were taught chemical concept using conventional lecture method. Therefore, the observed differences in the results were due to treatments given to the groups. The results of the analysis of the data on the research questions and null hypotheses are hereby discussed.

The result from Table 4.3.9 showed that students taught with multimedia (video) performed significantly better than those students taught using conventional lecture method. This finding agreed with the findings of Barzegi etal (2012) Abubakar (2014) and Akinoso (2018) whom found that multimedia have significant effect on improving students academic performance.

Also, Nweke, Dirsu, and Umesi (2010) shows that multimedia material like VCD and television that were used to synchronize a lesson presentation to the experimental group in Biology, produced greater academic performance in the experimental group than in the control group. In addition to the studies which stress the positive effects of multimedia on students' academic performance, there are also studies that stated the opposite such as those of (Guan, 2009; &

Rasch & Schnotz, 2009). The difference on the effects of multimedia on students' academic performance might be due to different educational level, field of studies and geographical area of the students.

The result from Table 4.3.10 revealed that students taught with graphic advanced organizers performed significantly better than those students taught using lecture method. This finding agreed with the findings of Agbenyeku (2014), Abubakar (2017) and Bukar (2016) whose works found that advanced organizer enhances student academic performance. However this finding is contrary to the finding of Okey and Avwiri (2014) who found no significant differences in performance of Physics students taught using advanced organizers and those taught without advanced organizers on the concept of electro magnetism. This might have occurred as a result of different subject of study. As many studies revealed positive effects of advanced organizers on students' academic performance both in science- based and non-science subjects.

The result from Table 4.3.11 revealed that upper Basic science students taught chemical concept using multimedia (video) perform significantly better than the upper Basic science students taught the same concept using graphic advanced organizer. This finding agreed with the findings of Lin and Chen (2007) who found that students exposed to animation only and animation plus descriptive advanced organizer perform slightly better than those exposed to static advanced organizer. Also, the finding is contrary to finding of Antoine (2013) who found that the use of graphic instruction was slightly better for students' achievement when compared to the use of power point instruction. There was much more interaction between the students and the teacher during the graphic organizer lesson.

The result from Table 4.3.12 showed significant difference in the motivation level of students between the experimental group I (multimedia) and control group (lecture method) in favour of experimental group I. This indicated that students taught using multimedia (video) were significantly motivated than those taught using lecture method. This finding is similar to that of Wu (2016), whose findings show significant correlations between learning motivation and learning outcomes of the students. The finding also agreed with the finding of Aggarwal (2007) also affirmed that when visual, audio and synchronized Multimedia are used for teaching, it stimulates several senses thus making the learner more involved in the learning process. This finding was contrary to the finding of of Nweke, Dirsu, and Umesi (2010) that found no significant effective between group taught with multimedia and group taught using lecture method in motivating students' interest toward Biology subject. The finding also contradict with the finding of Nozari and Siaman (2015) that no significant difference between the motivational achievement of education in post-test of control and experiment group. This might be as a result of different location for the study area.

The result from Table 4.3.12 showed that significant difference exist in the motivation level of students between the experimental group II (advanced organizer) and control group in favour of experimental group II. This finding agreed with the finding of Kigo etal (2018) whom found out That science process skills advanced organizer can be used to motivate students in the learning of Physics. The findings also agreed with the finding of Shihusa and Keraro (2009) that students taught using advance organizers had a higher level of motivation than those taught using conventional teaching methods.

The result from Table 4.3.13 revealed that significant difference exist between the mean rank of upper Basic science students taught chemical concepts using multimedia (video) and those taught the same concept using graphic advanced organizers. This was in favour of multimedia (video) group. This finding is similar to that of Wu (2016), whose findings show significant correlations between learning motivation and learning outcomes of the students. The finding also agreed with the finding of Aggarwal (2007) also affirmed that when visual, audio and synchronized Multimedia are used for teaching, it stimulates several senses thus making the learner more involved in the learning process.

The result from Table 4.3.14 showed that there was significant difference between the academic performance scores of male and female students from the experimental group I, experimental group II and control group. This finding was similar to the finding of Supanakorn and Bogg (2010) that found statistical difference in students' motivation based on gender when exposed to multimedia (podcast) online learning environment. Also, Agbenyeku's (2008) finding revealed that girls perform significant better when taught using advanced organizer. Kumar, Muniandi and Yahya (2016) found out that girls actually performed slightly better than boys when taught with multimedia. In contrary to this finding Abubakar (2014) and Akinoso (2018) that multimedia has no effects on gender academic performance. Abubakar (2017) which indicated that gender has no effect on learning conservation concepts with advanced organizers. The finding also contradicts with the finding of Bukar (2016) that showed no significant difference between males and females performance exposed to video advance organizer strategy. This indicated that both multimedia and advanced organizers are gender friendly. The contradiction of findings to other researchers might be as a result of different location for the study or difference educational level of the students, among other factors.

The result from Table 4.3.15 revealed significant difference between the motivation level of male and female students from experimental group I, experimental group II and control group. This finding agreed with the finding of Shihusa and Keraro (2009) that male students were more motivated by advance organizer teaching strategy than the female students. This is contrary to the finding of Kumar, Muniandi and Yahya (2016) that male students were more intrinsically motivated than female students when taught using multimedia. Also, Chauda (2007) observed that girls have more positive attitudes towards biology and hence should be more motivated to learn the discipline than boys. Also, Kareem (2018) found out that gender had significant effect on students' learning outcomes when exposed to multimedia. The contradiction to the findings might be as a result of different location used for the studies. This indicates that, the treatments (video multimedia and graphic advanced organizer) are gender friendly because they enhance motivation of both male and female students.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter is presented in the following subheadings:

5.2 Summary

5.3 Major Findings

5.4 Conclusions

5.5 Contributions to Knowledge

5.6 Recommendations

5.7 Limitation of the Study

5.8 Suggestions for Further Studies

5.2 Summary

This study investigated the effects of multimedia and advanced organizers on upper Basic science students' performance and motivation in chemical concepts, Zaria Metropolis, Kaduna State, Nigeria. eight research questions and eight null hypotheses were formulated and tested using independent t-Test, Mann-Whitney (U-test), ANCOVA and Kruskal-wallis statistical tools at 0.05 level of significant. In this study also the reviewed related literature based on the followings subheadings: Historical Development of Basic Science Education in Nigeria, Philosophy and objectives of Basic science, Academic Performance in Basic Science, Motivation in Basic Science, Concept of Multimedia, Multimedia and Academic Performance in Basic Science, Multimedia and Motivation in Basic Science, Concepts of Advanced Organizer, Advanced Organizer and Academic Performance in Basic Science, Advanced Organizer and

Motivation in Basic Science, Overview of Similar Studies and Implication of Related Literature for the Study.

The study Adopted pretest-posttest non randomization quasi experimental design, a pretest was administered before the treatment to establish the equivalence of the experimental and control groups ability levels. The students from experimental group I were taught with multimedia and the students from experimental group II were taught using Advanced Organizers while those in control group were taught using lecture method for the period of five weeks. The topic taught was Chemical Concept from Basic Science and Technology Junior secondary school curriculum. The instrument used for the study was Basic Science Performance Test (BSPT). Two hundred and Sixty Three (263) students from the three sampled coeducational schools from Zaria metropolis ware used for the study. The sampled schools were purposively selected from the from the nine Junior secondary schools in Zaria Metropolis, with the population of JSS 2 students of seven thousand three hundred and two (7,302).

The major findings of the study include: there is significant difference between the mean academic performance scores of experimental group I and control group, in favour of the experimental group I; there is significant difference between the mean academic performance scores of experimental group II and control group, in favour of the experimental group II. Significant difference was found between the mean academic performance scores of experimental group I and experimental group II. In favour of experimental group II. Significance difference exist between the motivation level of experimental group I and control group, in favour of experimental group I; there is significant difference between the motivation level of experimental group II and control group in favour of the experimental group II; Significant difference also exist between the motivation level of students from experimental group I and experimental group II. In favour of experimental group I. There is significant difference between the mean academic performance scores of male and female students from experimental group I, experimental group II and control group; significant difference exist between the motivation level of male and female upper Basic science students from the experimental group I, experimental group II and control group. In favour of experimental group I. Based on the findings it was recommended that Multimedia and Advanced Organizer should be use by Basic science teachers, since it enhance academic performance and motivation of students.

5.3 Major Findings

The followings are the major findings from this study:

1. There is significant difference between the mean academic performance scores of experimental group I (multimedia) and control group (lecture method);
2. There is significant difference between the mean academic performance scores of experimental group II (advanced organizer) and control group (lecture method);
3. Significant differences exist between the mean academic performance scores of experimental group I (multimedia) and experimental group II (advanced organizer).
4. Significance difference exist between the motivation level of experimental group I (multimedia) and control group (lecture method);
5. There is significant difference between the motivation level of experimental group II (advanced organizer) and control group (lecture method);
6. Significant difference exist between the motivation mean rank of students from experimental group I (group exposed to multimedia) and experimental group II (group exposed to graphic advanced organizer)

7. There is significant difference between the mean academic performance scores of male and female upper Basic science students from experimental group I, experimental group II and control group;
8. significant difference exist between the motivation level of male and female upper Basic science students from the experimental group I, experimental group II and control group.

5.4 Conclusion

Based on this study, the following conclusions were made:

1. Academic performance on chemical concepts can be improve by the use of multimedia and advanced organizers
2. Multimedia and advanced organizers if properly used can motivate students to learn Basic science.
3. The use of multimedia and advanced organizers is gender friendly as it promotes academic performance and motivation of males and females students.

5.5 Contributions to Knowledge

The concern of this study was to investigate the effects of multimedia (Video) and advanced organizers (graphics) on Academic performance and motivation of upper Basic science students in chemical concepts, Zaria Metropolis, Kaduna State, Nigeria. The findings of this study have a significant contributions and great implication for educational practices;

1. The researcher was able to establish that using multimedia and advanced organizers to teach Basic science students chemical concepts facilitate academic performance and motivation of upper Basic science students in Zaria Metropolis.
2. The use of multimedia (video) and advanced organizers (graphics) is gender friendly as it promotes academic performance and motivation of both males and females students.

