IMPACT OF ANIMATED-MEDIA STRATEGY ON ACHIEVEMENT, RETENTION AND INTEREST AMONG SECONDARY SCHOOL GEOGRAPHY STUDENTS IN WEATHER CONCEPTS; KATSINA STATE, NIGERIA.

BY

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AHMADU BELLO UNIVERSITY, ZARIA.

JANUARY, 2015

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A THESIS SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES, AHMADU BELLO UNIVERSITY IN PARTIAL FULFILLMENT FOR THE REQUIREMENT OF THE AWARD OF THE DEGREE OF MASTERS IN SCIENCE EDUCATION

DEPARTMENT OF SCIENCE EDUCATION
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JANUARY, 2015

DECLARATION

I declare that the work in this thesis entitled "Impact of Animated-Media Strategy on Achievement, Retention and Interest among Secondary School Geography Students in Weather Concepts; Katsina state, Nigeria" has been carried out by me in the Department of Science Education. The information derived from the literature has been duly acknowledged in the text and a list of references provided. No part of this thesis was previously presented for another degree or diploma at this or any institution.

_____	_____	_____
Salisu AMINU	Signature	Date

CERTIFICATION

This thesis entitled **"**IMPACT OF ANIMATED-MEDIA STRATEGY ON ACHIEVEMENT, RETENTION AND INTEREST AMONG SECONDARY SCHOOL GEOGRAPHY STUDENTS IN WEATHER CONCEPTS; KATSINA STATE, NIGERIA" by SALISU AMINU meets the regulations governing the award of degree of Masters in Science Education of the Ahmadu Bello University, Zaria, and is approved for its contribution to knowledge and literary presentation.

_____ _____

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DEDICATION

This thesis is dedicated to the memory of Late Aisha (Uwani), Fadeela and Safiya Bashir, Muhammad Jamilu, Ismail, Alh. Abdu Maigoro and all our late Family members. May their gentle soul rest in perfect peace, ameen.

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OPERATIONAL DEFINITIONS OF TERMS

The following terms have been operationally defined as used in this study:

- Academic achievement: This is the exhibition of knowledge attains by students in the school subject usually designed by test scores or by marks assigned by teachers.
- Animated media package: Instructional strategy in teaching experimental group that implies application of computer software package plus flash cards in instructional process.
- Animation: Is a way of developing a motion picture using a series of drawings, computer graphics, and photographs of objects.
- Control Group; Group of students taught weather concepts using lecture method only.
- Experimental Group: group of students taught weather concepts using Animated media package.
- Lecture method: Instructional strategy in teaching control group that involves verbal presentation of ideas, concept, and generalization of facts.
- Retention: This is the ability of students to remember material learned (weather concepts) after a given period.
- Weather concepts: Concepts or topic used in teaching experimental and control group and these are:
    i. **Weather**: Condition of a place over a short period.
    ii. **Elements of Weather:** these are variables or indices used in studying weather parameters and include: temperature, rainfall, atmospheric pressure, wind, humidity, sunshine, and clouds.

iii. **Temperature** is a measure of the level of sensible heat of matter, whether it is gaseous (air), liquid (water) or solid (rock or dry soil). The sun is the sole source of energy on the earth's surface.

iv. **Solar Radiation** is the energy, which exists in form of heat and light from the sun.

v. **Normal Lapse Rate** is the increase of temperature at the ground level and a decrease with increasing altitude.

vi. **Rainfall** is the amount of water in liquid or solid form from the atmosphere on to the earth's surface, lakes or oceans.

vii. **Atmosphere Pressure** is the weight of the volume of air that extends from the ground surface to the outermost layers of the atmosphere.

viii. **Instruments for Measuring Weather Elements:** Rain gauge is used in measuring rainfall and consists of a metal container, metal jar or glass bottle and metal funnel. Wind Vane and Anemometer are instruments for measuring wind direction and speed respectively. Hygrometer is used for measuring humidity. It consists of wet and dry bulb thermometer. Thermometer on the other hand measures temperature of a place. It is a narrow glass tubes contains mercury or alcohol.

LIST OF ABBREVIATIONS

Aca.	Academic achievement
APA	American Psychological Association
CAIP	Computer Aided Instructional Package
CG	Control group
EG	Experimental group
GIF	graphic Image Files
GIMP	graphic image processing software
HLPC	Highly Level Policy Committee on Curricula Development
Int.	Interest
MDGs	Millennium Development Goals
NECO	National Examination Council
NEEDS	National Economic Empowerment and Development Strategies
NPE	National Policy on Education
O_1	Pre-test
O_2	Post-test
0_3	Post-post test
Ret.	Retention
STAN	Science Teachers Association of Nigeria
SPSS	Statistic Package for Social Sciences

WAEC	West African Examination Council
WCAT	Weather Concept Achievement Test
WCIQ	Weather Concept Interest Questionnaire
X0	No treatment (Teaching using Lecture method)
X1	Treatment (Teaching using Animated media package:)

ABSTRACT

This study investigated the Impact of Animated-Media Strategy on Achievement, Retention and Interest among Secondary School Geography Students in Weather Concepts; Katsina state, Nigeria. The study has four research objectives, answered four research questions and tested four null hypotheses. The study was quasi experimental with pretest, posttest, post-posttest design. Weather Concepts Achievements Test (WCAT) and Weather Concepts Interest Questionnaire were developed and administered to 116 randomly selected students from a population of 699. The instruments were validated and the reliability coefficients of WCAT and WCIQ were established at r = 0.89 and r =0.9 respectively. Experimental group was taught using Animated-media strategy while the control group was taught using lecture method. Research questions were analyzed descriptively using means and standard deviations, ranks and sum of ranks. Null hypotheses were verified at $P \leq 0.05$ levels using t-tests and Mann-Whitney U-test. Results revealed significant difference in the academic achievement of subjects exposed to the animated media strategy and those taught using lecture. There were also significant differences in the retention and interest of subjects exposed to the same strategy and those taught using lecture method. Subject in the experimental group developed a significantly high positive interest than subjects in the control group. The study revealed no significant difference in the academic achievement of male and female students exposed to animated-media strategy. From the findings of the study, it was recommended among others, the need for Federal and State Ministries of Education to provide computers and projectors for teachers to facilitate their teaching with animations. The training and re-training of teachers on ICT was also recommended.

CHAPTER ONE

THE PROBLEM

1.1. Background to the Study.

Geography is an academic subject taught in senior secondary schools and tertiary institutions in Nigeria. It is the study of natural features and phenomena on the earth's surface and in the atmosphere. It also focuses on locations, space relations, and changes of physical phenomena on the earth's surface. Thus, Geography is geared towards teaching the interrelationships among phenomenon on the earth surface and those in the atmosphere (Abdulkarim, 2010 & Aderogba, 2011).

The objectives of teaching geography at Senior Secondary Schools level were spelt out by National Policy on Education (FME, 2004) and reinforced by examination bodies namely, the West African Examination Council, (WAEC,2013) and National Examination Council, (NECO,2013) and curriculum development body such as Nigerian Educational Research and Development Council (NERDC, 2008). These objectives have been thought of in terms of what geography can contribute to the realization of the aims of secondary education in Nigeria and include; giving students a sound knowledge of their immediate environment; inculcate in students' useful skills and outlooks that will enable them to make useful contribution to their community and nation at large; To develop in students the critical thinking ability, accuracy and objectivity for proper and logical investigation; among others (Aderogba, 2012).

In line with the realization of these objectives, the Senior Secondary School Geography Curriculum was designed to include what the National Council for American Geographers (1994) and National Geographic Society (2003) considered as "five themes of Geography".

These themes are; location; place; movement; interaction; and; region. The NERDC, (2008) in an attempt to restructure Geography curriculum of Senior Secondary School in Nigeria classified these themes as; environment and its resources (weather and climate inclusive); Regional Geography; economic and human geography; Introductory GIS and map reading and interpretation. These themes were planned to be taught within thirteen weeks of school calendar period. The curriculum review in geography by WAEC was carried out to facilitate the realizations of manpower needs of Nigeria.

Weather is the state of the atmosphere within short periods. Parameters of weather include temperature, cloudcover, precipitation, wind and preasure variances (Iwena, 2008). The concept of weather is a component of geography course of study that develops students' skills of observation, measurement, and recording, experimenting, and drawing inference of geographic data (Abdulkarim, 2010). The elements of weather being directly observed, measured, recorded and even predicted range from solar intensities; wind direction and velocity; humidity and precipitation indices; temperature variations; pressure gradients, cloud covers; and soil moisture. Solar intensity refers to the amount of solar radiation reaching the earth surface. Temperature is the degree of hotness or coldness of a place measured using thermometer. Wind is the air in motion characterized by speed and direction and measured by wind vane and anemometer. Humidity is the measure of the dampness of the atmosphere due to water in the gaseous state and which varies from place to place at different times of the day and is measured using hygrometer. Precipitation refers to the rain of the earth's surface from the atmosphere measured by rain gauge. Atmospheric pressure refers to the weight of air over time (Saulawa, 2006).

A technique of teaching weather relies on students making direct observation, measuring, recording, and analyzing weather changes. Another technique relies on students' use of maps,

photographs, models, sketches and the internet. Meteorological or weather instruments used by teachers and students have guided the collection and processing of weather data and daily, monthly and annual basis. The use of these instruments hves also made the teaching of weather concepts easier for teachers, more interesting and meaningful to students. Schools without such facilities make learning theoretical and boring. (Abdulkarim, 2010).

Strategies for teaching geography outlined by scholars range from the use of laboratory activities, lecture, discovery, inquiry, demonstration, problem solving, process approach, deductive and inductive methods, simulation, animation methods among others. Inaddition, efficacy of the methods and their effects on students' academic achievements were also outlined. Obeka (2013), revealed the inquiry and demonstration methods among the most effective strategies of teaching because students' cognitive achievement, interest, and retention of environmental concepts of Geography are attained and facilitated faster than in the other methods. Mahmud (2010), posited that discovery method enhances academic achievement of students in genetic concepts of Biology. Usman (2010), reinforced this idea through the outdoor laboratory activities in genetic concepts of junior secondary Basic Science, while Nsofor, and Ala (2013), recommends the use of media technology respectively.

Academic achievement was defined by Ogundukun, and Adeyemo, (2010) as the exhibition of knowledge attains or skills developed by students in a subject designed by test scores assigned by teachers. However, the Science Teachers Association of Nigeria (STAN, 1992) identified gross under funding, large class size, shortages of qualified science teachers, and poor teaching strategies among others as contributory to students under achievement in science subjects including geography. Reports by Ivowi (1995) and Okebukola (1997) further confirmed that the problems still existed in schools. These reports are a course of concern to teachers,

science educators, curriculum planners, and other key stakeholders including government according to Lekwot, Alkali and Abdulkarim (2004). Other challanges in learning geography outlined by Aderogba, (2012), include large classess, students' limited interest in geography compounded by limited teaching aids and poor teaching techniques. Apart from obsolete and inadequacy of equipments and laboratories for teaching geography, some teachers lacked in-depth knowledge of the subject matter and application of inappropriate teaching methods, (Abdulkarim, 2010). Atadoga and Onaolapo (2008), reported that the kinds of instructional strategies to be adopted by teachers for meaningful learning is dependent on teachers competency, concept to be taught, learners' age and available resources and space.

Researchers (Lawal, 2007; Atadoga, & Lakpini, 2013) found that the persistent low academic achievement in science education is attributed to teacher instructional strategies among others. Thus, instructional strategies used by teachers in teaching-learning process have significant influence on learners' academic achievement. In this study, the researcher investigated the impact of Animated-Media instructional strategy on geography students' academic achievement, retention, and interest in weather concepts of Secondary Schools.

The lecture method in this study is one where a teacher does most of the talking, while the students listen and take notes. The method involves verbal presentation of ideas, concept, and generalization of facts. Lecture method is less tedious, save times and provides fascinating and aesthetically stimulating experience especially for the new students on topics of interest (Obeka, 2009). However, Joshi (2008) opines that lecture method is teacher-centered with little or no participation of students; consequently, they remain passive listeners. Therefore, in this study lecture method was used as a control variable to determine its effectiveness in relation to Animated-Media Instructional strategy.

To overcome the problem of teaching and learning geography, some scholars advocated the use of media in teaching and learning (Kumar, 2008, Abdullahi, 2009, & Thomas & Israel, 2014). Multimedia teaching (MM) embraces the use of animation and cartoon style for its effective delivery. Multimedia approach can be used in teaching subjects like Geography, Biology, Chemistry, Physics, and Mathematics among others. Thus, this study used animated-media instructional strategy (computer, graphic, text, and sound) in teaching weather concepts.

Animated-media teaching strategy is a form of animation instructional method that implies the use of computer animation, graphic and cartoons in classroom instruction. Pilling (1997), defined Animation as a way of making a instructional movie by using a series of drawings, computer graphics, or photographs of objects that are slightly different from one another and that when viewed quickly one after another create the appearance of movement. Literally, animation is moving something that cannot move by itself. It is the technique of photographing successive drawings or positions of puppets or models to create an illusion of movement when the film is shown as a sequence (Mayer and Moreno 2002). The scholars further refer animation as a simulated motion picture depicting movement of drawn (or simulated) objects or as an image in motion. Animation capable features are innovations that can enliven the learning experience. In educational terms, animations can be viewed as a technique of visualization. According to Sanchez, Canas, and Novak, (2010), educational animations are animations produced for the specific purpose of fostering learning. The popularity of using animations to help students understand and remember information has greatly increased since the advent of powerful graphics-oriented computers. The use of technology allows animations to be produced much more easily and cheaply than in former years. Previously, traditional animation required specialized labor-intensive techniques that were both time-consuming and expensive. In

contrast, software is now available that makes it possible for individual educators to author their own animations without the need for specialist expertise. Teachers are no longer limited to relying on static graphics but can readily convert them into educational animations (Pilling, 1997).

Animated-media instructional strategy involves the use of two or more different types of animated instructional media in presentation of lesson. Supporting this view, Mayer, (2001) noted that animated teaching involving the use of Video Compact Disc (VCD), Digital Video Disc (DVD), power point, or 16mm film are sought of animation instruction. Animation teaching could be in form of lesson presentation, in that, still pictures; text, graphics, motion picture, background sound, as well as some narrations are combined at the same time in order to enhance students' understanding of concepts. It also includes the use of interactive elements such as graphics, text, video, sound, and cartoon teaching (Nweke, 2010). The flexibility of learning through animation allows a wider range of stimuli thus increases the students' engagement in learning. Studies by Kearsley (2002) revealed that students who learn from animation have greater self-esteem and motivation in ICT classes. The researcher added that animated pictures are used to support 3-D images in different displays, convey procedural knowledge, demonstrate the dynamics, and allow explorations through manipulations. The present study used animated-media package involving computer projection and observed its impact on students' interest and retention toward weather concepts.