3. The researcher developed package for multimedia (video) and advanced organizer (graphics) that can be used by upper Basic science teachers to improve academic performance and motivation in chemical concepts.
4. This research work is the first of its kind in Zaria metropolis, Kaduna State, Nigeria based on the literature the researcher was able to laid hand on. It could be replicated by other researchers within the metropolis, Zaria educational zone and other zones within and outside Kaduna state.

5.6 Recommendations

Based on the findings of this study, the followings recommendations were made;

1. The use of multimedia and advanced organizers should be encouraged among Basic science teachers in teaching chemical concepts and other relevant concepts in order to make learning more meaningful and effective. Hence, it became obvious from this study that multimedia (video) and advanced organizers (graphics) was found to be very effective in improving meaningful learning.
2. All the schools type which comprised coeducational schools, male schools and female schools should encourage the use of multimedia (video) and advanced organizers (graphics) as they are gender friendly.
3. Professional bodies Associations such as Science teachers Association of Nigeria (STAN), Nigeria Educational Research and Development Council (NERDC) should develop multimedia and advanced organizer packages that could be used by upper Basic science teachers in order to promote academic performance and motivation of the students.

4. Professional bodies such as Federal and State Ministries of Education should organize seminars and workshops for the purpose of training and retaining Basic science teachers on how to develop and use multimedia and advanced organizers in their various classrooms.

5.7 Limitations of the Study

The following are the limitations of this study:

1. The study is limited to chemical concept, taught using video as multimedia and graphics as advance organizers.
2. Lack of instructional facilities (projector, advanced organizer package and videos on chemical concept) made the study complex.
3. The sampled used for this study were public secondary schools in Zaria metropolis owned by Kaduna State government, private schools were not use for the study. Therefore, the results and conclusion were restricted to Zaria Metropolis.

5.8 Suggestions for Further Studies

The followings suggestions are put forward for further studies:

i. Studies on multimedia and advanced organizers could be extended to other subjects in both junior and senior secondary schools, Colleges of Education, Polytechnics, and Universities as the result obtained here is restricted to junior secondary schools.

ii. The study on multimedia and advanced organizers could also be extended to other metropolis and educational zones in Kaduna State, and other state of the federation for wider more generalized result.

iii. The study could be replicated to include other variables such as retention, interest, attitude and self-efficacy among others of student toward any relevant concepts either in science related subjects, social science or art using multimedia and advanced organizers.

iv. The study could be extended to the use of different types of multimedia such as animation, spoken text or printed text combine with pictures etc and advanced organizers such as audio organizers, expository organizers among others.

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APPENDICES

Appendix A

EQUIVALENT TEST

Descriptives

SCORE

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
GSS K/ DOKA	10	63.5000	10.93669	3.45848	55.6764	71.3236	46.00	80.00
GSS R/ DOKO	10	63.8000	8.28385	2.61958	57.8741	69.7259	55.00	76.00
GSS K/ JATAU	10	33.5000	4.52769	1.43178	30.2611	36.7389	29.00	43.00
GSS MAGAJIYA	10	27.9000	5.44569	1.72208	24.0044	31.7956	21.00	
Total	40	47.1750	18.36927	2.90444	41.3002	53.0498	21.00	80.00

ANOVA

SCORE

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	11014.275	3	3671.425	61.604	.000
Within Groups	2145.500	36	59.597		
Total	13159.775	39			

Post Hoc Tests

Multiple Comparisons

Dependent Variable: SCORE
Scheffe

(I) SCHOOL	(J) SCHOOL	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
GSS K/ DOKA	GSS R/ DOKO	-.30000	3.45245	1.000	-10.4239	9.8239
	GSS K/ JATAU	30.00000*	3.45245	.000	19.8761	40.1239
	GSS MAGAJIYA	35.60000*	3.45245	.000	25.4761	45.7239
GSS R/ DOKO	GSS K/ DOKA	.30000	3.45245	1.000	-9.8239	10.4239
	GSS K/ JATAU	30.30000*	3.45245	.000	20.1761	40.4239
	GSS MAGAJIYA	35.90000*	3.45245	.000	25.7761	46.0239
GSS K/ JATAU	GSS K/ DOKA	-30.00000*	3.45245	.000	-40.1239	-19.8761
	GSS R/ DOKO	-30.30000*	3.45245	.000	-40.4239	-20.1761
	GSS MAGAJIYA	5.60000	3.45245	.462	-4.5239	15.7239
GSS MAGAJIYA	GSS K/ DOKA	-35.60000*	3.45245	.000	-45.7239	-25.4761
	GSS R/ DOKO	-35.90000*	3.45245	.000	-46.0239	-25.7761
	GSS K/ JATAU	-5.60000	3.45245	.462	-15.7239	4.5239

*. The mean difference is significant at the 0.05 level.

Homogeneous Subsets

SCORE

Scheffe

SCHOOL	N	Subset for alpha = 0.05	
		1	2
GSS MAGAJIYA	10	52.9000	
GSS K/ JATAU	10		62.9000
GSS K/ DOKA	10		63.5000
GSS R/ DOKO	10		63.8000
Sig.		.462	1.000

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 10.000.

Appendix B

Name of Sampled Schools

s/no	Types	Schools	No. of JSSII Students Enrolment		Total
			Male	Female	
1	Experimental 1	GSS Kofan Doka	43	36	79
2	Experimental 2	GJSS Rimin Doko	38	52	90
3	Control C	GJSS Kofan Jatau	54	40	94
	Total				**263**

Appendix C

Reliability of BSPT Instrument for Pilot Testing

S/N	X	Y	X^2	Y^2	∑XY
1	19	16	361	256	304
2	12	12	144	144	144
3	18	19	324	361	342
4	10	19	100	361	190
5	14	14	196	196	196
6	12	19	144	361	228
7	14	21	196	441	294
8	26	24	676	576	624
9	27	26	729	676	702
10	19	24	361	576	456
11	25	27	625	729	675
12	16	19	256	361	304
13	30	28	900	784	840
14	20	25	400	625	500
15	17	20	289	400	340
16	23	24	529	576	552
17	14	18	196	324	252
18	27	22	729	484	594
19	15	19	225	361	285
20	23	27	529	729	621
21	18	15	324	225	270
22	26	31	676	961	806
23	13	16	169	256	208
24	22	19	484	361	418
25	11	17	121	289	187
26	28	25	784	625	700
27	13	15	169	225	195
28	21	24	441	576	504
29	16	14	256	196	224
30	23	27	529	729	621
31	15	20	225	400	300
32	22	28	484	784	616
33	32	30	1024	900	960
34	19	23	361	529	437
35	16	20	256	400	320
36	21	23	441	529	483
	697	770	14653	17306	15692

	$\sum X$=697	$\sum Y$=770	$\sum X^2$=14653	$\sum Y^2$=17306	$\sum XY$=15692
			.742		

Where

N = Total number of student for the pilot test (36)

X= test

Y= retest

ΣX = 697 (sum of test)

ΣY = 770 (sum of retest)

ΣX^2 = 14653 (sum of sq. of test)

ΣY^2 = 17306 (sum of sq. of retest)

ΣXY=15692 (sum of test and retest)

R= N($\sum$xy) - (x) $\sum$Y

((N(X^2) - (NY^2)-$(Y)^2$)

Pearson Product Moment Correlation formula.

N=36	$\sum$**X**=697	$\sum$**Y**=770	$\sum$**X**^{2}=14653	$\sum$**Y**^{2}=17306	$\sum$**XY**=15692

Substituting the values in the formulae:

= 36*15692 - 697*770

36*$(14653)^2$- 623016-$(17306)^2$

=.742

r=.74

Appendix D

Summary Table for Item Analysis of the Basic Science Performance Test (BSPT) Instrument

S/N	F1	D1
1	0.66	0.67
2	0.33	0.42
3	0.22	0.56
4	0.22	0.56
5	0.22	0.56
6	0.14	0.14*
7	0.44	0.61
8	0.15	0.11*
9	0.22	0.56
10	0.11	0.53
11	0.22	0.56
12	0.44	0.61
13	0.22	0.44
14	0.43	0.73
15	0.22	0.56
16	0.44	0.61
17	0.11	0.53
18	0.43	0.83**
19	0.22	0.56
20	0.11	0.47
21	0.50	0.50
22	0.11	0.47
23	0.11	0.47
24	0.22	0.44
25	0.11	0.47
26	0.22	0.56
27	0.22	0.56
28	0.44	0.39
29	0.65	0.89**
30	0.21	0.26
31	0.11	0.53
32	0.11	0.53
33	0.87	0.35
34	0.67	0.33
35	0.44	0.44
36	0.44	0.33
37	0.52	0.53
38	0.50	0.50
39	0.22	0.44
40	0.33	0.42

Note that question number 6 and 8* were dropped because they were found to be very difficult (below 0.25) scores. Therefore, those questions were rejected. Also, questions number 18 and 29** were rejected too, because they were found to be very simple (above 0.75) scores.

Appendix E
Reliability of Pilot tested BSMQ Instrument

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.897	.899	20

Item Statistics

	Mean	Std. Deviation	N
1.When I find Basic Science contents, difficult, I feel discouraged.	1.9167	.80623	36
2.No matter how I put effort, I cannot learn Basic Science.	1.2778	.81455	36
3.Basic science is for students with special ability	.4167	1.07902	36
4. When learning new Basic science concepts, I always relate them to my previous experiences.	.3333	.86189	36
5. Basic science will become my favorite subject if different teaching will be used often.	.2778	.77868	36
6. The use of different methods to teach chemical concept, motivates your interest in Basic science.	.2222	.63746	36
7. The use of different methods to teach chemical concepts improves my understanding of the concept.	.2778	.74108	36
8. I am satisfied with the use of various methods when teaching chemical concepts.	.1944	.52478	36
9. Different method of teaching should be used for every Basic science lesson?	.3056	.82183	36
10. A well organized teaching method makes the learning process active.	.2778	.74108	36
11. Good method of teaching is interesting and effective in the basic science classes.	.1667	.44721	36
12. Use of suitable teaching method poster better understanding of Basic Science contents	.2222	.59094	36

13. The learning of Basic Science using different teaching methods is important because it stimulates my thinking.	.3611	.93052	36
14. Using various teaching method to teach chemical concepts often makes the classroom boring.	.3056	.85589	36
15. The contents of chemical concepts do not include information that will be useful to me.	.4167	1.10518	36
16. I will like to study science related course at higher educational level. If the teaching of Basic Science utilizes traditional lecture method..	.2778	.81455	36
17. Due to the challenges of Basic Science, I will be encouraged to study Sciences in the future.	.4167	1.07902	36
18. I like to study Basic Science courses so that other students will think that I am smart.	.2500	.69179	36
19. The learning of Basic science is important because I can use it in my daily life.	.3056	.82183	36
20. Chemical concepts are more interesting when taught using appropriate teaching method.	.4444	1.15745	36

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	.433	.167	1.917	1.750	11.500	.175	20

Appendix F

BASIC SCIENCE PERFORMANCE TEST (BSPT) INSTRUMENT

Dear Students,

This instrument; Basic Science Performance Test (BSPT) is not to be recorded as your examination scores, please kindly answer the following questions as freely as you can.

Thank you.

Section A: Biodata

1. Name of school____
2. Gender: Male (   ); Female (   )
3. Duration:__________________

Section B: Items on Basic Science Performance Test (BSPT) Instrument

Please tick (√) the correct answer from option (**A-E**) in each question.

1. Chemicals are substance that are
   a. Produced by physical process
   b. Produced by chemical process
   c. Not to be used at all
   d. Produced by cheophysical process
   e. All of the above

2. Chemical process when formation of new substances is_____________
   a. Easily reversible
   b. Not easily reversible
   c. Very complex in nature
   d. Change the colour of a substance
   e. None of the above

3. One of these is not an example of chemicals
   a. Hydrochloric acid
   b. Sodium hydroxide
   c. Ammonia
   d. Sodium chloride
   e. None of the above

4. One of the following is a measure classification of chemicals
   a. Chemical based on use and hazardous nature
   b. Agricultural chemicals
   c. Industrial chemicals
   d. Laboratory chemicals
   e. All of the above

5. One of the following is not a characteristics of pharmaceutical/cosmetic chemicals
   a. Chemical used in production of drugs and cosmetic
   b. Use to improve upon the appearance of the body or cleansing purpose
   c. Use on any part of the body
   d. Include shampoo, soaps, moisturizer body cream, perfumes, fats and oil etc.
   e. Require high degree of impurities

6. Fines chemicals are produce in____________
   a. A large quantity
   b. Small quantities
   c. High degree
   d. The laboratories
   e. None of the above

7. Discover the use of agrochemicals from the option below
   a. They cause explosion
   b. They are not harmful to health
   c. Increase soil infertility
   d. Use in controlling pests and diseases
   e. None of the above

8. From the option below, separate the one that is not industrial chemicals____________
   a. They serve as raw materials for other chemicals products
   b. They include heavy chemicals and fine chemicals
   c. They are use in making different plastics
   d. They are good pollutants
   e. They are use in making weapons

9. The following are chemicals use in the laboratory except______________
   a. Hydrochloric acids
   b. Trioxonitrate (v) acids
   c. Ammonia
   d. Silver nitrate
   e. None of the above

10. A chemicals comprised all of the following except
   a. They are use in farming
   b. Use in industries
   c. They are categorized in to different classes
   d. They do not require safety measures
   e. Use in making cosmetics

11. Differentiate non- hazardous chemicals from the option below
   a. Can cause explosion
   b. Can cause death
   c. Destroy living tissue

d. Mostly concentrated acids and alkalis
e. They are very stable

12. Differentiate the one that is not moderately hazardous and toxic chemicals
    a. It can destroy skin
    b. It causes blistering of the skin
    c. Mostly dilute acids and alkali
    d. Good for drinking
    e. Less dangerous than toxic chemicals

13. Identify hazardous chemicals from these options
    a. Glucose
    b. Sodium chloride
    c. Water
    d. Bromine chloride
    e. Oxygen

14. One of the option demonstrate a way of ensuring safety when handling chemicals is________________
    a. Reading manufacturer's instructions
    b. Using chemicals without reading instructions
    c. Keeping chemicals for use at any time
    d. Tasting the chemicals before use
    e. All of the above

15. An example of highly hazardous and toxic chemicals is____________________
    a. Water
    b. Hypochloride
    c. Milk
    d. Bromine chloride
    e. Iron

16. Hazardous chemicals can cause:
    a. Harm
    b. Danger
    c. Corrosion
    d. Death
    e. All of the above

17. Sodium chloride is an example of ______________________
    a. Corrosive chemicals
    b. Hazardous chemicals
    c. Toxic chemicals
    d. Non-toxic chemicals
    e. Flammable chemicals

18. When using any chemical it is good to______________________
    a. Wear protective gloves when handling chemicals
    b. Taste the chemicals before use
    c. Touch the chemicals bare-handed
    d. Smell the chemicals
    e. Do none of the above

19. Agrochemicals are chemicals use in__________________
    a. Manufacturing industries
    b. Nuclear stations
    c. Agricultural sector
    d. Analytical reagent
    e. Medical industries

20. In the laboratories and chemical industries, gas masks should be worn when handling poisonous/dangerous gases to:
    a. Promote the inhalation of gasses
    b. Avoid inhalation of gases
    c. Promote exhalation of gasses
    d. Avoid exhalation of gasses
    e. Avoid none

21. All the following are example of heavy chemicals excepts_______________
    a. Tetraoxosulphate (vi) acid
    b. Ammonia
    c. Trioxonitrate (v) acid
    d. Silver nitrate
    e. None of the above

From 22 -25 identify the symbol of the hazard

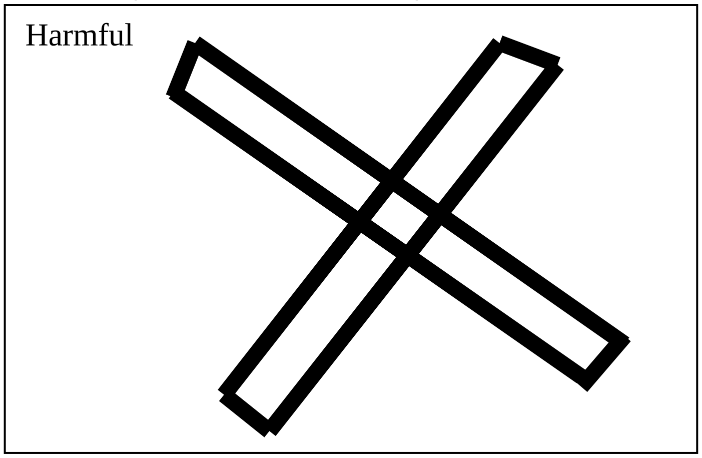
22. Identify the symbol below

a. Corrosive
b. Flammable
c. Danger
d. Irritant
e. All of the above

23. Compare and contrast the difference between symbol 22 above and symbol 23

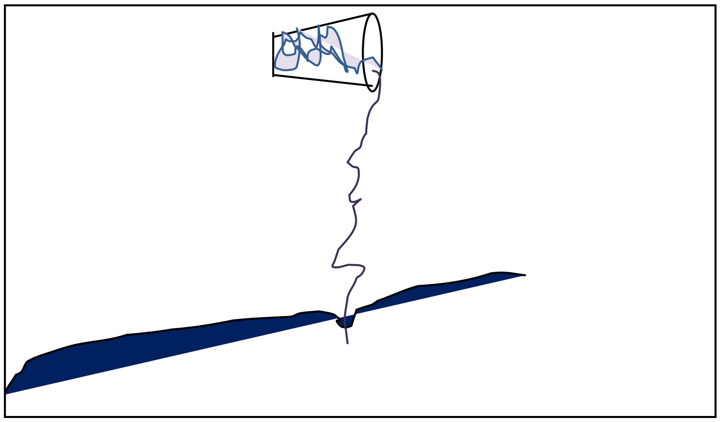
i. 22 is danger sign
ii. 23 is corrosive sign
iii. 23 is harmful sign
iv. 22 is irritant
v. Both 22 and 23 and danger

a. ii and iii
b. V only
c. I and iii
d. I and ii
e. Iv and v



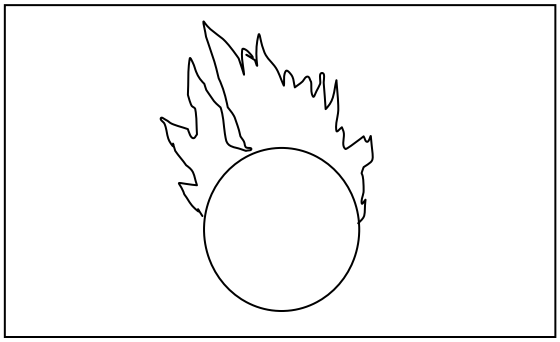
24. Identify the hazard symbol below

a. danger
b. corrosive
c. Irritant
d. oxidizing
e. None



25. Interpret the effect of the symbol below

a. Oxidizing
b. irritant
c. Corrosive
d. Flammable
e. danger



26. Chemicals could be harmful and dangerous when_____________________

a. using chemicals
b. properly handed
c. in the laboratory
d. not properly handed
e. none of the above

27. The following are general safety measures when using chemicals in the laboratory except___

a. communicate hazards to everyone that may come in contact with the chemicals
b. maintain and organize an orderly facility
c. observed and obey safety sign and instructions
d. leave the chemicals on the top of the table after use
e. Store chemicals on shelves with labels.