Interest in this study is a feeling of curiosity or concerned of subject, topic (in this case, weather concept) that make attention towards it. Renninger and Hiddi, (2011), put interest as a critical cognitive and affective motivational variable that guides attention, facilitates learning in different content areas, for all students of all ages, and develops through experience. Aggarwal,

(2008), ascertained that the the aim of teaching is to secure the students' attention through arousing and maintaining interest in lessons of multidimensional instructions. Mangal (2010) reported that idle learning environment and methods, functional teaching material and a motivating teacher have positive effect on students'interest in learning. Neumann, Neumann and Hood, (2011) indicated that students' exhibit a high level of interest in solving statistic concepts through animations and have posited the use of media technology as a gatewayto students' inquiry-based scientific investigations. Spatial topography can also be taught through media technology in the measurement of seasonal and weather changes, vegetation transition, terrain and hydrological features.

Retention in this study is the ability to remember tasks, or material learnt concepts. Bichi (2002) defined retention as the ability to retain and recall information or knowledge gained after learning. Other researchers such as Mangal (2010) and Obeka (2010), investigated and defined several variables that affect retention. Factors affecting retention include the content or tasks to be performed, learners past experiences, the interval between lesson and evaluation and instructional strategies employed. Thus, this study incorporated the use of animated-media instructional strategy in teaching and observed its impact on students' retention ability in weather concept at Secondary Schools. It is against this background that this study examined the impacts of animated-media instructional strategy on students' academic achievement, retention, and interest of weather concepts in Secondary Schools of Kurfi Education Zone of Katsina State.

1.1.1 Theoretical Framework

The research on learning with animations and pictures has been conducted from different theoretical perspectives among which are Mayer (2001)'s cognitive theory of Multimedia Learning, Ausubel (1968)'s subsumption model of learning and Constructivism of Piaget(1896-

1980), Resnick, (1989), Saunders, (1992). This study is based on Mayer (2001)'s cognitive theory of Multimedia Learning. This theory proposed that students are able to create a deeper understanding of words when they establish connections between words and pictures than from words or pictures alone. Mayer's theory regards the learner as a constructor of his or her own knowledge, actively selecting, organizing, and integrating relevant visual and verbal information. This theory further claims that information should be presented in such a way that the learners' limited working memory resources are employed as efficiently as possible. This is especially the case with multimedia instruction, where students have to integrate different information sources like text, pictures, and spoken words. The theory provides useful insights into why different combinations of media can have different effects on comprehension and learning. Mayer focuses on the auditory/verbal channel and visual pictorial channel, and defines multimedia as the presentation of material using both words and pictures.

Mayer (2002), proposed a cognitive theory model in order to explain the effects of multimedia materials on learning through: (i) dual channel assumption where the learner processes visual and auditory information through separate channels; (ii) limited capacity where learner's working memory is limited but can process each channel at a time; (iii) active processing wherelearning is integrated as compound information. Mayer's cognitive theory is illustrated in Figure1.1.

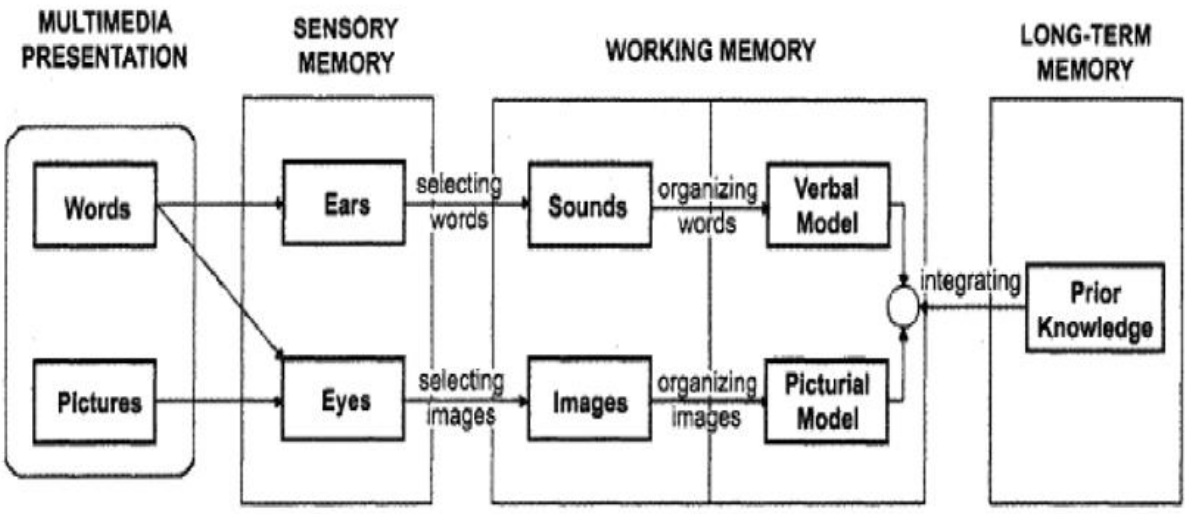


Fig 1.1: Illustration of Mayer's Cognitive Theory of Multimedia Learning

Source: (Mayer, 2001).

Mayer emphasized that the relation between Cognitive Theory and the design of multimedia instruction signifies of the Two-Way Street between cognition and instruction. Protagonist posited that when the relation between cognition and instruction is a two-way street, psychologists and educators communicate in ways that are mutually beneficial to both psychological theory and educational practice significant in this study. Multimedia learning requires that students' get engaged in substantial cognitive processing in verbal and visual presentation (Mayer and Moreno, 2003). The scholars reported that combinations of several multimedia technique optimize interest inlearning, retention, and transfer of knowledge. While animation explores how the brain processes information through pictures and text, multimedia learning is based on instructional messages designed as verbal and visual formats in information-processing systems.

Schar and Kaiser (2006), tested three of Mayer's multimedia learning principles to verify the applicability of Mayer's principles to learning outcomes. Their findings using forty-two Swiss forth-level primary school pupils did not generally contradict Mayer's principles.

However, it revealed the extent to which certain media combinations facilitated learning. Thus, the protagonist believed that there is strong empirical evidence that learning outcomes are improved by presenting the learner with verbal and pictorial information in a coordinated way called ‘‘multimedia principle’’. The current research adapted models of Schar and Kaiser (2006), Thomas, and Israel, (2014) to evolve a motion animated-media instructional strategy for teaching weather.

1.2 Statement of the Problem

On the various studies sited (Osufor, 2001; Amosom, 2008; Aderogba, 2011; Abdulkarim, 2011 & Aderogba, 2012) it was observed that the persistent low academic achievement in geography among students at secondary school level continue to exist especially on weather concepts. Despite several innovative strategies adopted by the teachers on the use of hands-on minds-on activities in teaching the subject, the poor academic achievement, low retention of the learned concepts as well as limited interest by the students persist, as reported by scholars and Chief Examiners WAEC and NECO (2010, 2011, 2012 and 2013). This has been attributed to inadequacy and dismal utilization of geography equipments for teaching, like using computers, globes, meteorological stations, water reservoirs, forest reserved, limited animations and usage of media technology. As such teachers constantly used lecture method in teaching the subject and ignore animations, a gap in the application of media technology to improve students’ performance in weather concepts and refined teachers’methodological techniques in the classroom. Limited literature exist on the impact of animation on students’academic achievement, retention and interest in geography at senior secondary schools in the study area. In addition, in utilizing this method, teachers considered the cognitive aspect of learners and neglect affective (interest). There is a need therefore to provide an alternative teaching strategy which

will hopefully incorporate cognitive, affective and psychomotor domains of students like the use of animated media strategy. The problem of this study therefore is what is the impact of exposure of Geography students to animated media teaching strategy on academic achievement, retention, and interest at Secondary School?

1.3 Objectives of the Study

The study was guided by the following objectives to;

1. determine the impact of animated-media strategy on Senior Secondary School students' academic achievement in weather concepts.
2. investigate the impact of animated-media strategy on Senior Secondary School students' retention of weather concepts.
3. establish the impact of exposure of Senior Secondary School students to animated-media strategy on interest towards weather concepts of Geography.
4. determine the impact of animated-media strategy on male and female Senior Secondary School Students' academic achievement in weather concepts.

1.4. Research Questions

To achieve the stated objectives, the following research questions were formulated to guide the research:

1. What is the difference in the mean scores of Senior Secondary School students taught weather concepts using animated-media strategy and those taught the same concept using lecture method?
2. What is the impact of animated-media strategy on Senior Secondary School geography students' retention of weather concepts?

3. What is the impact of the use of animated-media strategy on Senior Secondary School geography students' interest in weather concepts?
4. How the use of animated-media strategy does affect academic achievement of male and female Senior Secondary School geography students in weather concepts?

1.5. Research Hypotheses

The following null hypotheses were formulated and tested at 0.05 level of significance:

H_{O1}: There is no significant difference in the mean scores of Senior Secondary School geography students taught weather concepts using animated-media strategy and those taught the same concept using lecture method.

H_{O2}: There is no significant difference in the retention of Senior Secondary School geography students taught weather concepts using animated-media strategy and those taught the same concept using lecture method.

H_{O3}: There is no significant difference in the interest of Senior Secondary School geography students exposed to weather concepts using animated-media strategy and those taught the same concept using lecture method.

H_{O4}: There is no significant difference in the mean scores of male and female Senior Secondary School geography students in weather concepts exposed to animated-media strategy only.

1.6. Significance of the Study

This study examined the impacts of animated-media teaching strategy on Secondary School geography students' academic achievement, retention, and interest of weather concepts. The

result of this study might hopefully uplift the standard of geography education in the following ways:

i. Principals of schools might find the outcome of this study very useful in creating awareness on the need of conducting animated studies. This will consequently reduce complaints of insufficient teaching materials for teaching geography and the limitations associated with using laboratories in teaching weather related concepts.

ii. Geography teachers might understand and appreciate the value of using animation in enhancing academic achievement of students and reduce the stress of limited facilities and students being perceive listeners in the class.

iii. It is hope that this study might provide the learning skills of observation, recording, analysis, and reporting of geography phenomena that are likely to be developed among students. This has a philosophical background of inductivist and objectivist scholars who place a significant role of observation in driving scientific knowledge. This will enable provision of meaningful learning and develop conceptual growth in the minds of students when taught weather concept using animated media teaching strategy. It is also hoped that engaging students into lesson might develop their interest in geography.

iv. Textbook publishers and media outlets (print and electronic) may find the study useful to design activities that involve the use of animated-media teaching strategy instruction to aid meaningful learning among students.

v. Fellow researchers may hopefully use the outcome of the study to replicate it in the other study areas, improve on it or adapt it for similar studies and also add more information to the existing literature.

vi. The study might hopefully extent the frontier of learning for further researches on the teaching and learning of weather concepts at Senior Secondary School.

vii. The Association of Nigerian Geographers (ANG) might hopefully use the result of finding of this study to improve teaching of geography at secondary school there by organizing workshops, seminars, and conferences on utilization of animated-media teaching strategy among teachers at secondary school level.

1.7. Basic Assumptions

The present study is based on the assumptions that:

i. Both animated-media teaching strategy and lecture methods are applicable for teaching weather. concept of Geography

ii. Geography students were exposed to weather concepts before the study.

iii. Students in the study area exhibit similar Retention and interest ability

iv. It is assumed that gender may not have any significant effect on academic achievement of students.

v. It is equally assumed that classroom atmosphere will be conducive for teaching and learning.

1.8. Scope of the Study

This study examined the impacts of animated-media teaching strategy on academic achievement, retention, and interest of weather concept. It is delimited to public Senior Secondary School (SSS) students in Kurfi education Zone of Katsina state. The justification for this delimitation is that the study area happens to have many schools from where the samples can be drawn. Majority of the schools are public, running similar curriculum, funded by the same state government, and the same ministry of education is supervising teaching learning process. In

addition, only two schools in the study area were sampled for the study. The sample subjects are from different background and cut across gender. Here, SS II students offering geography as a subject were used. The justification for using SS II students in this study is because the targets groups are stable, unlike SSI who were not fully settles for the study, nor SS III students who are facing their final year examination. SS II students can also able to understand and communicate fairly in English more than SSI students. They are also familiar with weather Concepts due to years of exposure to the concept.

The concepts of Weather used in this study were:

- Defining the concept of weather;
- Terminologies associated with weather concepts.
- Land and sea breaze
- Environmental lapse rate.
- Elements of weather and their units of measurement;
- Instrument in measuring weather elements and precautions for using each instruments;
- Simple skills in observation, recording and reporting of weather data;
- Relevance of weather elements to physical and human activities.

The choice of these concepts were justified by the fact that National geography curriculum prescribed its teaching at this level. In addition, the concept appears mostly in the final year examination of geography (WAEC, 2013). Furthermore, research reports (Abdulkarim, 2010; & Aderogba 2012), confirmed that in most of secondary schools in Nigeria, meteorological instruments for teaching weather concept are lacking resulting to low academic achievement in geography, thus the choice of this concept.

CHAPTER TWO

LITERATURE REVIEW

2.1. Introduction

This study examined the impacts of animated-media instructional strategy on students' academic achievement, retention, and interest of weather concepts. In chapter one of this study, attempt have been made to discuss on the background to the study, statement of the problem, objectives of the study, research questions and hypotheses, significance of the study, basic assumptions, as well as the scope and delimitation of the study. This chapter reviewed some literatures related to this study under the following subheadings:

- Concept and Scope of Geography as Discipline.
- Weather Concepts in Geography Education.
- Instruments for Measuring Weather Elements
- Methods of Teaching Geography
- Academic Achievement in Geography Education
- Academic Achievement and Gender in Science Education
- Students' Retention Ability in Science Teaching
- Interest as a Factor in Science Education.
- Overview of Similar Studies.
- Implications of Literature Reviewed on the Present Study

2.2. Concept of Geography as a Discipline

Geography as an academic subject centers on the evolution and organisation of earths feature and process. In other word, it is the study of man and his environmental features. It also focuses on locations, space relations, and changes of physical phenomena on the earth's surface. It is about how, why, and where human and natural activities occur and how they are interconnected spatially (Mansary, 1992; Ajayi, 2003; Strahler & Strahler, 2006; Aderogba, 2012).