28. One of these is not a type of chemical

a. Nuclear chemicals
b. Industrial chemicals
c. Pharmaceutical chemical
d. Luteinizing chemical
e. Laboratory chemicals

29. One of these is type of chemical based on hazardous nature

i. Non-hazardous chemicals
ii. Flammable chemicals
iii. Corrosive chemicals
iv. Radioactive chemicals
v. All of the above

a. I and II
b. II and III
c. IV only
d. I only
e. V only

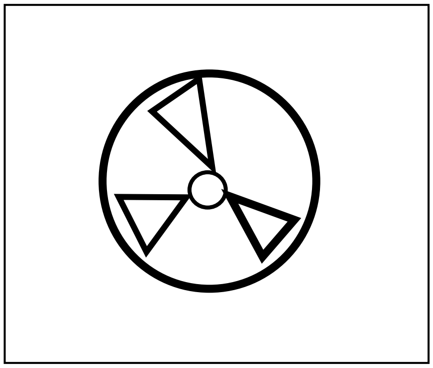
30. All of these are hazardous chemicals except__________________

i. Bromine chloride
ii. Carbonyl fluoride
iii. Dichloro acetylene
iv. Nitrogen
v. Acetaldehyde

a. I and V
b. V only
c. II and IV only
d. IV only
e. III only

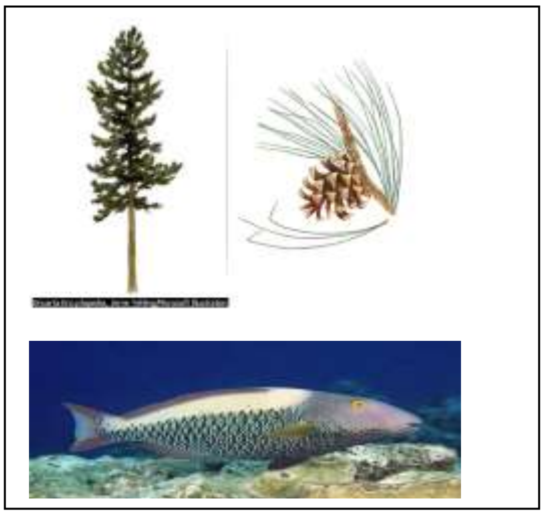
From 31 – 32 draw a straight line to link the symbol with the appropriate name

31.



Danger to environment

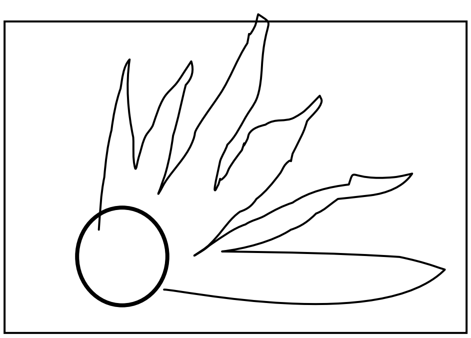
32



Radiation

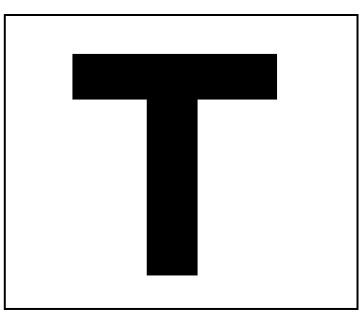
From 33 – 34 predict the effect of the hazards symbols unto the environment

33.



a. Explosive materials
b. Flammable materials
c. Other toxic materials
d. Radiation materials
e. Corrosive material

34.



a. They are toxic materials
b. Danger to environment
c. They are biohazard
d. Dangerously reactive materials
e. They irritant materials

35. The substance that is similar to toxic chemicals, but less dangerous and is still harmful if not carefully handed is related to___________________________

36. The chemical use for analytical and quantitative purpose is__________________________

37. ______________ is a substance prepared to be use on any part of the body

38. One of the following categories of chemical is not used in war

a. nuclear chemical
b. tear gas
c. mustard gas
d. highly hazardous chemicals
e. petrochemical

39. One of the combinations shows a product of hazardous chemical

i. sodium chloride
ii. alanine
iii. H_2O
iv. Glucose
v. Alkalis

a. I and V
b. II and IV
c. II and III
d. IV and I
e. I, II and III

40. Crop yield is a measure sector that increase production is related to_______________

a. food preservative chemicals
b. agrochemicals
c. fertilizer
d. zeranol
e. water

APPENDIX G

BASIC SCIENCE PERFORMANCE TEST (BSPT) MARKING SCHEME

1. B
2. B
3. E
4. A
5. E
6. B
7. D
8. E
9. E
10. D
11. E
12. D
13. D
14. A
15. D
16. E
17. D
18. A
19. C
20. B
21. E
22. C
23. C
24. B
25. A
26. D
27. D
28. D
29. D
30. D
31. RADIATION
32. DANGER TO ENVIRONMENT
33. A
34. A
35. MODERATELY HAZARDOUS
36. LABORATORY CHEMICAL
37. COSMETIC
38. E
39. B
40. B

APPENDIX H

BASIC SCIENCE MOTIVATION QUESTIONNAIRE (BSMQ) FOR EXPERIMENTAL GROUP 1 (GROUP TAUGHT USING MULTIMEDIA)

The researcher is conducting a study on Effects of Multimedia and Advanced Organizers on Upper Basic Science Performance and Motivation in Chemical Concepts, Zaria Metropolis, Kaduna State, Nigeria. The researcher therefore needs your cooperation in completing section A and responding to the statements in section B. The researcher is interested in your feelings and ideas about Basic science. Your response to this questionnaire will be treated with utmost confidentiality.

Section A: Please, kindly complete this section of the questionnaire.

Name of school ………………………………….

Class ……………….

Gender ………………………………….

Section B: Please indicate your feeling about the following statements by putting a mark (√) in the box corresponding to strongly Agree (**S.A**), Agree (**A**), Disagree (**D.A**), or Strongly Disagree (**S.D**). There is no right or wrong answer. Do not spend much time with any statement. **Please kindly respond to all the statements**. Thanks for your help

		S.A	A	D.A	S.D
1	When I find Basic Science contents, difficult, I feel discouraged.				
2	No matter how I put effort, I cannot learn Basic Science.				
3	Basic science is for students with special ability.				
4	When learning new Basic science concepts, I always relate them to my previous experiences.				
5	Basic science will become my favorite subject if multimedia will be used during in the course of teaching/learning activities.				
6	The use of multimedia in teaching chemical concepts motivates your interest in Basic science.				
7	Using multimedia in teaching chemical concepts increase my understanding of the concept.				
8	I am satisfied with using multimedia in teaching chemical concepts.				

9	Multimedia technology should be used for every Basic science lesson?				
10	Authentic instructional videos used by teacher make the learning process active.				
11	Lessons enriched with multimedia are more interesting and effective than traditional lessons.				
12	Multimedia instruction poster better understanding of Basic Science contents.				
13	The learning of Basic Science using multimedia is important because it stimulates my thinking.				
14	Using multimedia to teach chemical concepts often makes the classroom boring.				
15	The contents of chemical concepts do not include information that will be useful to me.				
16	I will like to study science related course at higher educational level. If the teaching of Basic Science utilizes multimedia instruction.				
17	Due to the challenges of Basic Science, I will be encouraged to study Sciences in the future.				
18	I like to study Basic Science courses so that other students will think that I am smart.				
19	The learning of Basic science is important because I can use it in my daily life.				
20	Chemical concepts are more interesting when multimedia instruction is used in teaching.				

APPENDIX I

BASIC SCIENCE MOTIVATION QUESTIONNAIRE (BSMQ) FOR EXPERIMENTAL GROUP 2 (GROUP TAUGHT USING ADVANCED ORGANIZERS)

The researcher is conducting a study on Effects of Multimedia and Advanced Organizers on Upper Basic Science Performance and Motivation in Chemical Concepts, Zaria Metropolis, Kaduna State, Nigeria. The researcher therefore needs your cooperation in completing section A and responding to the statements in section B. The researcher is interested in your feelings and ideas about Basic Science. Your response to this questionnaire will be treated with utmost confidentiality.

Section A. Please, kindly complete this section of the questionnaire.

Name of school ………………………………….

Class ……………….

Age ………………

Part B. Please indicate your feeling about the following statements by putting a mark (√) in the box corresponding to strongly Agree (**S.A**), Agree (**A**), Disagree (**D.A**), or Strongly Disagree (**S.D**). There is no right or wrong answer. Do not spend much time with any statement. **Please kindly respond to all the statements**. Thanks for your help

		S.A	A	D.A	S.D
1	When I find Basic Science contents, difficult, I feel discouraged.				
2	No matter how I put effort, I cannot learn Basic Science.				
3	Basic Science is for students with special ability.				
4	When learning new Basic science concepts, I always relate them to my previous experiences.				
5	Basic science will become my favorite subject if advanced organizers will be use often to introduce new lesson.				
6	The used of advanced organizers to introduced chemical concepts motivate your interest in Basic Science.				
7	The used of advanced organizers to introduced chemical concepts increase my understanding of the concept.				
8	I am satisfied with the used of advanced organizers when introducing chemical concepts.				

9	Advanced organizers should be used when introducing every Basic science new lesson.				
10	Authentic instructional Graphics used by teacher when introducing chemical concepts make the learning process active.				
11	Lessons enriched with advanced organizers are more interesting and effective than traditional lessons.				
12	Use of advanced organizers to introduce new lesson, poster better understanding of basic science content s.				
13	The learning of basic science using advanced organizers is important because it stimulates my thinking.				
14	Using advanced organizers to introduced chemical concepts often makes the classroom boring.				
15	The contents of chemical concepts do not include information that will be useful to me.				
16	I will like to study science related course at higher educational level, if the teaching of Basic Science utilizes Advanced organizers.				
17	Due to the challenges of Basic Science, I will be encouraged to study science in the future.				
18	I like to Study Basic Science courses so that other students will think that I am smart.				
19	The learning of Basic science is important because I can use it in my daily life.				
20	Chemical concepts are more interesting when advanced organizers are used to introduce the lesson.				

Appendix J

BASIC SCIENCE MOTIVATION QUESTIONNAIRE (BSMQ) FOR CONTROL GROUP (GROUP TAUGHT USING CONVENTIONAL LECTURE METHOD)

The researcher is conducting a study on Effects of Multimedia and Advanced Organizers on Upper Basic Science Performance and Motivation in Chemical Concepts, Zaria Metropolis, Kaduna State, Nigeria. The researcher therefore needs your cooperation in completing section A and responding to the statements in section B. The researcher is interested in your feelings and ideas about Basic Science. Your response to this questionnaire will be treated with utmost confidentiality.

Section A. Please, kindly complete this section of the questionnaire.

Name of school ………………………………….

Class ……………….

Age ………………

Part B. Please indicate your feeling about the following statements by putting a mark (√) in the box corresponding to strongly Agree (**S.A**), Agree (**A**), Disagree (**D.A**), or Strongly Disagree (**S.D**). There is no right or wrong answer. Do not spend much time with any statement. **Please kindly respond to all the statements**. Thanks for your help

		S.A	A	D.A	S.D
1	When I find Basic Science contents, difficult, I feel discouraged.				
2	No matter how I put effort, I cannot learn Basic Science.				
3	Basic Science is for students with special ability.				
4	When learning new Basic science concepts, I always relate them to my previous experiences.				
5	Basic science will become my favorite subject if different teaching methods and strategies will be use often.				
6	The use of traditional lecture method to teach chemical concepts, motivate your interest in Basic Science.				
7	The used of lecture method to teach chemical concepts improve my understanding of the concepts.				
8	I am satisfied with the used of lecture method when teaching chemical concepts.				

9	Lecture method should be used for every Basic science new lesson.				
10	A well organized lecture method makes the learning process active.				
11	Traditional teaching method is more interesting and effective than any other teaching methods.				
12	Traditional teaching method poster better understanding of basic science content s.				
13	The learning of basic science using traditional teaching method is important because it stimulates my thinking.				
14	Using traditional teaching method to teach chemical concepts often makes the classroom boring.				
15	The contents of chemical concepts do not include information that will be useful to me.				
16	I will like to study science related course at higher educational level, if the teaching of Basic Science utilizes traditional lecture method.				
17	Due to the challenges of Basic Science, I will be encouraged to study science in the future.				
18	I like to Study Basic Science courses so that other students will think that I am smart.				
19	The learning of Basic science is important because I can use it in my daily life.				
20	Chemical concepts are more interesting when taught using traditional teaching method.				

Appendix k

Lesson Plan for Basic Science Performance Test (BSPT) for Experimental Group 1 (Group Taught Using Multimedia)

Lesson I

School	
Class	JSS II
Sex	
Duration	70 minutes (double period)
Date	
Subject	Basic Science
Topic	Chemical
Previous Lesson	
Instructional Materials	Over head projector, downloaded videos from internet, recorded videos from chemical applying areas (laboratory, agricultural sectors, etc), computer etc.
Source	Classic Basic Science Text Book
Activity	Show videos on applying chemicals in laboratory, agriculture and industries to students; the video will be paused at certain stages. Then the teacher will give more explanation based on the scene shown.
Behavioural Objectives	By the end of this lesson students should be able to: i. Define chemical ii. Give example of chemicals iii. Classify chemicals in to 2 major groups (chemical based on use and hazardous nature) iv. Explain pharmaceutical and cosmetic chemicals
Introduction	The lesson will be introduced by showing a video scene making use of some chemicals in laboratory, industries and farmland, while instructing students to carefully observe. Then the teacher interacts with the students based on their observations of chemicals shown.
Presentation	The lesson will be presented by the following steps:
Step I	Chemical is define as: Chemical is a substance that is either an element compound, usually produced by a chemical process that leads to the formation of new substance and the new changes are not easily reversible.
Step II	Examples of chemicals are; water, ammonia, sodium hydroxide, sodium chloride (common salt), hydrogen chloride acid etc.

Chemicals are classified best on use and hazardous nature.

Step III
Pharmaceuticals are chemicals that are use in production of drugs. Cosmetics are substance that are prepared to be used on any part of the human body including the skin, lips, face, nails etc.
Drugs and cosmetic usually required in a high degree of purity.

Summary
A summary of the lesson will be written and allow students to copy

Evaluation
The lesson will be evaluated by the following steps:

i. What is chemical?
ii. Give five examples of chemicals
iii. Identify 2 major classes of chemicals
iv. What do you understand by pharmaceutical chemical
v. What do you understand by cosmetic chemicals

Conclusion
The lesson will be concluded by given the students permission to ask questions and the teacher responds by given appropriate answer.

Lesson II

School
Class JSS 2
Sex
Duration 70 minutes (double period)
Date
Subject Basic Science
Topic Agrochemical and Industrial Chemicals
Previous Lesson Chemical and classes of chemicals

Instructional Materials
Over head projector, downloaded videos from internet and recorded videos showing application of chemicals from Farmland and industries, computer etc.

Source
Classic Basic Science Textbook

Activity
The lesson will be introduced by showing a video scene making use of some chemicals in agricultural sector and industries, while instructing students to carefully observe. Then the teacher interacts with the students based on their observations of chemicals shown.

Behavioural Objectives

By the end of the lesson students should be able to:

i. Define agrochemical
ii. List some uses of agrochemicals
iii. Give some examples of agrochemical
iv. Define industrial chemical
v. Identify the 2 categories of industrial chemical
vi. Give some examples of industrial chemicals.

Introduction

The lesson will be introduced by showing a video scene making use of some chemicals in Agricultural sector and industries. while instructing students to carefully observe. Then the teacher interacts with the students based on their observations of chemicals shown.

Presentation

The lesson will be presented by the following steps:

Step I

Agrochemicals are chemicals used in agricultural sector to boast the crop yield. The chemicals ranges from the one apply to soil to increase the soil fertility to those use in controlling pest and disease. Examples of agrochemicals are; ammonium sulphate, zeranol, pebulate etc.

Step II

Industrial chemicals are chemicals produce in industries and serve as raw materials for other chemicals products. Industrial chemicals are categorized in to heavy chemical and fine chemicals.

Step III

Heavy chemicals are produce in large quantity because they are in high demands; usually other chemical industries need them as raw materials, example include, Amonia, sodium hydroxide, tetraoxosulphate (vi) acid etc.

Step IV

Fine chemicals are produced in small quantity but of high degree of purity, for example silver nitrate. Other industrial chemicals include; petrochemicals like phenol, benzene, polyvinyl chloride; they are use in making different plastics.

Summary

A summary of the lesson will be written on the board and allow the students to copy.

Evaluation

The lesson will be evaluated in the following way:

i. Define agrochemical
ii. Give 2 uses of agrochemicals
iii. List 3 examples of agrochemicals

iv. Define industrial chemicals
v. What are the major categories of industrial chemicals?
vi. What are the examples of industrial chemicals

Conclusion The lesson will be concluded by allowing students to ask questions and the teacher will respond by given appropriate answer.

Lesson III

School

Class JSS2

Sex

Duration **7**0 minutes (double period)

Date

Subject Basic Science

Topic Laboratory and Nuclear Chemical

Previous Lesson Agrochemical and Industrial Chemical

Instructional Materials Over head projector, downloaded videos from internet and recorded videos showing application of chemicals from Farmland and industries, computer etc.

Source Classic Basic Science text book.

Activity The lesson will be introduced by showing a video scene making use of some Laboratory and Nuclear chemicals, while instructing students to carefully observe. Then the teacher interacts with the students based on their observations of chemicals shown.

Behavioural Objectives By the end of the lesson students should be able to:

i. Define laboratory chemical
ii. Give examples of laboratory chemical
iii. Define nuclear chemical
iv. List example of nuclear chemical
v. Mention 2 effects of nuclear chemicals

Introduction The lesson will be introduced by showing a video scene making use of some laboratory and nuclear chemicals, while instructing students to carefully observe. Then the teacher interacts with the students based on their observations of chemicals shown.

Presentation The lesson will be presented by the following steps:

Step I	Laboratory chemicals are chemicals use in the laboratories for analytical and quantitative purpose. Example of laboratory chemicals include; hydrogen chloride, trioxonitrate (v) acid, tetraoxosulphate (vi) acid, sodium hydroxide, etc.
Step II	Nuclear chemicals are the chemicals use in weapons. Examples of nuclear chemicals include tear gas, mustard gas, hydrogen cynide, these chemicals have effect on skin and respiratory system.
Summary	The summary of the lesson will be written on the board and allow students to copy.
Evaluation	The lesson will be evaluated as follows: i. What is laboratory chemical? ii. Give 3 examples of laboratory chemicals iii. What is nuclear chemical? iv. List 2 examples of nuclear chemicals? v. Mention 2 effects of nuclear chemicals?
Conclusion	The lesson will be concluded by allowing students to ask questions and the teacher will respond by given appropriate answers.

Lesson IV

School	
Class	JSS2
Sex	
Duration	70 minutes (double period)
Date	
Subject	Basic Science
Topic	Chemicals based on Hazardous Nature
Previous Lesson	Laboratory and Nuclear Chemicals
Instructional Materials	Over head projector, downloaded videos from internet and recorded videos showing application of chemicals from Farmland and industries, computer etc.
Source	Classic Basic Science Textbook
Activity	The lesson will be introduced by showing a video scene, applying highly hazardous, moderately hazardous and non- toxic/hazardous chemicals, while instructing students to carefully observe. Then the teacher interacts with the students based on their observations of chemicals shown.