2.2.1 Scope of Geography as a Discipline.

Scope is the range covered by an activity or subject. According to Nigerian Education Research and Development Council (NERDC 2008), major scope and subdivisions of geography are: Physical geography, Mathematical Geography, Biogeography and Human geography. Eventhough, Strahler and Strahler, (2006) organized these subfields into two broad realms of human geography and physical geography. Human components of geography according to scholars (Strahler and Strahler, 2006; Atere, 2006; Obioma, 2008; Abdulkarim, 2010) focus on the socio-economic, population andsettlement, patterns of locations. Hysical geography examines patterns ofthe natural processes occurring at the Earth's surface that provides the natural setting for human activities namely, the study of climate, landforms, Coastal inland and marine waters, vegetation, risks and hazard and soils. In line with this, the NERDC (2008) categorized the scope of geography at senior secondary school level into seven themes (Local Geography, The earth and the solar system, Environment and its resources, Regional Geography of Nigeria, Map reading and Interpretation, Economic and Human Geography and Introductory Geographic Information System). In SS I level, students were exposed to all the seven themes. However, the themes reduced to six at SS II level, and to five at SS III level. At all the levels,

weather concepts were embedded as Environment and its resources theme. The West African Examinations Council and National Examinations Council (2013) detailed the scope of geography at the secondary school levels into physical, human, regional, and practical geography to facilitate students'assessments

The scope of geography globally was described as eclectic in nature. That is to say Geography is inter disciplinary charecteristics branches out to other disciplines such as Biology – (Biogeography), Physics (Geophysics), Medicine (Medical geography), Economics – (Economic Geography), Politics - (Political Geography) Agricultural Science (Agricultural Geography), Computer Information Science (Geography Information Science) among others. These characteristics of geography make it a dynamic subject of study according to Atere, (2006). However, Boehim (1996) and Aderogba (2012), stated that geography provides trained students with a wide career opportunities. For instance, a geographer who study Cartography and Geographic Information System will be a Cartographer for Federal Government (agencies such as Defense Mapping Agency, US Geographical Survey or Environmental Protection Agency or Private Sector (e.g. Environmental System Research Institute, Integral or Bentley); Map Liberian, GIS specialist for Planners, land developers, estate agencies, local government, remote sensing analyst, Surveyor. Physical Geographer can work on weather forecaster; outdoor guide; coastal zone manager; hydrologist; soil conservation/agricultural extension agent. Environmental Studies offered environmental geographer an opportunity to become an environmental manager; forestry technician; park ranger; hazardous waste planner among others.

According to Rilwani, Akahomen, and Gbakeji, (2014), the strength of geography as a subject in the senior secondary school lies in the background training and opportunity it can provide to students who want to pursue different types of professions, among which are careers

in self-employment, professional establishments, paid employment in government and industries and specialized professions Detail of major fields and opportunities in geography is presented in appendix F. This study therefore focuses on weather concept of senior secondary school geography. The concept was embedded under Environment and its resources theme of geography that can be found at SSI, SS II and SS III level. However SS II level were used for this research.

2.2.2. Objectives of Teaching Geography in Schools

The objectives of teaching geography at secondary school level were derived from national educational aims and objectives of the Federal Government of Nigeria (FGN, 2004). The National Aims and Objectives of Education in Nigeria are:

- The inculcation of National consciousness and National unity.
- The inculcation of the right type of values and attitudes for the survival of the individual and the Nigerian society.
- The training of the mind in the understanding of the world around us.
- The acquisition of appropriate skills, abilities, and competences both mental and physical as equipment for the individual to live in and contribute to the development of his society.

According to Atere, (2006) the objectives of teaching geography was linked to what geography can contribute to the realizing the aims secondary education in Nigeria in the following areas:

a. providing students a sound knowledge of their immediate environment.
b. developing students' ability to comprehend and explain natural phenomena.
c. inculcating students useful skills and outlooks that will enable them to make useful contribution to their community and their country.

d. enable the students appreciate problems of other peoples and in fact, to show empathy to them.
e. develop in students the critical thinking ability, accuracy and objectivity for proper and logical investigation.
f. foster in students a sense of responsibility toward their own society.
g. develop in students a comprehension of the spatial relationship and various features on the surface of the earth.
h. enable students comprehend the habitation of man within his environment.

In line with the National Policy of Education (FGN, 2004) and the broad objectives of teaching geography, the West African Examination Council as one of the examination bodies at secondary school level in Nigeria further clarifies these aims and objectives of teaching geography at Secondary School level:

I. Understand the concept of different characters and the spatial relationship of the features on the earth surface.
II. Understand the concept of man-environment relation, that is, to examine and explain the interaction of man with his physical and cultural environment.
III. Acquire the basic knowledge of the nature and function of physical and human environments and understanding of their inter-relationships on the resulting issues.
IV. Organize and formulate principles according to acquired geographical concepts and apply these principles to interpret and analyze spatial problems in the immediate and wide environment.

V. Develop skills and techniques for accurate, orderly, and objective geographical investigations to be carried out both in the classrooms and in the environment (Aderogba, 2012).

In accordance with the National Policy on Education (FGN, 2008), geography as a Senior School subject should therefore help the Nigerian Senior Secondary School students to:

(a) Understand the concepts of differential character and the spatial relationships of the surface features of the earth.

(b) Understanding the concept of man-environment relations (i.e. to examine the life of man within his physical and cultural environments and to explain their interactions).

(c) Appreciate and develop a sense of responsibility towards one's own society and an intelligent interest in the formulation of national goals and policies, especially as they influence the different resources and regions of the area.

(d) Develop sympathetic understanding of the people of other lands, based upon the recognition that they may have different assemblies of resources, different goals and different problems from the people of their home area.

(e) Organize and formulate principles according to acquired geographic concepts, which they can use to analyze and interpret spatial problems in their immediate and wider environments.

(f) To develop skills and techniques for accurate, orderly objective geographical investigations to be carried out both in the classroom and in the immediate environment.

Going by the above, Atere, (2006) and Aderogba, (2012) stated what geography as a subject could contribute towards the realization of national aims and objectives as follows:

a. Teaching Geography exposes students to know more about the immediate environment and the globe at large; appreciate their environment and even realize the need for the judicious

conservation of these resources which is akin to the second national educational aims (inculcation of the right type of values and attitude).

b. Through the teaching of geography, students could acquire certain essential skills such as the art of close observation of natural phenomena, accuracy in the recording and analysis of the collected data, and logical and critical thinking. These skills equip the students for meaningful contribution to the development of their society, and these are in consonance with the fourth national educational aim.

c. The objectives of geography teaching also prepare the students toward the inculcation of the national consciousness and national unity, which is the first national educational aim.

Based on the objectives of geography teaching, this study developed four objectives and examined the impact of animated-media instructional strategy on the academic achievement, interest, and retention in weather concept of senior secondary school geography.

2.2.3 Secondary School Geography Curriculum

The National Policy on Education (2004) considers Education as an instrument for change and development. In order to make it possible for education to fulfill that fundamental role, there is the need to design, plan and implement relevant and related curricula for the school subjects in Educational system of Nigeria. It is that need that spurs the Nigerian Educational Research Council to sponsor the Senior Secondary School Geography Curriculum Planning/Writing workshop between 9th and 19th January 1985 at the Durbar Hotel, Badagry Express Road, Lagos, Nigeria, at the instance of the Federal Government (Atere, 2006).

The Geography Curriculum package that has been developed for the Senior Secondary School Geography programme has many special features. Such features have been designed and built into the curriculum in order to make the teaching and learning of Senior Secondary School

Geography a more challenging, appealing, stimulating, relevant and rewarding experience. Some of the special features of this curriculum package, as observed by Atere (2006), and NERDC, (2008) are the following:

(a) The provision of a geography programme that is based on the choice of suitable and relevant themes; units, content, teaching method, students' activities, teaching aids and evaluation;

(b) The reduction in the scope and content coverage of the subject matter of Senior Secondary School Geography, without losing the high quality required at that level.

(c) The provision of a wide range of experience for students in the use of the concept-centred approach to learning, problem-solving and activity-based techniques for the acquisition of basic geographic knowledge and skills;

(d) The inclusion of innovative elements into the syllabus, through the emphasis placed on practical geography throughout the 3-years course and the introduction of geographic principles, concepts and skills that are relevant to current trends in the discipline and useful for solving environmental problems; among others.

Obioma (2008), explained that following the Federal Government reform in education and the need to attain the Millennium Development Goals (MDGs) and the critical targets of the National Economic Empowerment and Development Strategies (NEEDS), which includes: value orientation, poverty eradication, job creation, wealth generation and using education to empower the people, it has become imperative that the existing curricula for senior secondary school should be reviewed and re-aligned to fit the reform programme.

The NCE at its meeting in Ibadan in December 2005 directed the NERDC to carry out this assignment. In response to the above developments, a Highly Level Policy Committee on Curricula Development (HLPC), made up of critical stakeholders and chaired by NERDC, took

the initiative to provide the guidelines of restructuring the curriculum. The committee held a meeting of experts and workshops between January 2007 and March 2008. The meeting resulted in the production of current geography curriculum module composed of 52 contents to be covered within a total periods of nine (9) terms (NERDC, 2008).

Obioma (2008), added that since the curriculum reflects the total experiences to which all students must be exposed, the contents, performance objectives, activities for both teachers and students, teaching and learning materials and evaluation guide are provided. The prescriptions represent the minimum content to be taught in the schools in order to achieve the objectives of the new senior secondary programme. The teachers are encouraged to enrich the contents with relevant materials and information from their immediate environment, but adapting the curriculum to their needs and aspirations. In compliance with the above, all the topics/ themes of geography in the new senior secondary school curriculum were provided with the contents, performance objectives, activities for teachers and students, teaching and learning materials and evaluation guide (NERDC, 2008).

The curriculum content has provided insight on the kinds of skills to identify measure and test during treatment of subjects. Thus, this study used curriculum content of senior secondary geography curriculum and formed the bases of lesson plan of animated-media instructional strategy and lecture method in relation to academic achievement, retention, and interest in weather concepts.

2.3 Weather Concept in Geography

Weather is the condition of a place over a short period. Ajayi, (2003) defined weather as the condition of the atmosphere at any particular time or over a certain period as shown by various methodology phenomena, including atmospheric pressure, temperature, humidity,

rainfall, wind speed and direction and cloudiness. However, Iweana (2006) opined that weather is the condition of the lower atmosphere of a place over a short period, which is always very brief as changes regularly. It could be sunny, rainy or cloudy. It is the state of the atmosphere in relation to variations in temperature, rainfall, humidity, wind, simple cloud cover and other meteorological conditions. Barry and Charley (2003), and Abdulkarim (2010), distinguished the concept of weather from climate. While the later was regarded as the atmospheric condition of a place over a long period, the former refers to the average weather condition of a place over a long period usually about or over 30 years. This phenomenon is governed by latitude, position relative to continents and ocean as well as the local geographical conditions. This involves the systematic observation, recovery and processing of the climatic elements. Weather of a place can best be understood through its element. Scholars ascertain that weather instruments that can be observed and recorded include temperature, rainfall, atmospheric pressure, wind, humidity, sunshine, and clouds.

Temperature, as observed by Ajayi (2003), and Iwena, (2006), is an important element of weather. It is define as a measure of the level of sensible heat of matter, whether it is gaseous (air), liquid (water) or solid (rock or dry soil). The sun is the sole source of energy on the earth's surface. The energy, which exists in form of heat and light, is called solar radiation. The heat produced warm up the air in the atmosphere and force it to move up and down in different directions. The temperature of the atmosphere varies greatly on the earth surface (Ajayi, 2003). The temperature is highest at the ground level and a decrease with increasing altitude is identified as the normal lapse rate which usually about 6.5^0C for every 1000 meters ascent above sea level. However, Strahler and Strahler (2006), observed that the temperature affect the cloth we wear, cost of food, plant selection, and animals that make up the biological landscape of the

region. Geographical weathering and soil form processes are dependent on temperature over the long term.

Rainfall and other forms of precipitation are other concepts of weather. Strahler and Strahler (2006) defined rainfall as the amount of water in liquid or solid form from the atmosphere on to the earth's surface, lakes or oceans. It is formed when moist air is cooled, causing water vapor to form liquid droplets or solid ice particles. Ajayi (2003), observed that rainfall as an important form of precipitation, which result from the cooling of saturated air in the lower atmosphere. Atmosphere pressure is the weight of the volume of air that extends from the ground surface to the outermost layers of the atmosphere (Ajayi, 2003). In addition, Obeka (2010), observed that numerous measurements of air pressure are used for weather analysis in identifying troughs of high-pressure systems

2.3.1 Instruments for Measuring Weather Elements

Scholars (Ajayi, 2003; Barry and Chorlry, 2003; Strahter and strahter, 2006; Oladipo, 2009; Obeka, 2010; Abdulkarim, 2010; Hadfield, 2012) listed instruments for measuring weather elements to include: Rain gauge; Wind Vane; Anemometer; Barometer; Hygrometer; and Thermometers, Sundial among others.

Rain gauge is used in measuring rainfall and consists of a metal container, metal jar or glass bottle and metal funnel (Ajayi, 2003). Obeka (2009) ascertained that rain gauge is an instrument used to measure the amount of liquid precipitation over set of periods. The researcher posited that most rain gauges record precipitation in millimeters, inches or centimeters either manually or Automatedon.

Ajayi, (2003) observed that rain gauge function better when kept in an open space far from buildings and trees or shelter.This enables the instrument to collect rain water directly and

ensures that no water drops from roof or trees enter the funnel after rain stopped. With daily examination, it is kept in good condition for effective recording. It is sunk into ground such that 30 centimeters of it is above the ground level where the need arises.

Wind Vane and Anemometer are instruments for measuring wind direction and speed respectively. Wind vane work by moving to minimize air resistance. Wind vane consists of freely rotating arrow pointing to the direction of wind movement. Wind speed is measured using anemometer. It consists of three or four cups attached to the ends of the horizontal spaces mounted on a higher vertical spindle. Obeka, (2009) observed that in primitive situation where these instruments are not available; finger technique were used to test the direction of wind. This is attained by wetting the finger and raising it upwards. The coolest side of the finger is the direction from where wind is blowing.