Behavioural Objectives	By the end of the lesson students should be able to: i. Explain highly toxic chemicals ii. Give examples of some highly toxic chemicals iii. Explain moderately hazardous and toxic chemicals iv. Give some examples of moderately hazardous and toxic chemicals v. Explain non-hazardous and toxic chemicals Give examples of non-hazardous and toxic
Introduction	The lesson will be introduced by showing a video scene making use of some highly toxic, moderately toxic and non-toxic chemicals, while instructing students to carefully observe. Then the teacher interacts with the students based on their observations of chemicals shown.
Presentation	The lesson will be presented by the following steps:
Step I	Highly toxic chemicals are chemicals that can cause explosion, death; they can destroy living tissues including eyes and skin e.g bromine chloride, carbonyl fluoride, chloropicrin, acetaldehyde etc.
Step II	Moderately hazardous chemical are substances similar to toxic chemicals but less dangerous, they are however, still harmful. If not handle carefully may cause irritation, reddening or blistering of the skin e.g dilute acids, alkalis, hydrogen peroxide, hypo chloride (bleach).
Step III	Non hazardous chemicals are chemicals that are not harmful and may not cause any advert effect e.g sodium chloride, water, alanine, calcium phosphate, glucose, calcium citerate, ribito oxygen, nitrogen etc.
Summary	The summary of the lesson will be written on the board and allow students to copy.
Evaluation	The lesson will be evaluated by the following steps: i. Give brief explanation of highly toxic chemicals ii. Give 2 examples of highly toxic chemicals iii. Explain moderately hazardous and toxic chemicals iv. Give 2 examples of moderately hazardous chemicals v. Explain non hazardous chemicals vi. Give 2 examples of non hazardous chemicals
Conclusion	The lesson will be concluded by allowing students to ask questions and the teacher will respond by given appropriate answers.

Lesson V

School	
Class	JSS2
Sex	
Duration	70 minutes (double period)
Date	
Subject	Basic Science
Topic	Safety Measures When Using Chemical
Previous Lesson	Chemical based on Hazardous Nature
Instructional Materials	Over head projector, downloaded videos from internet and recorded videos showing application of chemicals from Farmland and industries, computer etc.
Source	Classic Basic Science Test book
Activity	The lesson will be introduced by showing a video scene, on how to take safety measures when using chemicals, while instructing students to carefully observe. Then the teacher interacts with the students based on their observations of chemicals shown.

Behavioral Objectives

By the end of the lesson students should be able to:

i. Understand general safety measures when using chemicals;
ii. List some safety measures when handling chemicals;
iii. Identify some international hazards symbols

Introduction

The lesson will be introduced by showing a video scene on how to take safety measures when using chemicals, while instructing students to carefully observe. Then the teacher interacts with the students based on their observations of the chemicals shown.

Presentations

The lesson will be presented by the following steps:

Step I

Chemicals could be harmful and dangerous when not properly handed. The followings are general safety measures one can take when using chemicals:

Step II

1. Handles all chemicals with care.
2. Maintain and organized an orderly facility
3. Follow basic safety procedure

4. Adhere to the manufacturers safety instructions
5. Observed and obey safety signs
6. Store chemicals on shelves with labels.
7. Communicate hazards to everyone that may come in contact with chemicals.
8. For toxic chemicals always wear gloves when handling such
9. Wear safety glasses/goggles when working with chemicals that can explode. Equally gas mask should be worn to avoid inhalation of dangerous gasses.

Step III

International hazards symbols include the followings:

Danger

Radiation

Summary

The summary of the lesson will be written on the board and allow students to copy.

Evaluation

The lesson will be evaluated by the following steps:

i. Mention some safety measures when using Chemicals?

ii. Identify the hazardous signs for danger and corrosive substances?

Appendix L

Lesson Plan for Basic Science Performance Test (BSPT) for Experimental Group 2 (Group Taught Using Advanced Organizers)

Lesson I

Phase I: Presentation of Graphic Advanced Organizers on Chemicals Concepts (Pharmaceutical and Cosmetics chemicals)

Analyzing Pharmaceutical Chemicals

Mixing Chemicals in the Laboratory

Observing Chemical in the laboratory

Applying Cosmetic Chemicals

School	
Class	JSS II
Sex	
Duration	70 minutes (double period)
Date	
Subject	Basic Science
Topic	Chemicals (Pharmaceutical and Cosmetics)
Previous Lesson	
Instructional Materials	Graphic advanced organizers based on chemical concepts.
Source	Classic Basic Science Text Book
Activity	Observing and watching the graphics advanced organizers presented by the teacher, followed by discussion.

Behavioural Objectives

By the end of this lesson students should be able to:

v. Define chemical
vi. Give example of chemicals
vii. Classify chemicals in to 2 major groups (chemical based on use and hazardous nature)
viii. Explain pharmaceutical and cosmetic chemicals

Introduction

The lesson will be introduced by presenting graphics advanced organizers specifically on pharmaceutical and cosmetics chemicals to students and instructing them to observe it carefully.

Phase II

Making links of the chemical concepts to the organizers by presenting the learning tasks and logically ordering of learning materials to the organizers. This will be done by asking students to give some examples of other chemicals they are aware of within their environments. Also, by asking the students to mention some examples of pharmaceutical chemicals and cosmetics chemicals.

Presentation The lesson will be presented by the following steps:

Step I Chemical is define as a substance that is either an element or compound, usually produced by a chemical process that leads to the formation of new substance and the new changes are not easily reversible.

Step II Examples of chemicals are; water, ammonia, sodium hydroxide, sodium chloride (common salt), hydrogen chloride acid etc. Chemicals are classified best on use and hazardous nature.

Step III Pharmaceuticals chemicals are chemicals that are use in production of drugs.
Cosmetics are substance that are prepared to be used on any part of the human body including the skin, lips, face, nails etc.
Drugs and cosmetic usually required in a high degree of purity.

Phase III Strengthening of cognitive organization. This done by asking the learners to make summaries by relating the concepts learnt in the learning task to concepts in advance organizers. To elicit, critical approach is done by informing students that, ‘chemicals have also negative effects on human health; this usually happened as a result of poor utilization and lack of proper safety measures.

Summary A summary of the lesson will be written and allow students to copy

Evaluation The lesson will be evaluated by the following steps:

i. What is chemical?
ii. Give five examples of chemicals
iii. Identify 2 major classes of chemicals
iv. What do you understand by pharmaceutical chemical
v. What do you understand by cosmetic chemicals

Conclusion The lesson will be concluded by given the students permission to ask questions and the teacher responds by given appropriate answer.

Lesson II

Phase I: Presentation of Graphic Advanced Organizers on Chemicals Concepts (Agrochemicals and Industrial Chemicals)

spraying Agrochemicals

Applying of Agrochemicals

Using Industrial Chemicals

School	
Class	JSS 2
Sex	
Duration	70 minutes (double period)
Date	
Subject	Basic Science
Topic	Agrochemical and Industrial Chemicals
Previous Lesson	Chemical and classes of chemicals

Instructional Materials Graphic advanced organizers based on Agrochemicals and industrial chemicals.

Source Classic Basic Science Textbook

Activity Observing and watching the graphics advanced organizers on Agrochemicals and industrial chemicals presented by the teacher, followed by discussion.

Behavioural Objectives By the end of the lesson students should be able to:

i. Define agrochemical
ii. List some uses of agrochemicals
iii. Give some examples of agrochemical
iv. Define industrial chemical
v. Identify the 2 categories of industrial chemical
vi. Give some examples of industrial chemicals.

Introduction The lesson will be introduced by presenting graphics advanced organizers based on Agrochemicals and industrial chemicals to students and instructing them to observe it carefully.

Phase II Making links of Agrochemicals and Industrial chemicals to the organizers by presenting the learning tasks and logically ordering of learning materials to the organizers. This will be done by asking students to give some examples of other agrochemicals and industrial chemicals, known to them.

Presentation The lesson will be presented by the following steps:

Step I Agrochemicals are chemicals used in agricultural sector to boast the crop yield. The chemicals ranges from the one apply to soil to increase the soil fertility to those use in controlling pest and disease. Examples of agrochemicals are; ammonium sulphate, zeranol, pebulate etc.

Step II Industrial chemicals are chemicals produce in industries and serve as raw materials for other chemicals products. Industrial chemicals are categorized in to heavy chemical and fine chemicals.

Step III Heavy chemicals are produce in large quantity because they are in high demands; usually other chemical industries need them as raw materials, example include, Amonia, sodium hydroxide, tetraoxosulphate (vi) acid etc.

Step IV Fine chemicals are produced in small quantity but of high degree of purity, for example silver nitrate. Other industrial chemicals include; petrochemicals like phenol, benzene, polyvinyl chloride; they are use in making different plastics.

Phase III Strengthening of cognitive organization. This is done by asking the learners to make summaries by relating the concepts learnt in the learning task to concepts in advance organizers. To elicit, critical approach is done by informing students that, 'Agrochemicals and industrial chemicals have also negative effects on human health; this is usually occurred as a result of poor utilization and lack of proper safety measures.

Summary A summary of the lesson will be written on the board and allow the students to copy.

Evaluation The lesson will be evaluated in the following way:

i. Define agrochemical
ii. Give 2 uses of agrochemicals
iii. List 3 examples of agrochemicals
iv. Define industrial chemicals
v. What are the major categories of industrial chemicals?
vi. What are the examples of industrial chemicals

Conclusion The lesson will be concluded by allowing students to ask questions and the teacher will respond by given appropriate answer.

Lesson III

Phase I: Presentation of Graphic Advanced Organizers Chemicals (Laboratory and Nuclear)

Using chemicals in the lab.

Observing Chemicals in the Laboratory

Adding drops of chemical in the lab

Mixing of chemicals together

Using Nuclear chemical as Nuclear weapons

School	
Class	JSS2
Sex	
Duration	**7**0 minutes (double period)
Date	
Subject	Basic Science
Topic	Laboratory and Nuclear Chemical
Previous Lesson	Agrochemical and Industrial Chemical

Instructional Materials — Graphic advanced organizers based on laboratory and nuclear chemicals.

Source — Classic Basic Science text book.

Activity — Observing and watching the graphics advanced organizers on laboratory and nuclear chemicals presented by the teacher, followed by discussion.