Hygrometer is used for measuring humidity. It consists of wet and dry bulb thermometer. Thermometer on the other hand measures temperature of a place. It is a narrow glass tubes contains mercury or alcohol. Strahter and Strahter,(2006) reported that temperature is measured in degrees celcious (^{O}C) or Fahrenheit (^{O}F). Two types of thermometers noted by scholars are maximum thermometer (which measures the highest temperature attained during the day) and minimum thermometer (which records the lowest temperature reached during the day). Thermometers are kept in Stevenson screen, designed to protect it from direct sun and rains and to attain correct recordings at a period. (Ajayi, 2003, Strahter & strahter, 2006, Obeka 2009, & Abdulkarim, 2010).

In geography, scholars (Barry and Chorlry, 2003, Strahter and strahter, 2006, Oladifo, 2009, Aderogba, 2010, Abdulkarim, 2011) observed that the teaching of weather is an essential component that develops the skills of observation, measurement, recording, experimenting and

making influences of geographic data among students. This involved the use of measuring instruments such as rain gauge, thermometers, and barometers among others.

This study investigated the impact of the use of animated-media instructional strategy on academic achievement, retention and interest of geography students in weather concepts.

2.4 Methods of Teaching Geography

The concept of "method" refers to the ways, approaches, procedures, and kinds of activities that teachers and students engage in the interactive process with a view to inducing, inspiring, and facilitating learning for accomplishing a set of instructional objectives. According to Okam, (2009), method include utilization of appropriately selected curriculum materials, content and learning experiences, motivational strategies, an application of learning theories and a demonstration of a knowledge of developmental psychology or other aspects of educational psychology in the teaching learning process.

Scholars (Amosun, 2008, Joshi, 2008, Okam, 2009, Usman, 2010, Obeka, 2010, Abdulkarim & Lawal, 2012, &Aderogba, 2012) opined that there have been varieties of methods and techniques for teaching sciences. Most of these are in use and each of them provides something useful and worthwhile to a capable and enthusiastic teacher. None of these methods are error proof; because they have limitations. These methods include:(i) Lecture method (Brown,1997, Umar, 2006, Maikano, 2007 & 0kam2009);(ii) Project method (Ogunsanya, 1992, Atere, 2006 & Okam, 2009); (iii) Inquiry Method (Adedoyin, 1990, Mansaray, 1992, Obeka 2010, Olajide, 2009); (iv) Discussion Method (Ibrahim 1998; Atere, 2006; Okam, 2009); (v) Simulation method (Ughamadu, 1992, Atere, 2006, Obeka 2009); (vi).Fieldtrip method (Ajaegbo, 1995, Omolade, 2002, Atere,2006 Busari, 2009); (vii) Laboratory activity method

(STAN, 1998, Malkano, 2007, Olajide, 2009, Aderogba, 2010, Usman, 2012); and (ivii) Animation method (Mayer, 2001, Rule, & Bjzek,2010, Tayo, 2011, Lin, 2011, Pagliano, Brown, Figen,2012 & Aksoy, 2013). This study used the animation and lecture methods to guide in testing the subjects.

2.4.1. Animation Method

Animation is a way of developing a motion picture using a series of drawings, computer graphics, and photographs of objects. It is a technique of photographing successive drawings or positions of puppets or models to create an illusion of movement when the film is shown as a sequence. Pilling, (1997) define animation as "created performance," that is carefully worded to establish validity and secure resources for an animation program or class. According to Mayer and Moreno (2002), animation refers to a simulated motion picture depicting movement of drawn (or simulated) objects or moving something that cannot move by itself.

Schnotz and Bannert (2003), describes animation as the rapid succession of pictures indicating a series of slides, appearance and disappearance of iconic element continually. In educational terms, animation is a technique of visualization. Sánchez, Cañas, and Novak,(2010) describe educational animations as animations produced for the specific purpose of fostering learning. The popularity of using animations to help students understand and remember information has greatly increased since the advent of powerful graphics-oriented computers. This technology allows animations to be produced much more easily and cheaply than in former years. Previously, traditional animation required specialized labor-intensive techniques that were both time-consuming and expensive. In contrast, software is now available that makes it possible for individual educators to author their own animations without the need for specialist expertise. Teachers are no longer limited to relying on static graphics but can readily convert them into

educational animations. According to Thomas and Israel (2014), animation teaching is a device that has the features of both audio and visual representations that are used in the teaching/learning process for effective dissemination of knowledge. Thus, animation teaching enhances learning of service subject.

Lin (2011) ascertained that animation has been used in various discipline to deliver instructional material that is hard to present alone using static visuals or that contains content that is highly abstract or invisible to human eyes. Thus, in computer based instructional environment, animation is typically used due to its inherent characteristic that facilitates the teaching and learning processes. According to Aksoy (2013), animation has three characteristics, namely; the picture; display of movements and Simulation. Animation corresponds to the context of the topics, otherwise it becomes distracting, and the intended objectives of using it defeated. The study therefore centers on animations as the rapid display of sequence of pictures on computer screen that has the potential to provide feedbacks in students' achievement, interest and retention in learning.

Animation history draws back to 1880s. The first animation films date back as early as 1910 when cartoon shorts began showing in theatres. Since then, numerous animation films have been released expanding into more complex films that require a breadth of different from the previous cartoons to motion animations. Algilasi (2010), maintain that most of the first films were French and released in America. The Warner Brothers produced some of the most notable motion pictures of the 20th century.

The continuous development of technological inventions allowed animators to excel in this field. Hoban and Nielsen (2010) observed that the worldwide explosion in personal digital technologies offers increasing opportunities for students in primary or secondary schools to

create their own digital media. Waldrip, Prain, and Carolan (2006), has attributed this exponential growth in personal digital technologies with a growing body of research which suggests that getting students to create a multimodal representation of a science concept is a good way to enhance learning. A representation is a sign that stands for something else and can be expressed using different modes — by text, photographs, sketches, voice, numbers, graphs or models. It is through developing a sign and thinking about its meaning that students develop a better understanding of what it is meant to be representing. Importantly, research (for example, Hoban & Nielsen,2010) has shown that constructing a representation helps students to make meaning of a science concept and this is often preferential to students copying an expert-generated representation from a textbook, which is a common practice in classrooms.

Rieber (1991), posited that animations assist students to understand abstract and invisible processes and can improve students' learning motivation. David and Dan (2002), asserted that a successful animation syllabus is interdisciplinary, and encourages students to develop effective skills and practice interactive activities. Wu and Shah (2004), observed the neglect of determining the impact of animation to students' mind, thus understanding the information of the animation may differ, and it depends on the sex and the spatial visualization understanding ability.

Use of animations has been strongly encouraged as an innovative, constructivist and students-centered alternative to the traditional learning approaches in many countries. Studies from many countries have demonstrated positive effects, which the use of different and innovative methodologies and visualization technologies may have to students' understanding of central scientific concepts. For instance, in Estonia animations have been shown to be beneficial in science lessons (Soika, 2007). The use of activating and innovative learning technologies in

Estonia is also encouraged by the new national curricula for basic school and gymnasium. In these official documents, learning is emphasized as a process during which a student actively constructs personal knowledge in continuous interaction with his/her social environment.

English and Rainwater (2006) study the instructional effectiveness of using animations to teach learning objectives in an undergraduate operating systems course. Statistical analysis using a paired t-test indicates inclusion of animations in an undergraduate operating systems course yielded significant overall student achievement gains as measured by pretest and posttest scores. Many instructors in computer science today are reluctant to design and include animation and visualizations as teaching tools due to time constraints and doubts about their benefits.

In Germany, Hoffler and Leutner (2007), studies the effect of instructional animation versus static pictures. The meta-analysis revealed that animation is superior over static picture presentation. In Malaysia, Rahmat, (2010) indicated that computer animation learning courseware had given a positive impact on student's performance in visual art education subject. In China, Hwang, Tam,Lam and Lam (2012), have demonstrated that the use of animations as supplementary learning material of physiology content in four academic years is effective in improving learner's academic achievement. Here in Nigeria,

Owolabi and Oginni (2014) ascertain that there is a significant difference in the performance of science students exposed to cartoon animation than their counter part exposed to lecture method only. The difference is in favor of students exposed to treatment.

2.4.1.1 Classification of Animation Technique

Scholars (Anderson, 1993; Mayer, 2001; O'Day, 2007; Rahmat, 2010 & Awad, 2013) hold the view that there are three main types of animation techniques: Traditional animation, Stop motion and Computer animation.

1. Traditional Animation: Films produced this way are originally drawn on paper. Each frame slightly differs from the one before it to create the illusion of motion. The drawings are photocopied into transparent acetate sheets called cells, and are filled in with paints of assigned colors or tones. Therefore, this technique is often referred to as paper/ cell technique. This method first appeared in the 20th century. By the 21st century, photographed or scanned frames replaced hand drawing film frames (Anderson, 1993).

2. Stop Motion: Animators physically manipulate actual objects and photographing them one frame of film at a time to create the illusion of movement. There are many different types of stop-motion animation including puppet animation, clay animation, cutout animation, graphic animation, etc.

3. Computer Animation: Computer animation creates the illusion of movement through a succession of computer-generated still images. This digitally created animation encompasses a variety of techniques including 2D animation and 3D animation. This animation takes less time than previous traditional animation.

Computer animation holds a great potential as a tool for creating multimedia instructional environments. Instructors can use computer animation to demonstrate learning materials visually as they want and they can control every aspect of the animation. According to Mayer's Cognitive Theory (2001), the computer is a system for delivering information to students. The instructor's role is to present information, as words or pictures, or both, and the learner’s role is to receive the information. Adding pictures, such as animation, should deepen the meaning of the presented information and give it a physical translation.

In this study, computer animation called animated-media instructional strategy is used as treatment to experimental group. The animation involves power point projection of the animated software of weather concepts.

2.4.1.2 Animated-Media Instructional Strategy

Animated-media instructional strategy is a form of Computer Aided Instructional Package (CAIP) that implies application of computer software package in instructional process. It is the integration of hardware and software (Alsultan & Abdullah, 2006). It represents some aspects of reality that one is unable to present directly to the learners, because it presents image, sound and action. According to Nsofor, and Ala, (2013) any instructional process that evokes the involvement of as many of the human sensory organs tends to facilitate the permanency of learning.

Multimedia instructional environments and animated models are widely recognized to improve the way that people learn (Mayer, 1999). In multimedia instructional environments, students are exposed to material in a verbal as well as a pictorial form.

In this study, the researcher adapts animated-media instructional strategy of weather concept as instructional strategy for teaching experimental group. The animation was developed with the aid of: Microsoft office power point 2007; Adobe flash files (soft files); and; GIF animated images: internet downloaded meteorological instruments. These components were embedded into the Microsoft document to form a single animation package. Adobe flash files (soft files) were imported into the power point using computer software named “adobe acrobat”. GIF animated images were developed using computer software called Graphic Image Processing software (GIMP). Images used in the package were downloaded from www.flicker.com;

www.tumblir.com; and; Google images. Adobe flash software is used to independently play all soft files.

2.4.1.3 Advantages of Using Animation in Teaching

Morison and Tversky (2001) posits that animation with graphic convey spatial information better than text alone because they represent space with space. Weiss, Knowton and Morison (2002), uphold that animations have five functions; namely; connection; attention gaining: motivation; presentation; and clarification. Stih (2004) positioned that these animations provide a valuable ways of communicating dynamic, complex sequences of physical events effectively better than graphs.

Additional advantages of animation were reported by Agina (2003) to include;

1. Skill and Ability Improvement; The interactive animation takes less time to teach students complex concepts and facilitate faster learning of difficult topics. Using an interactive animation solves the problem of the imagination-skill in education and training.

2. Interactivity: This is a mutual action between the learner, learning system, and learning materials. Students learn faster and develop positive attitudes toward it.When using audio and video techniques are employed, the interaction gets more motivating to students.

3. Engagement: Interactive learning with live-action animation, simulation, video, audio, graphics, feedback, expert advice, and questions and answers maintain students' interest and reinforce skills. Through continual practice, learning is absorbed and integrated into daily performance.

4. Motivation: Since animation is an inspired and interactive way for flexible education and training, students will be more motivated to learn

5. Immediate Feedback: Students get an immediate feedback from the animation system, which will enhance their skills and abilities.

6. Animation programs are noted for their flexibility and practicality. They aid students through attracting and holding their attention.

Animation aims to reduce students' time in learning, more practical and task-oriented. It leads to greater long – term memory retention (O'Day,2007). According to Ainsworth (2008), affective account of learning with animations suggests that, learners may often report increase in satisfaction and motivation. Ling (2011), states that animation has been used in various disciplines to deliver instructional material that is heard to present alone using static visuals or that contains content that is highly abstract to human eyes. Animation provides feedback in various forms that may be both entertaining and motivating to learn stringing for the correct response. Aksoy (2013), maintains that computer animation technique enables higher academic achievement in comparison to traditional teaching methods. Riaza and Halimah (2008) reported that students perform better in recall scores when animation and narration were used in teaching.

2.4.1.4 Disadvantage of Using Animation in Teaching

Despite the benefit of animation teaching, scholars maintain that it has some hindrances. For example, Morison and Barbara (2001), states that although animated graphics uses motion to show change over time presenting information about change over time with animated graphics, which did not enhance learning beyond presenting motion graphics. Agina (2003), supported that animation has the following disadvantages:

1. Some information of real-life learning is lost in the animation processes.

2. Computer animation programs function better during sessions than in the translation of a course of study.

3. Animation programs cannot be adapted to take into account different student levels and consideration within a group or class.

4. Animation programs requires special equipment for a quality presentation.

5. Animation programs cannot depict actuality like videos.

The researcher concludes that the use of animation programme as a process for creating interactive learning environment helps students with visual tendencies to understand and maintain the learnt material. Al-Khalifa (2005), comments that, there appears to be difficulty in determining whether animation is more effective than verbal/pictorial representation or vice versa. Ainswort (2008), is of the view that, an analysis of motor and perceptual consequence of learning with animations shows that while they make dynamic information explicit, it should reduce the amount of cognitive effort required, to team about the dynamic system. They also introduce significant problems for perceptual processing and memory because of their transcend nature. Therefore animated-Media package involving computer (Microsoft power point), cartoons, flash cards, and animated weather concepts software was used as a treatment in this study.