Behavioural Objectives — By the end of the lesson students should be able to:

i. Define laboratory chemical
ii. Give examples of laboratory chemical
iii. Define nuclear chemical
iv. List examples of nuclear chemicals
v. Mention 2 effects of nuclear chemicals

Introduction — The lesson will be introduced by presenting graphics advanced organizers based on Laboratory and nuclear chemicals to students and instructing them to observe it carefully.

Phase II — Making links of laboratory and nuclear chemicals to the organizers by presenting the learning tasks and logically ordering of learning materials to the organizers. This will be done by asking students to give some examples of other laboratory chemicals and nuclear chemicals, known to them.

Presentation — The lesson will be presented by the following steps:

Step I — Laboratory chemicals are chemicals use in the laboratories for analytical and quantitative purpose. Example of laboratory chemicals include; hydrogen chloride, trioxonitrate (v) acid, tetraoxosulphate (vi) acid, sodium hydroxide, etc.

Step II

Nuclear chemicals are the chemicals use in weapons. Examples of nuclear chemicals include tear gas, mustard gas, hydrogen cynide, these chemicals have effect on skin and respiratory system.

Phase III

Strengthening of cognitive organization. This is done by asking the learners to make summaries by relating the concepts learnt in the learning task to concepts in advance organizers. To elicit, critical approach is done by informing students that, ‘Laboratory and Nuclear chemicals have also negative effects or hazardous to human health; this is usually as a result of poor utilization and lack of proper safety measures.

Summary

The summary of the lesson will be written on the board and allow students to copy.

Evaluation

The lesson will be evaluated as follows:

i. What is laboratory chemical?
ii. Give 3 examples of laboratory chemicals
iii. What is nuclear chemical?
iv. List 2 examples of nuclear chemicals?
v. Mention 2 effects of nuclear chemicals?

Conclusion

The lesson will be concluded by allowing students to ask questions and the teacher will respond by given appropriate answers.

Lesson IV

Phase I: Presentation of Graphic Advanced Organizers on Chemicals based on Hazardous Nature

Using Highly Toxic Chemicals

Using Moderately Hazardous Chemicals

Using Non- Hazardous Chemicals

School	
Class	JSS2
Sex	
Duration	70 minutes (double period)
Date	
Subject	Basic Science
Topic	Chemicals based on Hazardous Nature
Previous Lesson	Laboratory and Nuclear Chemicals

Instructional Materials Graphic advanced organizers based on highly hazardous, moderately hazardous and non hazardous chemicals.

Source Classic Basic Science Textbook

Activity Observing and watching the graphics advanced organizers on highly hazardous, moderately hazardous and non- hazardous chemicals presented by the teacher, followed by discussion.

Behavioural Objectives By the end of the lesson students should be able to:

i. Explain highly toxic chemicals
ii. Give examples of some highly toxic chemicals
iii. Explain moderately hazardous and toxic chemicals
iv. Give some examples of moderately hazardous and toxic chemicals
v. Explain non-hazardous and toxic chemicals
Give examples of non-hazardous and toxic

Introduction The lesson will be introduced by presenting graphics advanced organizers based on highly hazardous, moderately hazardous and non-hazardous chemicals to students and instructing them to observe it carefully.

Phase II Making links of chemicals based on hazardous nature to the organizers by presenting the learning tasks and logically ordering of learning materials to the organizers. This will be done by asking students to give some examples of other highly hazardous, moderately hazardous and non- hazardous chemicals known to them.

Presentation The lesson will be presented by the following steps:

Step I Highly toxic chemicals are chemicals that can cause explosion, death; they can destroy living tissues including eyes and skin e.g

	bromine chloride, carbonyl fluoride, chloropicrin, acetaldehyde etc.
Step II	Moderately hazardous chemical are substances similar to toxic chemicals but less dangerous, they are however, still harmful. If not handle carefully may cause irritation, reddening or blistering of the skin e.g dilute acids, alkalis, hydrogen peroxide, hypo chloride (bleach).
Step III	Non hazardous chemicals are chemicals that are not harmful and may not cause any advert effect e.g sodium chloride, water, alanine, calcium phosphate, glucose, calcium citerate, ribito oxygen, nitrogen etc.
Phase III	Strengthening of cognitive organization. This is done by asking the learners to make summaries by relating the concepts learnt in the learning task to concepts in advance organizers. To elicit critical approach is done by informing students that, ‘highly hazardous and moderately hazardous chemicals are very dangerous to health and lives in generals. Non hazardous chemicals can also be dangerous under certain circumstances; this is usually as a result of poor utilization and lack of proper safety measures.
Summary	The summary of the lesson will be written on the board and allow students to copy.
Evaluation	The lesson will be evaluated by the following steps: i. Give brief explanation of highly toxic chemicals ii. Give 2 examples of highly toxic chemicals iii. Explain briefly moderately hazardous and toxic chemicals iv. Give 2 examples of moderately hazardous chemicals v. Explain briefly non hazardous chemicals vi. Give 2 examples of non hazardous chemicals
Conclusion	The lesson will be concluded by allowing students to ask questions and the teacher will respond by given appropriate answers.

Lesson V

Phase I: Presentation of Graphic Advanced Organizers based on Safety Measures when using Chemicals

Using Hand gloves, Air Mask and Eye goggles

Wearing of Lab Coat

Oxidation Hazard Symbol

Radiation Hazard Symbol


Danger Warning Sign

School	
Class	JSS2
Sex	
Duration	70 minutes (double period)
Date	
Subject	Basic Science
Topic	Safety Measures When Using Chemical
Previous Lesson	Chemical based on Hazardous Nature
Instructional Materials	Graphic Advanced Organizers based on Safety Measures when using Chemicals.
Source	Classic Basic Science Test book
Activity	Observing and watching the graphics advanced organizers on Safety Measures when using chemicals presented by the teacher, followed by discussion.
Behavioral Objectives	By the end of the lesson students should be able to: i. Understand general safety measures when using chemicals; ii. List some safety measures when handling chemicals; iii. Identify some international hazards symbols

Introduction The lesson will be introduced by presenting graphics advanced organizers based on safety measures when using chemicals to students and instructing them to observe it carefully.

Phase II Making links of chemicals based on Safety Measures when Using Chemicals to the organizers by presenting the learning tasks and logically ordering of learning materials to the organizers. This will be done by asking students to give some examples of other safety measures when using chemicals known to them.

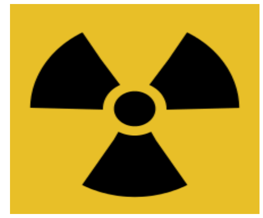
Presentations The lesson will be presented by the following steps:

Step I Chemicals could be harmful and dangerous when not properly handed. The followings are general safety measures one can take when using chemicals:

Step II

1. Handles all chemicals with care.
2. Maintain and organized an orderly facility
3. Follow basic safety procedure
4. Adhere to the manufacturers safety instructions
5. Observed and obey safety signs
6. Store chemicals on shelves with labels.
7. Communicate hazards to everyone that may come in contact with chemicals.
8. For toxic chemicals always wear gloves when handling such
9. Wear safety glasses/goggles when working with chemicals that can explode. Equally gas mask should be worn to avoid inhalation of dangerous gasses.

Step III International hazards symbols include the followings:



Radiation

Phase III

Strengthening of cognitive organization. This is done by asking the learners to make summaries by relating the concepts learnt in the learning task to concepts in advance organizers. To elicit, critical approach is done by informing students that, 'Safety measures when using chemicals are not well implement and this causes serious hazards to both lives and properties in the affected areas'.

Summary

The summary of the lesson will be written on the board and allow students to copy.

Evaluation

The lesson will be evaluated by the following steps:

i. Explain safety measures when using chemicals.
ii. Mention some safety measures when using Chemicals?
iii. Identify the hazardous signs for danger and corrosive substances?

Conclusion

The lesson will be concluded by allowing students to ask questions and teacher will respond by giving appropriate answers.

Appendix M

Lesson Plan for Basic Science Performance Test (BSPT) to teach Chemical Concept using Lecture Methods

Lesson I

School	
Class	JSS II
Sex	
Duration	40 minutes
Date	
Subject	Basic Science
Topic	Chemical
Previous Lesson	
Instructional Materials	Text book, and chalk board
Source	Classic Basic Science Text Book

Behavioural Objectives By the end of this lesson students should be able to:

i. Define chemical
ii. Give example of chemicals
iii. Classify chemicals in to 2 major groups (chemical based on use and hazardous nature)
iv. Explain pharmaceutical and cosmetic chemicals

Introduction The lesson will be introduced by giving definition of chemical.

Presentation The lesson will be presented by the following steps:

Step I Chemical is define as a substance that is either an element compound, usually produced by a chemical process that leads to the formation of new substance and the new changes are not easily reversible.

Step II Examples of chemicals are; water, ammonia, sodium hydroxide, sodium chloride (common salt), hydrogen chloride acid etc. Chemicals are classified best on use and hazardous nature.

Step III Pharmaceuticals are chemicals that are use in production of drugs. Cosmetics are substance that are prepared to be used on any part of the human body including the skin, lips, face, nails etc.
Drugs and cosmetic usually required in a high degree of purity.

Summary A summary of the lesson will be written and allow students to copy

Evaluation	The lesson will be evaluated by the following steps: i. What is chemical? ii. Give five examples of chemicals iii. Identify 2 major classes of chemicals iv. What do you understand by pharmaceutical chemical v. What do you understand by cosmetic chemicals
Conclusion	The lesson will be concluded by given the students permission to ask questions and the teacher responds by given appropriate answer.