2.4.2 Lecture Method

Lecture method involves verbal presentation of ideas, concept, and generalization of facts. The method is one of the science teaching instructional strategies that encourages rote learning and regurgitation of information without necessarily aiding understanding and this does

not enhances academic achievement as observed by scholars (James, 2000; Bichi, 2002; Umar, 2006; & Maikano 2007).

Lecture method is also refers to as expository method because it is teacher-dominated and learner's passive method (Atere, 2006). In using this method, the teacher talks while the students listen (Maikano, 2007). Lecture method is also known as talk-and-chalk method in a situation when the teacher decides to write the summary of the points s/he has taught on the board (Joshi, 2008). In lecture method, the teacher delivers pre-planned lesson to the students with little or no instructional aids in lecture method. (0kam, 2009).

Lecturing, as a method, is used largely to build up basic theoretical knowledge, which must be acquired by the students before he/she is able to display practical skills and undertake practical tasks in the laboratory. It is highly valued in a situation where the number of students, who are benefiting from it is quite large and in a situation where there is inadequate number of competent and qualified teachers coupled with the insufficient instructional materials, lecture method with note taking technique may be more effective than any other methods. In fact, in teaching geography, lecture method will be more effective in a very large class situation in which the teacher combines the method with the effective use of instructional materials, questioning technique and other appropriate strategies that can be employed based on the classroom situation, (Atere, 2006, Okam, 2009).

Joshi (2008), ascertained that lecture method serves four basic purposes, namely; (i) motivating students to learn; (ii) Clarifying students' problems during lessons; (iii) Reviewing classroom work in order to improve students' mastery of the subject; and (iv) to expand ideas, knowledge or information in order to engender interests and mastery amongst students. In general, the approach becomes effective if the purpose is clearly understood.

Okam (2009), reflects that the lecture method is used in achieving the following designs in teaching:

- Provision of some relevant background materials and information which bear on a topic or lesson
- For introducing a new different topic
- Summarizing and recapitulating certain generalizations
- For providing supplementary information beyond what textbooks have to offer
- For explaining certain theoretical principles or points which cannot be easily demonstrated
- Explaining demonstrations that have been executed.

Scholars (such as Mansaray, 1992, Ogunsanya, 1992, Joshi, 2008, Okam, 2009, Atadoga & Lakpini, 2013) have identified some merits and demerits of lecture method in teaching-learning processes as follows:

- The lecture method is useful in imparting factual information in an efficient manner to convey facts, concepts and principles to students who have difficulty reading their texts
- It is easy and convenient for the lecturer to deliver his prepared lectures without hustles of practical demonstration; also, the lecturer hardly considers the possibility of students' participation.
- Good lecture can motivate, inspire, and instigates a student towards creative thinking and helps to get thinking patterns of students to be more focused.
- The method is convenient and suitable for carrying out a number of academic activities and responsibilities during certain occasions. Some of these activities include: (i) introducing a topic (ii) summarizing a subject-matter; (iii) giving instruction before

performing any laboratory experiments; (iv) explaining complicated and difficult experiments; (v) giving historical accounts of scientific events, scientific discoveries and inventions; (vi) describing the lives of great scientists, their achievements and contributions to science.

Lecture method is associated with the following shortcomings:

- There is no provision for activities in the method as students are reduced to the status of passive listeners. This implies limited development of scientific attitude and training.
- It does not take care of observation, experimentation, drawing inferences as there are no opportunities for students to engage in practicals
- It does not provide immediate mechanisms for ascertaining students' level of understanding and mastery of what is being taught.
- It does not cater for individual needs of students.

As noted by Bligh (2000), the standard lecture format may not be the most effective way to promote thinking and develop attitudes, but changes to lecture techniques may help to overcome such limitations. Selecting appropriate lecture techniques is also one-way to help lecturers become more effective. As such, there remains considerable scope to explore the use of technology in enhancing the delivery of, and ultimately, the learning outcomes of a lecture. This study used lecture method as an instructional strategy for teaching the control group.

2.5 Academic Achievement in Geography Education

Academic achievements in geography is the exhibition of knowledge attain or skills developed by students in the subject usually designed by test scores assigned by teachers. It is an indication of the types of learning and its environment in a teaching and learning process. According to Aydın and Coşkun (2011), the scores in examinations and the passing notes in class

usually determine the achievements of the students about the course (geography). It can also be in the final year examinations conducted by examination bodies such as WAEC, NECO and NEBTEB (Aderogba, 2012).

WAEC as an examination body have outlined some weaknesses resulting to poor achievement of students in the final year geography examination. For instance, in Nov/Dec 2009, Geography Paper 1 question number three dealt with aspect of weather and climate. The WAEC chief examiners report on this question revealed that many of those who attempted it could not correctly plot the combined temperature and rainfall graph for the station; quite a good number of the candidates could not correctly calculate the annual rainfall; and that many of the candidates could not correctly deduce that the rainfall and temperature distribution shown in the station represented that of the Tropical Continental Climate.

Furthermore, chief examiners' report (WAEC, 2011), indicated that students performance in questions related to weather and climate is relatively poor. This is because majority of them could not indicate the correct unit of measurement of annual rainfall and mean annual rainfall. In addition, majority could not correctly indicate the instruments of measuring pressure, humidity, and rainfall. Some of the candidates could not describe the effects of climate on agriculture temperature is measured using thermometer. The situation is the same in 2012 were majority of students who sat and attempt for November/December, 2012 geography paper question number 1B, could not properly explained the factors affecting weather and climate. Such factors include; cloud cover and humidity; insulation; planetary wind; ocean current; latitude and altitude among others (WAEC, 2012).

Scholars (Sabitu & Nuradeen, 2010; Aderogba, 2012; Rilwani, Akahomen, & Gbakeji, 2014) have identified several factors influencing students' academic achievement in geography as a course of study including class size, laboratories, instructional strategies, textbooks, guidance and counseling services, academic and professional qualification of teachers, teachers' attributes, students' attributes, peer groups, parental and home background, and school environment among others. According to Sabitu and Nuradeen, (2010) the success of any teaching and learning process, which invariably influences students' academic achievement depend on how effective and efficient the teachers are. Teacher knowledge plays a significant role in classrooms, as it can affect teachers' choice of appropriate strategies during the teaching process.

Furthermore, Akintade (2011), stated that, it is very important that a secondary school geography teacher should be academically articulate in his area of specialization. Zarei and Sharifabad, (2012) observed that teachers can be different from each other based on the experience they have attained during teaching. Thus, the influence of teachers' teaching effectiveness on the learning outcome of students as measured by students' academic achievement has been the subject of several studies (Adediwura & Tayo, 2007). Rilwani, Akahomen, and Gbakeji, (2014) suggest that effective teaching is a significant predictor of students' academic achievement; therefore, effective teachers should produce students of higher academic achievement. According to Ofoegbu, (2004), poor academic achievement of students in Nigeria has been linked to poor teachers' performance in terms of accomplishing the teaching task, negative attitude to work and poor teaching habits, which have been attributed to instructional strategy. In this study therefore, the impact of innovative teaching strategy (animated-Media instructional strategy) on academic achievement of geography students in weather concepts have been examined.

2.6 Academic Achievement and Gender in Science Education

Academic achievement as a variable in students' learning has been a matter of concerned in the present day research. Busari (2000) defines academic achievement as the level of performance in the subject as exhibited by an individual. According to Ogundukun, and Adeyemo, (2010), Academic achievement is the exhibition of knowledge attain or skills developed by students in the school subject usually designed by test scores or by marks assigned by teachers which can be low or high.

Researchers (Lawal, 2007; Usman, 2010; Atadoga, & Lakpini, 2013) found that the persistent low in academic achievement is attributed to teacher instructional strategies among others. Thus, instructional strategies used by teachers in teaching-learning process have significant influence on learners' academic achievement. Atadoga and Onaolapo (2008), states that, instructional strategies adopted by teachers at all levels of education in imparting knowledge and skills to the learners are determined by teachers abilities, topic to be taught, learners age, available resources and available space. Thus, Poopola (2010), ascertained that, academic achievement is a function of a various factors such as method of teaching, teachers' qualifications, child's home background, school environment, attitude, interest among others. Ogundukun, and Adeyemo (2010), added that, academic achievement (low) is related to the decline in the availability of teaching resources in the school.

The concept of "gender" in teaching and learning process has attracted the attention of many psychologist, biologists, and researchers as a result of which a lot of literatures exist on different aspects of the concepts (Bichi (2002). Research question number four of this study focuses on academic achievement of male and female students in weather concept. This

necessitates the researcher to review some relevant literatures on gender and academic achievement in science education.

A considerable amount of researches has focused on gender differences in school learning (Nsofor, 2010). Male show more positive attitudes toward science than females (Prokop, Tuncer & Chuda, 2007). Moreover, a careful consideration of the statistics of contribution of gender in Science Technology and Mathematics (STM) in Nigeria reveals that the participation of women is significantly low (Olagunji & Abiona, 2008). Evidences have supported this view in almost every science and technological based organization. Some studies have found gender disparity in the use of instructional methods on students' achievement in favor of male, (Mari, 1994; Bichi,2002; Usman,2007;Olagunji & Abiona, 2008; Olorukoorba, Lawal, & Jiya 2012,&Obeka, 2013). Others have found none (Haruna,2000, Maikano, 2007, Mari 2010, Usman, 2010). Studies have also revealed that, the application of instructional treatment on a mixed gender school population improves the academic achievement of students at the same time yield to different responses or results (Patrick & Ezenwa, 2000).

Alpha (2007), in a research on Gender Disparity on Achievement in Mathematics of Senior Secondary School, opined that performance of males is higher than that of females. In support of this, Usman (2007), compared the Relationship Between Students Performance and their Academic Achievement in Biology using NISTEP mode of teaching reveals that senior secondary male biology students perform well in any rigorous work than their female counterpart. In a similar vein, Obeka (2009), conducts a research on EPODEWALAD and Power Simulation games of geographic and environmental education. Findings of the study, among others, revealed that gender is a significant factor in students achievement in environmental

education concepts of geography with male students performed better than their female counterparts are.

On the contrary, study conducted by Mari (1994) on "Understanding of Science Process and its Relationship to Achievement in Integrated Science" argued that females perform better than males in integrated science. Bichi (2008) work on "Effects of Gender on Historically Enriched Curriculum on Academic Achievement in Evolution Concept Using Senior Secondary Biology Students. The finding revealed disparity among gender in support of girls.

The findings of Haruna in his study (2000) reveal that there is no significant difference in the performance of gender in chemistry. Maikano (2007), find no significant difference in the academic achievement between male and female students taught ecological concepts the outdoor laboratory instructional strategy. Mari (2010), supports this assertion in his study on entry qualification and performance. The result shows that male and female students admitted with the same entry qualification have no difference in their performance. In addition, Usman (2010), opines that outdoor laboratory method enhances academic achievement of students in spite of their gender.

The causes of disparity between male and female student as observed by Yaga (1992) is the characteristic nature of teachers who were more friendly with boys than girls. Usman (2000), and Aigboman, (2002), added that is the ways science is being taught in the classroom that cause the disparity between male and female students. American Psychological Association, (APA, 2010) suggests that social and cultural factors perceived or actual performance difference, can also be responsible for this disparity.

In a study titled "Effects of Constructivist Teaching Strategy on Gender in Learning of Addition and Subtraction Skills at Primary School Level "conducted by Kajuru and Ado (2012),

establish that, innovative teaching strategies with integrated resource materials enhance academic achievement of students. In similar vein, Obeka (2013), studies the effects of innovative teaching strategies with integrated resource materials on academic achievement for access and quality environmental education. A sample of 85 students was selected using intact-classes in two senior secondary schools in Otukpo educational zone Benue state, Nigeria. The study employs quasi experiment, test, and posttest design. Four hypotheses raised were analyzed using t-test. The result of this study further shows that using lecture method with integrated standard and improvised instructional material, influence academic achievement consequently, this helps the students to collaborate in a practical rather than passive manner, which has positive effect on students' academic achievement.

Academic achievement and gender are variables in this study for determining whether Animated-Media is gender stereotype or not. Hence, two instructional strategies were used to determine their impacts on the academic achievement of male and female senior secondary geography students.

2.7 Students' Retention Ability in Science Teaching

Retention as a variable in this study is the ability to remember things, task, or material learned (for example, weather concepts) previously. It is the endurance of behaviors, which have been learned, or acquired when the behavior is not being utilized. Bichi (2002), sees retention as the ability to retain and later recall information or knowledge gained after learning.

Mukherjee (2002), maintains that retention has to do with the ability of human beings to reproduce past learning. Every individual shows some degree of mastery to reproduce his past learning or experience. For this to happen, three stages of human behavior have to be considered, viz- (a). There must be some initial learning experience, (b) there must be an intervening period

during which individual stores the learned materials and experience, and (c) there is the final stage of reproduction of the initially learned materials or experience.

Aggarwal (2008), regards the term retention as the process of relegation of the past experience in the sub-conscious mind of the individual in the form of mental experience. In similar vein, Suleiman, (2011), defines retention as the ability of one to remember what he has learned in the later time, it takes place when learning is coded in to memory. It is one of the four main elements of memory (others are learning, recall, and recognition). However, Mangal (2010), reports that these four elements have been replaced by three distinct stages (encoding, storage and retrieval). The storage stage is concerned with the power of retention of encoded information.

Educational psychologists have used retention as one of the criteria for distinguishing between short term and immediate memory (Ladan, Dantani. Ayas &Adamu, 2009).The initial stage of memory process is learning. If there is no sufficient intelligence for learning, there can be no retention.

Mangal (2010), ascertained that in immediate memory, the retention time is less than one second while in short term memory the period of retention can be extended to quite a longer duration as a result of the proper efforts and rehearsal by students.

Retention of learned materials, as a variable in students' learning, can be measured. Aggarwal (2008), identifies four methods of measuring retention. These are: Recall or reproduction; Relearning or saving method (this involve calculating the number of trials taken to learn materials in the beginning and note down the savings of trials relearning it after some lapse of time); Recognition; and; Reconstruction. A good memory and retention lead to meaningful

learning leading to production of a series of changes within our entire cognitive structure, modifying existing concepts, and forming new linkages between concepts

According to Bichi (2002), permanent and meaningful learning is the target of our educational endeavor. Understanding and retention are the products of meaningful learning when teaching is effective and meaningful to the students. Thus, appropriate coding of incoming information provides the index that may be consulted; so that retention takes place without elaborate search, ability retains and consequently remembers what we have experienced, or what we have in the memory (Oyedokun, 1998 & Adeyemo, 2010).