Lesson II

School	
Class	JSS 2
Sex	
Duration	40 minutes
Date	
Subject	Basic Science
Topic	Agrochemical and Industrial Chemicals
Previous Lesson	Chemical and classes of chemicals
Instructional Materials	Chalk board and text book
Source	Classic Basic Science Textbook
Behavioural Objectives	By the end of the lesson students should be able to: i. Define agrochemical ii. List some uses of agrochemicals iii. Give some examples of agrochemical iv. Define industrial chemical v. Identify the 2 categories of industrial chemical vi. Give some examples of industrial chemicals.
Introduction	The lesson will be introduced by having a brief revision of previous lesson and link it with the new topic.
Presentation	The lesson will be presented by the following steps:
Step I	Agrochemicals are chemicals used in agricultural sector to boast the crop yield. The chemicals ranges from the one apply to soil to increase the soil fertility to those use in controlling pest and disease. Examples of agrochemicals are; ammonium sulphate, zeranol, pebulate etc.

Step II Industrial chemicals are chemicals produce in industries and serve as raw materials for other chemicals products. Industrial chemicals are categorized in to heavy chemical and fine chemicals.

Step III Heavy chemicals are produce in large quantity because they are in high demands; usually other chemical industries need them as raw materials, example include, Amonia, sodium hydroxide, tetraoxosulphate (vi) acid etc.

Step IV Fine chemicals are produced in small quantity but of high degree of purity, for example silver nitrate. Other industrial chemicals include; petrochemicals like phenol, benzene, polyvinyl chloride; they are use in making different plastics.

Summary A summary of the lesson will be written on the board and allow the students to copy.

Evaluation The lesson will be evaluated in the following way:

i. Define agrochemical
ii. Give 2 uses of agrochemicals
iii. List 3 examples of agrochemicals
iv. Define industrial chemicals
v. What are the major categories of industrial chemicals?
vi. What are the examples of industrial chemicals

Conclusion The lesson will be concluded by allowing students to ask questions and the teacher will respond by given appropriate answer.

Lesson III

School
Class JSS2
Sex
Duration **4**0 minutes
Date
Subject Basic Science
Topic Laboratory and Nuclear Chemical
Previous Lesson Agrochemical and Industrial Chemical

Instructional Materials Blackboard and text book.

Source Classic Basic Science text book.

Behavioural Objectives By the end of the lesson students should be able to:

i. Define laboratory chemical
ii. Give examples of laboratory chemical
iii. Define nuclear chemical
iv. List example of nuclear chemical
v. Mention 2 effects of nuclear chemicals

Introduction The lesson will be introduced by having a brief revision of previous lesson and link it with the new lesson.

Presentation The lesson will be presented by the following steps:

Step I Laboratory chemicals are chemicals use in the laboratories for analytical and quantitative purpose. Example of laboratory chemicals include; hydrogen chloride, trioxonitrate (v) acid, tetraoxosulphate (vi) acid, sodium hydroxide, etc.

Step II Nuclear chemicals are the chemicals use in weapons. Examples of nuclear chemicals include tear gas, mustard gas, hydrogen cynide, these chemicals have effect on skin and respiratory system.

Summary The summary of the lesson will be written on the board and allow students to copy.

Evaluation The lesson will be evaluated as follows:

i. What is laboratory chemical?
ii. Give 3 examples of laboratory chemicals
iii. What is nuclear chemical?
iv. List 2 examples of nuclear chemicals?
v. Mention 2 effects of nuclear chemicals?

Conclusion The lesson will be concluded by allowing students to ask questions and the teacher will respond by given appropriate answers.

Lesson IV

School	
Class	JSS2
Sex	
Duration	40 minutes
Date	
Subject	Basic Science
Topic	Chemicals based on Hazardous Nature
Previous Lesson	Laboratory and Nuclear Chemicals
Instructional Materials	Writing board and text book
Source	Classic Basic Science Textbook

Behavioural Objectives

By the end of the lesson students should be able to:

i. Explain highly toxic chemicals
ii. Give examples of some highly toxic chemicals
iii. Explain moderately hazardous and toxic chemicals
iv. Give some examples of moderately hazardous and toxic chemicals
v. Explain non-hazardous and toxic chemicals
Give examples of non-hazardous and toxic

Introduction

The lesson will be introduce by having brief revision of previous lesson and link it with the new lesson.

Presentation

The lesson will be presented by the following steps:

Step I

Highly toxic chemicals are chemicals that can cause explosion, death; they can destroy living tissues including eyes and skin e.g bromine chloride, carbonyl fluoride, chloropicrin, acetaldehyde etc.

Step II

Moderately hazardous chemical are substances similar to toxic chemicals but less dangerous, they are however, still harmful. If not handle carefully may cause irritation, reddening or blistering of the skin e.g dilute acids, alkalis, hydrogen peroxide, hypo chloride (bleach).

Step III

Non hazardous chemicals are chemicals that are not harmful and may not cause any advert effect e.g sodium chloride, water, alanine, calcium phosphate, glucose, calcium citerate, ribito oxygen, nitrogen etc.

Summary

The summary of the lesson will be written on the board and allow students to copy.

Evaluation The lesson will be evaluated by the following steps:

i. Give brief explanation of highly toxic chemicals
ii. Give 2 examples of highly toxic chemicals
iii. Explain moderately hazardous and toxic chemicals
iv. Give 2 examples of moderately hazardous chemicals
v. Explain non hazardous chemicals
vi. Give 2 examples of non hazardous chemicals

Conclusion The lesson will be concluded by allowing students to ask questions and the teacher will respond by given appropriate answers.

Lesson V

School	
Class	JSS2
Sex	
Duration	40 minutes
Date	
Subject	Basic Science
Topic	Safety Measures When Using Chemical
Previous Lesson	Chemical based on Hazardous Nature
Instructional Materials	Writing board and text book
Source	Classic Basic Science Text book

Behavioral Objectives By the end of the lesson students should be able to:

i. Understand general safety measures when using chemicals;
ii. List some safety measures when handling chemicals;
iii. Identify some international hazards symbols

Introduction the lesson will be introduced by having a brief revision of previous lesson and link it with the new topic

The lesson will be presented by the following steps:

Presentations Chemicals could be harmful and dangerous when not properly handed. The followings are general safety measures one can take when using chemicals:

Step I

Step II

1. Handles all chemicals with care.
2. Maintain and organized an orderly facility
3. Follow basic safety procedure
4. Adhere to the manufacturers safety instructions
5. Observed and obey safety signs
6. Store chemicals on shelves with labels.
7. Communicate hazards to everyone that may come in contact with chemicals.
8. For toxic chemicals always wear gloves when handling such
9. Wear safety glasses/goggles when working with chemicals that can explode. Equally gas mask should be worn to avoid inhalation of dangerous gasses.

Step III

International hazards symbols include the followings:

Danger

Radiation

Summary

The summary of the lesson will be written on the board and allow students to copy.

Evaluation

The lesson will be evaluated by the following steps:

i. Explain safety measures when using chemicals

ii. Mention some safety measures when using Chemicals?

iii. Identify the hazardous signs for danger and corrosive substances?

Appendix N

Request Letter for the Validation of Research Instrument

Department of Science Education: Ahmadu Bello University, Zaria. October 10, 2018,

Professor (Mrs.) M.A. Lakpini, Institute of Education, Ahmadu Bello University, Zaria

Dear Ma,

Validating Research Instrument in Respect of Aliyu ABDULLAHI P17EDSC8032

The above M.ed science education student is researching on the Effects of Multimedia and Advanced Organizers on upper Basic Science Students Performance and Motivation in Chemical Concept, Zaria Metropolis, Kaduna State, Nigeria. He has developed an instrument for data collection. Kindly go through the instrument and validate it to enable him collect reliable data. Research questions, Objectives of the study and null hypotheses from his chapter 1 are attached here with for your reference. Thank you.

Yours faithfully: Prof. Isa A. Usman (Student’s supervisor).

Request Letter for the Validation of Research Instrument

Department of Science Education: Ahmadu Bello University, Zaria. October/10/ 2018.

Professor (Mrs.) Binta Abdulkarim, Department of Science Education, Ahmadu Bello University, Zaria.

Dear Ma,

Validating Research Instrument in Respect of Aliyu ABDULLAHI P17EDSC8032

The above M.ed science education student is researching on the Assessment of Multimedia-Advanced Organizers as a Predictor to upper Basic Science Academic Performance based on School Setting in Zaria, Kaduna State, Nigeria. He has developed an instrument for data collection. Kindly go through the instrument and validate it to enable him collect reliable data. Research questions, Objectives of the study and null hypotheses from his chapter one are attached here with for your reference. Thank you.

Yours Faithfully: Prof. Isa A. Usman (Student's supervisor).

Request Letter for the Validation of Research Instrument

Department of Science Education: Ahmadu Bello University, Zaria. October, 10/ 2018/.

Doctor Muhammad Kabir Falalu, Department of Science Education: Ahmadu Bello University, Zaria.

Dear Sir,

Validating Research Instrument in Respect of Aliyu ABDULLAHI P17EDSC8032

The above M.ed science education student is researching on the Effects of Multimedia and Advanced Organizers on upper Basic Science Students Performance and Motivation in Chemical Concepts, Zaria Metropolis, Kaduna State, Nigeria. He has developed an instrument for data collection. Kindly go through the instrument and validate it to enable him collect reliable data. Research questions, Objectives of the study and null hypotheses from his chapter one are attached here with for your reference. Thank you.

Yours faithfully: Prof. Isa A. Usman (Student's supervisor).

Request Letter for the Validation of Research Instrument

Department of Science Education: Ahmadu Bello University, Zaria. August, 21, 2019,

Doctor Aminu Sambo, Institute of Education, Ahmadu Bello University, Zaria

Dear Sir, **Validating Research Instrument in Respect of Aliyu ABDULLAHI P17EDSC8032**

The above M.ed science education student is researching on the Effects of Multimedia and Advanced Organizers on upper Basic Science Students Performance and Motivation in Chemical Concepts, Zaria Metropolis, Kaduna State, Nigeria. He has developed an instrument for data collection. Kindly go through the instrument and validate it to enable him collect reliable data. Research questions, Objectives of the study and null hypotheses from his chapter 1 are attached here with for your reference. Thank you.

Yours faithfully: Prof. S.S. Bichi (Student's supervisor).