Several factors influence retention. For example, Blair and Simon (1998), states that anything that aid learning should improve retention while things that lead to confusion, or interference among learning materials decrease the speed and efficiency of learning and accelerates forgetting. Interference may exist in several forms such as retroactive inhibition, or emotional inhibition. Retroactive inhibition occurs when things are learned, the result of that learning usually occurs after a passage time. In the intervening period, many other things are learned. This interpolated learning interferes with the memory of the original materials and the interference is known as retroactive inhibition (Suleiman, 2011).

Paul (1999), as cited in Suleiman (2011), ascertained that retention is base model for which the meaningful stimuli are processed by the brain at a deep level. This model is attributed to the long time memory (retention) which is based on our ability to process semantic knowledge deeply by associating recall items. Retention constitutes learning and recall. Mangal (2011) ascertained that retention of learned material could be improved through:

1. Being free from excessive anxiety, fear and other emotional factors which tend to block memory.

2. Developed self confidence and never think that you would not be able to recall something
3. Association of ideas, connection, and systematic thinking are very helpful in the task of recall.
4. Never strain self for too long to recall something

Method of learning or sending is the easiest way to measure retention. Sometimes after several years have gone, we cannot recall single line of materials learned early, yet we attempt to memorize it again, we find it comes back rapidly as before (Ladan, Dantani. Ayas & Adamu, 2009). Memory is a process involves in the retention of material. A mechanism in which an individual stores information for a short period of time (short-term memory). Long-term memory is the permanent repository of information acquired from the world around us.

Retention is an aspect of long-term memory, which has a seemingly limitless capacity to store information with little or no decay and requires little, if any, rehearsal (Mangal, 2011). However, Mukherjee (2002), states that, in order to improve learning retention, the following factors has to be considered:

1. Since individuals differ in their ability to retained learned materials over a period of time, the teaching methods ought to be different and varied to meet the need of everybody in the learning situation.
2. 2. During teaching, various forms of group labeling, closure etc should be employed.3. Attempts should be made to create situation for proactive and retroactive facilitations, and to minimize their effects on inference, by suitable planning of curricular and sequence of the lessons.

3. There should be provision and time for recapitulation and revision of the learned materials during each lesson, and in each week, students should be encourage to improve on their study habits, note taking, recording and reading.
4. Care should be taken in the transmission of information by providing for gaps or pauses, and using a language of highest redundancy.
5. Spaced practice instead of massed practice should be encouraged to enhanced retention of the learned materials; in the same way, students would benefit from part and whole learning of the text than trying to memorize the text by the whole method only, should be encouraged.
6. Since understanding plays a vital role in one's ability to recall at a later stage, emphasis should be given on understanding than learning by rote or repetitive drill of the same material.

Blair and Simon (1998), conducted an experiment on the Effect of Traditional Learning Method in Teaching two Sections of an Undergraduate Course on the Retention. The researchers discovered that those students taught using inquiry method had better retention ability than those taught with traditional lecture method.

Based on studies in other disciplines showing the value of a proper narrative, O'Day (2006), in his study "Animated cell biology: a quick and easy method for making effective high-quality teaching animations" posited that group viewing the graphic with a legend obtained a much higher mean retention grade (80.6%) compared with those who viewed the graphic lacking a legend (58.1%). Viewing the figure with a legend also led to slightly higher initial marks than the respective un-narrated animation (75.0%). These suggestive data support the widely held view that animations enhance the pedagogical value of visually presented information.

Aggarwal (2008), stated that, one of the important aims of school instruction is to encourage the students to acquire and to retain the knowledge imparted in school for future use in school life and in meeting out-of school life problems of the present and future, hence it is very essential to take proper steps to enable students retain and recall easily.

In addition, many researchers have also investigated and defined several variables that affect knowledge retention. Obeka (2010), added that, they include the type and content of tasks to be learned, amount of original learning, instructional strategy used and length of retention interval. It is not uncommon for geography students to learn material, take examination, and forget the material there after.

This study incorporated the use of animated-media instructional strategy in teaching for experimental group, lecture method for control group, and observed their impacts on students' retention ability.

2.8 Interest as a Factor in Teaching

Interest is a feeling of curiosity or concerned about subject that makes the attention turn towards it. Nworgu (1992) and Obeka (2010), views interest as the course of certain actions which acts as drive or motivations that propels people to act in certain ways and as the effect of an activity from which a child is learn to pay attention as the lesson goes on if he or she is interested in the particular lesson and the - method of learning. It is a type of attitude when share in some characteristics of cognitive, affective and psycho or components.

Aggarwal (2008), defines interest as a feeling that prompts us to spontaneous activity. It is a motivating force that impels us to attend to a person, a thing, or an activity as well as

effective experience that has been stimulated by the activity itself. According to the researcher, once interest is aroused in studies, games, literature and good conduct, the child will consider no sacrifice and effort too great to attain proficiency. Thus, interest can be the cause of activity and the result of participation in activity.

Mangal (2010), observed that interest is the key factor and driving force that help us in paying attention as well as remaining engaged in our so attended activities. It is a great motivating force and reservoir of one's inner potential, capable of molding and shaping one's behavior and personality make-up in a particular field. Interests are not permanent and fixed; they changed as a result of maturation, learning and other internal as well as environmental conditions and factors.

Hussin,Maanif and D'Cruz (2000), asserts that many theorists and researchers have found that it is important to recognize the consent of maturation and interest not as single entity but as multi-factional one. The researcher also believes that teachers are able to drive the students to learn the language and to sustain students' interest in the language, learnt, if they can provide activities that are: Interrelated between in-class and out-of class language activities ;communicative game type integrative (Shirt/small, action transform larger activities); Pleasant state and non-threatening; Enthusiastic; Group-based; Meaningful or relevant; Challenging. These activities help promote self-confidence experiences of success learning satisfaction and good relationships among students and between teachers and students.

Obeka, (2009), observes that, in spite of zeal, determination and sincere interest, students' interest and ability can be clambered by the use of ineffective teaching method such as the traditional lecture. Other factors affecting interest in learning as pointed by Aggarwal (2008),

and Mangal (2010), are; personal factors (socio-economic status, students mental health and development, his age, sex, child' ideals, motives and wishes); environmental factors (education and training, cultural status, opportunities to the child for exploring interests). Interest is a critical cognitive and affective motivational variable that guides attention, facilitates learning in different content areas and for students of all ages, and develops through experiences (Renninger and Hiddi, 2011).

Interest of the learner can be measured. Aggarwal (2008), posited that scholars attention on knowing the interest of an individual can be attributed to four factors; interest is an impelling factor; its' relationship with abilities; it indicate the probability of the actual work relating to a subject; and; measurement may suggest alternative fields- academic and vocational which the students have not yet seriously considered. Scholars (such as Aggarwal, 2008, Mangal, 2010, Renninger and Hiddi, 2011) have identified variety of methods by which interest can be measured. However, the overwhelming literatures coined to the use of; interest inventories; Kuder's preference record; Stewart and Brainard's specific interest inventories; Cleeton's Vocational Interest Inventories; and; Strong's Vocational Interest Blank.

Relevance of interest in learning can never be a dispute. Nworgu (1990), in his study on effect of resource materials types on achievement retention observed no significant influence on gender interest. Result of studies on EPODEWALAD and Power Simulation Games of Geographical and Environmental Education by Obeka (2009), shows that, students taught using EPODEWALAD simulation displayed greater interest in the environmental concept of geography than lecture group. The use of technology increased student interest and attention towards statistical concepts. It made you see where it could be more interesting"; "It was a less

boring way of learning"; "It was interesting to see how statistics can work" (Neumann, Neumann and Hood, 2011).

Interest as well as close attention is essential for useful learning and memorization. A person who has no interest in what he learns will not give due attention to it and consequently will not be able to learn it. This care should be taken to create the necessary interest in the material by making its purpose clear and linking it with one's natural instincts and urges. All the factors causing distraction should be reduced to a minimum so that all attention can be paid to the material at home (Mangal, 2011).

In this study, interest is considered as a variable measured in experimental and control groups. Animated-media instructional strategy and lecture method were used in determining whether or not the strategies can enhance interest of students on weather concept of geography.

2.9 Overview of Similar Studies

A number of studies were conducted on the impact of animation method in teaching and learning. Scholars (Morison & Tversky, 2001, Knowton and Morison, 2002, Stith, 2004 & Barak, Ashkar, & Dori, 2010) narrates that when a capable and enthusiastic teacher presents animation systematically provides a valuable way to communicate dynamic, complex sequences of events more effectively to students.

In similar vein, Knowton and Morison (2002), advocates that, when animations is used in teaching, it served five functions; connection; attention gaining: motivation; presentation; and clarification functions. Supporting this view, Agina (2003), opines that animation as a tool of education and training has advantages of: Skill and ability Improvement;. Interactivity; Engagement; Motivation; provision of Immediate Feedback; aid students through attracting and

holding their attention. Animation method as an important tool for science education was further supported by studies (for example, Hoffler & Leutner 2007; Tayo, 2012 ; Thomas & Israel, 2014), who proves that animated images transform abstract idea into concrete images, thus improving the student's achievement, understanding, and attention.

Susan and Jay (1991), study on animated demonstration Versus written instructions for learning procedural tasks in university of Machingan. Twenty-eight students and staff form the sample of the study involving 2 x 2 7 x 3 mixed factorial design. F – test analysis was carried out and result shows that animated demonstration appears to have advantage over text in improving academic performance of students. This study is in university and did not considered the impact of animation on retention and interest, hence the gap to fill in the present study.

Bryne, Catambone and Stasko (1999), carry out a study titled "Evaluating Animations as Student Aids in Learning Computer Algorithms" with a sample of 22 participants formed. Two hypotheses were tested using one – way analysis of variance 2 x 2 factorial design were also used. The result of finding shows a reliable main effect for animation, f (1, 84) = 3.98 P = 0.049, MSE = 2.24. Thus, the benefits conferred by animation centers on encouraging students to make and test protection as the two have indistinguishable effects on post – test performance of students.

Lee (1999), compares two classes of 30 students in which one was taught using a traditional note taking approach and a calculator and the other was taught using hands on activities and statistical animated software on a computer. During a subsequent interview, the technology rich approach was reported to reduce boredom, be better at relating statistics to research and problem solving, and make statistics more concrete. In the same vein, Sanger,

(2000), states that, the chemistry animation research has demonstrated that computer animation supported education has a positive effect on students' conceptual under-standing of chemical processes.

Mornson and Tversky (2001)'s study of the ineffectiveness of animation in instruction among Stanford University Students. One hypothesis was raised and tested using t-test. Result of finding shows that graphics were more effective than text in some cases, especially for participants with low spatial ability, but animation did not further increase effectiveness.

Weiss, Knowton and Mornsan (2002), in a study "Principles for using Animation In Computer Based Instruction; Theoretical Heuristics for Effective Instruction" suggests that, the inherent purposes of animation are cosmetic, attention gaining, motivation, presentation and clarification functions. Thus, the use of animation, as a presentation strategy is particularly helpful when presenting highly abstract or dynamic process.

Meletiou-Mavrotheris (2003), employs a similar hand on activity approach to Lee (1999), but combines it with a computer (animated) software package designed to enhance learning. Observations of five students and an examination of the dialogue between them and their instructor indicates that this approach facilitate the learning of statistical concepts. One limitation, as noted by the author, was that the study took place outside the natural classroom setting.

Stith (2004)'s study on use of animation in teaching cell biology, compared the correct responses to specific questions by groups viewing the apoptosis animation versus students who did not. Stith's data suggests that questions involving rote memory did not benefit from the animation, but those involving dynamic processes did benefit. Murtagh (2004), ascertained that,

there have been several school-based action research studies in Australia using animation to promote students' literacy skills. One project, "Clay Animation in the Primary Classroom", was conducted at Hawthorndene Primary School and investigated the use of clay animation as a teaching and learning approach to enhance outcomes for disengaged and underachieving students. Titles of the fictional QuickTime movies produced include a "Zoo Trip," "Snakes", "Hamburger" and "Elephant Sandwich." The study concluded that, "clay animation as a teaching and learning tool is an exciting, time consuming, challenging, motivational process, and above all, a lot of fun. It can impact in a positive way on learning, group skills and teamwork, self-esteem, confidence and leadership skills".

Murray, Neville, and Webb (2005), conduct clay animation task, which is Student Centered Curriculum among Multi-literacy and Disengaged Students at Tintinara Area School to assist year 4-6 boys to improve their literacy skills. The boys created a sequence of representations by writing stories with a selected theme, designing them with a storyboard, constructing clay figures and backdrop scenes, using digital photography and then completed written evaluations. In the study, the targeted group of boys became aware of the importance of planning and structuring their narratives, which suggested the need for more explicit teaching of narrative structure so that children could enhance their stories.

Feng Feng, Lin and Chung (2006), in meta – analytical research on the effectiveness of animation in facilitating multi-level learning (factorial knowledge, comprehension and application) summarized the findings of 34 published experimental studies that involved 13, 514 participants. Conclusion among the 34 studies reported positive effects of animation in promoting learning. The overall mean weighted average effect size was d+ = 0. 313, with 95% confident interval (CI) being 0.277 to 0.349. This average-group recovery animation improved

multi level-learning achievement at a rate of 62% as compared with 50% in the students in the static graphics groups.

Hoffler and Leutner (2007), investigates a Similar Meta - analysis of 26 primary students yielding 26 pair – wise companions of dynamic and static visualizations reveals medium sized overall advantages of instructional animations over static pictures. The mean weighted effect size on learning outcome (d = 0.37 (95%, CI 0.215 – 0.49). moderator analysis indicate even more substantial effect sizes when the animation is representational rather than deviational (d = 0.40, 95% CI 0.26 – 053), when the animation is highly realistic e.g video-based (d = 0.76 95%, CT 0.39 – 1 .13). This, animation appear to be better than their reputation.

Ruffini (2009), states that, the use of animations is more effective than static sequential images for teaching dynamic events. Animations when design properly can attract and maintain interest in a presentation. This Animated packages compared with static graphics can be more informative, cluster to the characteristic of the subject matter; more explicit; more explanatory, and; clearer.

Aremu and Abiodun (2010), work on the use of animation and lecture method on academic achievement of Nigerian secondary school students. The moderating effect of mental ability and gender were also investigated in the study. The study sample covers 180 SS II biology students who were selected using simple random sampling technique from two Federal Government Schools in Southern Nigeria. The pre-test-post-test, control group, quasi experimental design with 2x2x2 factorial matrix was adopted for the study. Students in experimental group were taught using animated package developed by the researchers as computer animation. While students in control group were taught using lecture method. The

result of this study shows that there is significant mean effect of treatment on students' achievement in biology. The computer animation was effective in improving students, academic achievement than lecture method.

Sánchez, Cañas, and Novak (2010), made a study on the importance of animation as a visual method in learning chemistry. The study objective was to examined differences in students' motivation and learning outcomes resulting from two different teaching methods. The study used two groups. For the first group visual material was presented in traditional paper form. For the second group the material was presented via the computer animation. The sample population consists of 41 students from gymnasium final grade, who had designed concept maps before. The animation and knowledge tests were represented in the module learning environment, which was familiar for the students from previous lessons. The study took place in two days, so the number of students varies: 29 students creates concept maps before and after the studying process, but they all answered to the knowledge tests. Similar materials were created for those who studied from paper-based instruction and for those who followed the animation. In both cases, the material contained identical information (as a text or as a voice), figure of process and pictures of the topic. Students studied individually from the materials; the main multimedia principles while the animations created were followed. The animation explained invisible processes of micro stage. It was interactive- students had the ability to use control tabs. The animation was two- dimensional and did not use many different colors, high speed and molecule models in the animation. The animation contains voice explanation, the most important facts and rules were accentuated textually. Excessive effects (fast moving, incoming, contrasting colors etc) were not used. Their findings revealed that:

a) The results of knowledge tests were similar to both groups (there were no significant differences, which would depend on the studying method)

b) Students, who had studied from the animation, represented the structure of the figure (which was in the animation and paper based instruction); they create less links with concepts than before the studying process;

c) Students, who had studied from the paper-based instruction, had created more propositions and all of them had created different structured concept maps. In that study, the structure of the concept maps (created propositions) and the number of the propositions depends on the individual studying method.

Neumann (2011), worked on evaluating computer-based simulations, multimedia and animations that help integrate blended learning with lectures in first year statistics. The course is a university year one statistics course mainly for students studying psychology. The topics includes basic research approaches; descriptive statistics (graphical and numerical); correlation; z-scores; probability; sampling distributions; and hypothesis testing for one sample and/or two samples using the z-test, t-test, and their nonparametric equivalents. The course was taught over one semester that comprised of 13 weeks of teaching using 2-hour for lectures per-week accompanied by 1-hour tutorial. The tutorial classes incorporated small group exercises and computer based exercises in which the SPSS statistical package was taught. The course had a website that used the Blackboard LMS, from which students could access resources. Approximately 200 students were enrolled. The technology used includes multimedia, computer-based simulations, animations, and statistical software. Interviews were conducted on a stratified random sample of 38 students in a first year statistics course. The animated package was a graphic file in GIF format and was integrated into the PowerPoint slides. The results shows three

global effects on student learning and engagement: shows the practical application of statistics, helped with understanding statistics, and addressed negative attitudes towards statistics. It also shows a graphical representation of a confidence interval of the mean moving along the x-axis of a normal distribution

Lin (2011), undertook a study on facilitating learning from animated instructional package. 582 undergraduate students enrolled in an eastern university in the United State participates in the study. A 2 x 3 factorial design were used. Analysis of data involves the use of mean, standard deviation, and analysis of variance. Result of finding shows that students who received animated visual treatment scored significantly higher on all criteria posttest than those who received the static visual treatment consistently, for both phases of analysis.

Tayo (2012), studied the effect of Animated Agricultural Package on attitude and performance of Students in south-west area using JSS III students in Ilesa west local government area of Osun state. He used 100 JSS III students as a sample of the study. The animated packages were developed locally based on the topics on crop rotation and design in modules using macromedia flash B.G and Microsoft power point 2007. Two research instruments (ASAT and SATASAQ) were used for data collection. Descriptive (mean and standard deviation) and inferential (f-test) statistics were used in the analysis. The result shows that:

- Students attitude towards agricultural science was enhanced with the use of the animated instructional package ($f = 4.398$, $p<0.005$).
- Students exposed to developed animated agricultural package performed significantly better than those exposed to the conventional lecture method did ($F = 0.082$, $P<0.05$).

Hwang, Tam, Lam and Lam (2012), conducted a study titled "Review of Use of Animations as a Supplementary Learning Material of Physiology Content in four Academic years" involving 913 students in twelve different classes. Survey and group interview were conducted. Result of finding shows that animated package surely explain contents more explicitly to students, make lesson more interested to the students. This, animations are good supplementary learning materials for students particularly for learn complicated concepts.

Aksoy (2012), studied the effects of animation technique on the 7^{th} grade of Erarum MEB Yildizkent IMKB primary school during the 2011 – 2012 sessions. Animation were presented in a form of power point and lecture method served as control the finding shows that Animated media technique is more effective than traditional teaching method in terms of enhancing students achievement. Recently, Thomas and Israel (2014), work on effectives of animation and multimedia teaching on students' performance in science subjects. A sample of 100 students was randomly selected from four secondary schools in Ado Ekiti Local Government Area, Ekiti state. Quasi – experimental research design of two groups "pre test" posttest control design. The result of three hypotheses distracted were analyzed using t – test. The result shows that there is significant difference in the academic achievement of students exposed to animated media teaching (t – calculated = 6.12 > table 1.98, w = 100, X = 23. 92, 90.66, SD (4.73, 6.43), DF = 98) over the lecture method.

Retention has a link with academic achievement (Bichi, 2002, O'Day,2006). O'Day (2007) in his study "The Value of Animations in Biology Teaching; a study of long – tem memory retention involving 393 students of Biology. Animations from three different sources were used each with different parameters. The result analysis involving mean, standard deviation, and t-test shows that animations provide a valuable way to communicate dynamic,

complex sequences of Biological events more effectively than text in a static graphic. Students prefer having animations in view of reading the textbook. In addition, animations lead to greater long – term memory retention that simple graphics.

Interest as a variable in science education has been found to be one of the strong catalysts of teaching and learning. Several literatures (Aggarwal, 2008; Obeka, 2009; Mangal, 2010; Renninger & Hiddi, 2011) were reviewed on how interest can be generated as well as its measurement. Thus, in the present study, animated-media instructional strategy on weather concept developed using Adobe flash files (soft files), GIF animated images (developed using computer soft ware called "graphic image processing software, GIMP") and Internet downloaded meteorological instrument embedded into the Microsoft document to form a single animation package to be used with Microsoft office power point (2007). The developed package was used as a treatment for experimental group and observes its' impacts on academic achievement, interest and retention in weather concept among senior secondary school students of Kurfi education Zone Katsina state, Nigeria.

2.10 Implication of Literature Reviewed on the Present Study

From the studies review so far, Scholars such as Okam, (2009), Usman, (2010), Aderogba, (2012), Obeka, (2013) Atadoga and Lakpini (2013) and Thomas and Israel (2014**)** have identified that instructional strategy employed by teachers in teaching sciences significantly affect the level of students' academic achievement. In geography, several hindrances to effective learning arise and students tend to have low interest and retention in the subject. For instance, Abdulkarim (2010) and Aderogba (2010) as the hindrance to students' academic achievement and retention in geography observed limitation of insufficient instructional facilities,

meteorological station, and laboratories for teaching geography in school. Consequently, these generate low academic achievement among students. In order to address the problem, several innovative instructional methods have been found in the review. One of such methods is teaching using animation which is found to be superior over some methods of teaching sciences. From the review, most of the study with animation method was conducted in countries like Japan, China, Malaysia, and southeastern Nigeria among others. In addition, the review revealed that the studies conducted were mostly in Biology, Statistic, Chemistry, Physics, Computer science, and Languages and at all level of education. A similar study was conducted in Geography in senior secondary school of Katsina state, Nigeria and on the concepts of weather to examine the impact of animated-media instructional strategy on academic achievement, retention, and interest at this level.

The literatures reviewed have pointed out that study on animated-media instructional strategy have been conducted on variables such as performance and attitude of students in tertiary institutions. Most of these studies were in biology, physics, chemistry, and mathematics; none exists in the field of geography, specifically weather concepts. To fill this gap, similar study was conducted here using secondary school students on the impact of animated-media instructional strategy in relation to academic achievement, retention, and interest in weather concept of geography.

The literatures reviewed have helped in ascertaining countries of the world that are using animated-media instructional strategy in teaching. Countries notable in this research are; China, USA, UK, Australia, Malaysia, and Germany, a gap to fill using Nigeria. The present study was conducted in Kurfi Education zone of Katsina state in Nigeria. The study also filled the gap of

determining the impact of animated-media instructional strategy on gender academic achievement, retention, and interest in weather concept.

CHAPTER THREE

METHODOLOGY

3.1. Introduction

The aim of this study is to investigate the impacts of animated-media instructional strategy on students' academic achievement, retention, and interest of weather concepts. In Chapter two, literatures related to this study were reviewed. This chapter therefore presents the methodology of the study under the following sub-headings:

- Research Design
- Population of the Study
- Sample and Sampling Procedure
- Instrumentation
- Validity of Instruments
- Reliability of Instruments
- Data Collection Procedure
- Administration of Treatment
- Data Analysis

3.2 Research Design

This study employ pretest posttest quasi-experimental control group design. The study used two group; experimental and control. Experimental group (EG) are group exposed to experimental treatment (X_1). That is, teaching using animated-media instructional strategy. While, control group (CG) are group taught using lecture method (X_0). This design have been

prescribed by Kerlinger (1973) and used by Bichi (2002), Bawa (2011), and Thomas and Israel (2014).

Weather Concept Achievement Test (WCAT), and Weather Concept Interest Questionnaire (WCIQ) were administered to both experimental and control groups. Experimental group **(EG)** received experimental treatment **(X_1)**. That is, teaching using animated-media instructional strategy. While, control group **(CG)** is taught using lecture method **(X_0).** Subjects were randomly assigned to experimental and control groups prior to the administration of treatment. Two intact classes (one from experimental group and one from control group) were used for the study. Both Experimental and control group were pre-tested **(O_1)** on academic achievement and interest before the administration of treatment. The essence of pre-testing is to ensure selection of samples that are not significantly different in abilities in terms of academic achievements before treatment.

The two groups were taught weather concepts for a period of Six weeks. The treatment was teaching using animated-media instructional strategy (**X_1**) for Experimental Group (**EG**). The control group received no treatment but was taught using lecture method (**Xo**). Posttest **(O_2)** was administered after treatment to determine the impact of the two instructional methods on students' academic achievement and interest in weather concepts taught. After a period of two weeks of posttest administration, post-post test **(03)** were administered to students using the same test item in pre and post test to determine students' retention ability in weather concepts of secondary school geography. Kerlinger (1973) in Sambo (2008), affirmed that this design offer numerous advantages such as:

- It revealed whether or not a particular instructional strategy is superior over the other.

- It can be used to identify differences in the groups at the beginning of the study.
- It is an indicator for gaining mastery of the concepts selected.

The research design illustration of the study is represented in figure 3.1 below:

Group 1: EG ⟶ O1 ⟶ X1 ⟶ O2 ⟶ 03

Group 2: CG ⟶ O1 ⟶ X0 ⟶ O2 ⟶ 03

Fig.3.1: Research Design Illustration

Source: (Adapted from Kerlinger, 1973; Sambo, 2008 & Mamman, 2013)

Key:

EG= Experimental group

CG=Control group

X1= Treatment (Integrating teaching using animated-media instructional strategy)

X0=No treatment (Teaching using lecture method only)

O_1= Pre-test administration

O_2= Post-test administration

0_3= Post-post test administration (Retention)

3.3. Population of the Study

The population for this study covered all public senior secondary schools (SS II) offering geography in Kurfi education zone. There are five public senior secondary schools with population of 699 Senior Secondary School year II students in the study area. From this figure, 512 were male while 187 were female of average age of 17 years plus.

Table 3.1: Population of the Study

S/N	School	Gender		
		Male	**Female**	**Totals**
1	GSSS Kurfi	287	65	352
2	GSSS Birchi	102	30	132
3	GSSS Rawayau	88	15	103
4	GSSS Tsauri	35	15	56
5	GGDSSS Kurfi	00	56	56
	TOTALS	**512**	**187**	**699**

Source: (Katsina State Ministry of Education, 2013).

3.4. Sample and Sampling Technique

A total number of 116 SS II geography students drawn from two public senior secondary schools of Kurfi education zone form the sample of the study. Subjects were randomly assigned to experimental and control groups prior to the administration of treatment. Two intact classes (one from experimental group and one from control group) were used for the study. However, before selecting the sample, pre test was administered to four secondary schools out of five to ensure selection of samples that are not significantly different in abilities in terms of academic achievements before treatment. Analysis of Variance (ANOVA) was used in the analysis. A post-hock test was further conducted to determine schools with comparative abilities. As a result of this exercise, two schools namely- GDSSS Tsauri (school A) and GGDSSS Kurfi (school B) were found not different significantly and were used as a sample for this study. The choice of 116 students as a sample of this study is in line with Central limit theorem which recommended minimum of thirty sample size as noted by Tuckman, (1975). This suggests that the minimum of 30-sample size is viable for experimental research. A random sampling technique with the aid of

random table of numbers (Kerlinger, 1973). The detail of the sample is presented in table 3.2 below:

Table 3.2: Sampling Frame

School	Group	Male	Females	Total
School A	**Experimental**	35	21	56
School B	**Control**	35	25	60
Total		70	**46**	116

3.5. Instrumentation

Two research instruments were developed by the researcher and used for the study. These are:

- Weather Concept Achievement Test (WCAT)
- Weather Concept Interest Questionnaire (WCIQ).

3.5.1. Weather Concept Achievement Test (WCAT)

This instrument is a 60 items achievement test developed by the researcher to determine the achievement and retention of students in weather concept. The instrument was developed from the weather concepts of senior secondary school geography curriculum (see content in table 3.3). The WCAT item consists of 50 objectives (multiple type) test items each with four alternatives (A-D) and 10 true or false questions. The item took into consideration all the six educational taxonomy of Bloom to ensure equal distribution of the items over the units. The distribution of the item based on the six taxonomies is that knowledge has 20 questions, comprehension 13 questions; application has 9 questions and six questions each for Analysis,

Synthesis and Evaluation. The number of questions and weight allocated to each contents and taxonomy.

Table 3.3- Table of Specification for WCAT Construction

S/N	Content	Weight (%)	Kn. (30)	Co. (21)	Ap. (17)	An. (11)	Sy (11)	Ev. (10)	Total (100)
1.	Definition of weather.	(15)	3	2	1	1	1	1	9
2.	Elements of weather and units of measurement.	(22)	4	3	3	1	1	1	13
3.	Instrument in measuring weather elements.	(18)	3	3	1	1	2	1	11
4.	Simple observation, recording, and reporting of weather data.	(27)	4	3	3	2	2	2	16
5.	Relevance of weather elements to physical and human activities	(18)	4	2	2	1	1	1	11
	Total	100	18	13	10	7	7	6	60

KEY: **Kn.=Knowledge, Co.=Comprehension; Ap.=Application; An.=Analysis; Sy; Synthesis; Ev= Evaluation**
Sou**rce: (Adopted from Sambo, (2008) &Obeka, (2011)**

3.5.2. Weather Concept Interest Questionnaire (WCIQ).

The Weather Concept Interest Questionnaire (WCIQ) is a 26 items interest inventory questionnaire developed by the researcher to determine the interest of students between and after treatment on weather concept of Geography. The items were developed using the Likert (1973)'s 5- point rating scale involving; Strongly agreed (S.A); Agreed (A); Undecided (U); Disagreed (D); and; Strongly disagreed (S.D). Each option carries weight in the order of priority from five to one in positive interest responses and from 1-5 in negative interest responses. The students were asked to freely indicate their interest on weather concepts by simply ticking one of the five options that suit their interest. From the item, maximum score is 130, minimum score is 26 and the average score is 78. A score of 78 and above signified positive interest and thus acceptance

region. A score below 78 indicated no interest towards weather concept and therefore rejection region. Detailed of Weather Concept Interest Questionnaire (WCIQ) items developed by the researcher are presented in appendix "D".

3.5.3 Validity and Reliability of the Instruments.

A. Validity of WCAT

The validity of Weather Concept Achievement Test (WCAT) was achieved by presenting the instrument to a panel of qualified experts that include the following:

1. Panel of three qualified expert with a PhD. qualification and rank of Senior lecturers in the department of Science Education, Ahmadu Bello University, Zaria.
2. Panel of supervisory committee
3. Two experts in geography (meteorologist/climatologists)
4. Two language education specialist and three Geography teachers at secondary school level with BSc.Ed degree.

A copy of the developed items were submitted to each Science Education expert for validitation and requested to:

- Study the instrument and certify if the questions were considered to be testing the academic achievement of the students.
- Examine whether the items are clear to avoid ambiguity.
- Certify if they are appropriate for the level of the students under study
- Check for possible errors in the instruments and suggest corrections

The geography specialists are expert in the field of meteorology and climatology with a PhD. qualification and ranked as senior lecturers. One in the department of geography, Ahmadu Bello University, Zaria and the other in Umaru Musa Yaradua University, Katsina. Two copies of the developed items were submitted to each expert for face validity and requested to examine the items instrument in relation to:

- Study the instrument and certify if the questions were considered to be testing the academic achievement of the students.
- Examine whether the items are clear to avoid ambiguity
- Give the general criticisms and suggestions toward improvement of the instrument.

However, prior to validation by experts in science education and meteorologists, five copies of the developed WCAT were presented to six secondary school teachers with qualification of B.Sc. Ed. Qualification. Three in the field of geography and three in English Language, each with more than five years of teaching experience for pre-validation exercise. The essence of involving secondary school teachers is to enable them have their insight on instrument before issuing it to the expert. The teachers were asked to:

- Look into the content of WCAT and see whether the content is relevant to the study subject.
- Examine the grammatical structure, wording, and sentences arrangement.

After validation exercise, most of the items in the instruments were found to be satisfactory and met the requirement of content validity, as for the agreement of all the experts. However, some of the items that were found irrelevant to this study were removed completely in the WCAT hence, reduced from seventy to sixty.

B. Validity of Weather Concept Interest Questionnaire (WCIQ)

Weather Concept Interest Questionnaire (WCIQ), was validated by panel of three qualified experts in the department of Educational psychology, guidance and counseling, Ahmadu Bello University, Zaria, with PhD. qualification in the field of psychology with minimum rank of senior lecturer. The experts were requested to:

- Study the instrument and certify if the questions were considered to be testing the interest of students in weather concept.
- Certify if the items are appropriate for the level of the students under study
- Check for possible errors in the instrument.
- Suggest appropriate corrections on the possible errors observed in the instrument

The expert validated the instrument and corrected some of the errors observed. For instance, some items were found irrelevant to the study sample and thus were removed. Also, the number of questions drawn initially was dropped down from 30 to 26.

C. Reliability of the Instruments

i. Pilot Test

Pilot test was conducted with a group of 30 students in one Senior Secondary School that did not form the study sample, to determine the reliability of the instruments. The school selected for this purpose is similar to those of the main study in term of location, ownership and status levels. Both WCAT and WCIQ was administered during pilot study. However, WCAT was administered to these students at the beginning of the first week (test) and collected back for scoring. After an interval of two weeks, the same instrument was re-administered to the same

group of students (re-test). Tuckman (1975), who proposed the minimum interval of two or more weeks between first and second administration, recommended the use of two weeks interval.

The result of the two tests are compared and correlated. Reliability coefficient of the instrument is determined using Pearson Product Moment Correlation (PPMC) method with the aid of SPSS Package. From the result obtained, reliability of the instrument is found to be 0.89. This signifies that there is strong positive relationship between the first and second administration of WCAT, hence the instrument is consistent and reliable for the study. However, the length of time taken for students to respond to the test item was determined. For instance, it takes the first five students forty minutes to finish the test. The average students spend sixty minutes on the test; while the last set of students spend seventy minutes to respond to the test items.

WCIQ was also pilot tested at the same school. However, unlike WCAT, the WCIQ test item was administered once and split half method (odd-even) were used to test the reliability of scores on 30 students. Here, the test score were split into two equivalent halves arranged as odd and even numbered items. The scores of the two halves were correlated and Spearman Rank Order Correlation Statistic was used to estimate the reliability for the instrument. From the obtained correlation between the two half tests of WCIQ, the r-value was found to be 0.97.

The essence of this pilot test was to:

- Testing the workability of the programme, theory or study
- Obtaining reliability coefficient of the instruments
- Determining the appropriateness of the items of the instruments
- Identifying appropriate statistical tools to be used in the main study and also

- Find out the administrative and logistic problems that may hinder the main study.
- Find out the characteristics of the instrument item analysis.
- Determined the appropriateness of the length of time required to answer items in the two tests separately
- Ascertain the appropriateness of the wording of the two instruments

3.5.4 Items Analysis

a. item Difficulty Index

Item analysis was carried out from the pilot study score to determine the item difficulty, and discrimination indices. Sambo (2008), defined item difficulty as a measure of percentage of people, candidate who got the item right over the total number of candidates that attempted the item it is determine by using the formula:

$$\mathbf{P = R/T \times 100}$$

Where: R, is the number of candidate who got the item right

T, is the total number of candidate

Sambo (2008), further recommended that, in the research literature, items with difficulty index between 40% to 60% are accepted. For the present study, items with difficulty index of 40% to 60% are retained. Item below 40% are considered being too easy, and 60% being too difficult. These items were modified to suit the research. Detail of this is presented in table 3.4 below and in appendix H.

Table 3.4: Item Difficulty Index for WCAT

Item No.	$P = \frac{R}{T} \times 100\%$
1	0.61
2	50
3	55
4	43
5	45
6	65
7	42
8	29
9	31
10	44
11	50
12	35
13	43
14	45
15	65
16	42
17	48
18	46
19	29
20	25
21	49
22	30
23	50
24	53
25	55
26	41
27	47
28	50
29	48
30	44
31	44
32	50
33	55
34	43
35	45
36	65
37	42
38	48
39	46
40	45
41	47
42	61
43	51
44	57
45	48
46	53
47	62
48	60
49	54
50	52
51	45
52	64
53	52
54	49
55	53
56	48
57	54
58	56
59	46
60	58

Key: P difficulty index; X= Discarded for being too Difficult; M modified and retained

B. item Discrimination Index

The discrimination index of the test is the ability of the test item to separate between high and low-ranking students in the entire test. The scholar ascertained that it is essential that each of the items of the test discriminatee between the candidates much the same way that the total test is

doing. To compute discrimination index of test item, the researcher proposed the use of the following relation:

$$D = \frac{RU-RI}{N}$$

Where: D =discrimination index of test item

RU = number of candidate that got the item correct in the upper 27% of the group.

RI = number of candidate that got the item correct in the lower 27% of the group

N = number of candidates in the 27%upper or lower part of the group

Bichi (2002) and Sambo (2008) posited that items of discrimination index of 0.40 and above are very good for the study, 0.30 – 0.39 are reasonably good, 0.20 – 0.29 are marginal items that need improvement, while items with discrimination index of 0.19 and below are poor items to be discarded. Thus, in this study item above 0.40 was accepted for final selecting of WCAT instrument. Detail of this is presented in table 3.5 below and in appendix H.

Table 3.5: Item Discrimination Index for WCAT

Item No.	$D = \frac{Ru - RL}{N}$
1	0.54
2	0.44
3	0.43
4	0.45
5	0.45
6	0.42
7	0.48
8	0.29M
9	0.31M
10	0.50
11	0.28M
12	0.35
13	0.45
14	0.45
15	0.42
16	0.48
17	0.53
18	0.27
19	0.29M
20	0.52M
21	0.56
22	0.31M
23	0.58
24	0.70
25	0.56
26	0.53
27	0.51
28	0.48
29	0.50
30	0.50
31	0.50
32	0.44
33	0.43
34	0.45
35	0.45
36	0.42
37	0.48
38	0.53
39	0.57
40	0.47
41	0.48
42	0.49
43	0.53
44	0.48
45	0.47
46	0.73
47	0.50
48	0.41
49	0.47
50	0.52
51	0.47
52	0.50
53	0.47
54	0.51
55	0.49
56	0.55
57	0.52
58	0.58
59	0.60
60	0.47

Key: P difficulty index; D descrimination Index; X= Discarded for being too Difficult; M modified and retained

3.5.5 Animated-Media Package

Animated-media Package is a package developed by the researcher on weather concept used as an instructional strategy for experimental group. The animation was developed with the aid of the following:

- Microsoft office power point (2007)
- Adobe flash files (soft files)
- GIF animated images
- Internet downloaded meteorological instruments.

These components were embedded into the Microsoft document to form a single animation package. Adobe flash files (soft files) were imported into the power point using computer soft ware named “adobe acrobat”. GIF animated images were developed using computer soft ware called “graphic image processing software (GIMP)”. Images used in the package were down loaded from www.flicker.com;www.tumblir.com;and; Google images. Adobe flash software is used to independently play all soft files.

The animated images downloaded from internet source and include; animated meteorological instrument, episodes on weather elements, environmental lapse rate, land and sea breath, relevance of some weather elements on physical and human development. These images were in form of JPEG, PNG, GIF, BMP. In all the above images’ forms, only GIF format support animation. However, computer software called GIMP converted all the images to animated package that can be projected and displayed motion images.

The animation was based on the following content of geography:

- Definition of the concept of weather and climate and their differences; terminologies associated with weather concepts (land and sea breath, environmental lapse rate);
- Elements of weather and their units of measurement
- instrument in measuring weather elements and precautions for using each instrument;
- Simple observation, recording analysis, interpretation and reporting of weather data
- Relevance of weather elements to physical and human activities.

3.6. 1 Administration of Treatment.

Teaching of experimental group was conducted by the researcher himself. However, prior to the administration of treatment, pretest was administered to the group to determine their prior knowledge related to weather concepts and to ensure selection of groups that are not significantly different in abilities. Experimental group in this study are group of students exposed to experimental treatment (teaching using Animated-Media Strategy). The treatment has six distinct stages separated into three major stages namely, pre animation; content delivery and post animation.

Pre-animation stage dealt with the provision of enabling environment for the conduct of animation teaching. That is providing the computer, projector, animated weather software, animated flashcards and ensure supply of power source without interrupting throughout the lesson. Connect the computer and projector to the power source and ensure that the software is installed in the computer for the lesson. Sitting arrangement should be that there is enough space for projection so that it will not affect the appearance of the image on the screen. As part of pre-animation, the teacher ensured that students observed

the weather of the environment before the presentation. In addition, objectives of the lesson were clearly stated and explained to the students.

The next stage is content delivery or animation stage, where the teacher begin with brief introduction of the lesson to the students. That is, the teacher asked students to narrate their experience on what they observed in the day's weather and stated if there is difference with the weather of the previous day. This is then followed by power point projection of the developed animated package in the class based on topic of discussion. Each episode is projected on the screen and students were actively participating in observing, recording, and discussing of the presentation. The role of teacher is facilitating and clarification of points unclear to students. Flash cards based on weather concepts projected were also distributed to students as part of the package to enable them interacts with the media and perform activities of animations during the lesson. It should be noted that after each episode, students performed activities based on it and teacher interact with students in answering questions and observations raised during projection and activities.

The last stage of animation is evaluation stage which is a stage of determining whether the stated objective have been achieved or otherwise. In this stage, the teacher ask students some questions based on the lesson treated with a view to remedy some areas of difficulties observed during lesson. At the end of each lesson, students have some take home exercise on weather concepts. This exercise lasted for a period of Six weeks with two hours fifteen minutes (45 minutes par period) interaction per week. Immediately after the treatment, the test instrument was re-administered to student as a posttest to determine the achievement and interest of students in weather concept. After two weeks of posttest, the

same instruments were re-administered as post-post test to determine students' retention ability. The treatment administration can be summarized as follows:

- Step 1:Pre-animation stage (ensure that all relevant materials for animation are adequate and ready to be used).
- Step II: Introduction (link students' previous knowledge with the lesson to be treated through questioning and activities).
- Step III: Content Delivery (power point presentation of animated weather concepts).
- Step IV: Teacher-students' interaction to clarify points.
- Step V: Activity stage (integrating teaching with various students' activities using other graphic animated-media package).
- Step VI: Evaluation (this involved application of questioning techniques to determine the attainment of the objectives of the lesson or otherwise).
- Step VII: Review/Conclusion (highlight and clarify point and areas of difficulties observed during the lesson; allow students to produce their own note through observation during presentation and; ask them to perform some take-home assignments based on the lesson treated).

The strategy is guided by the flow chart presented in figure 3.2, and the detail of lesson procedure is presented in appendix F.

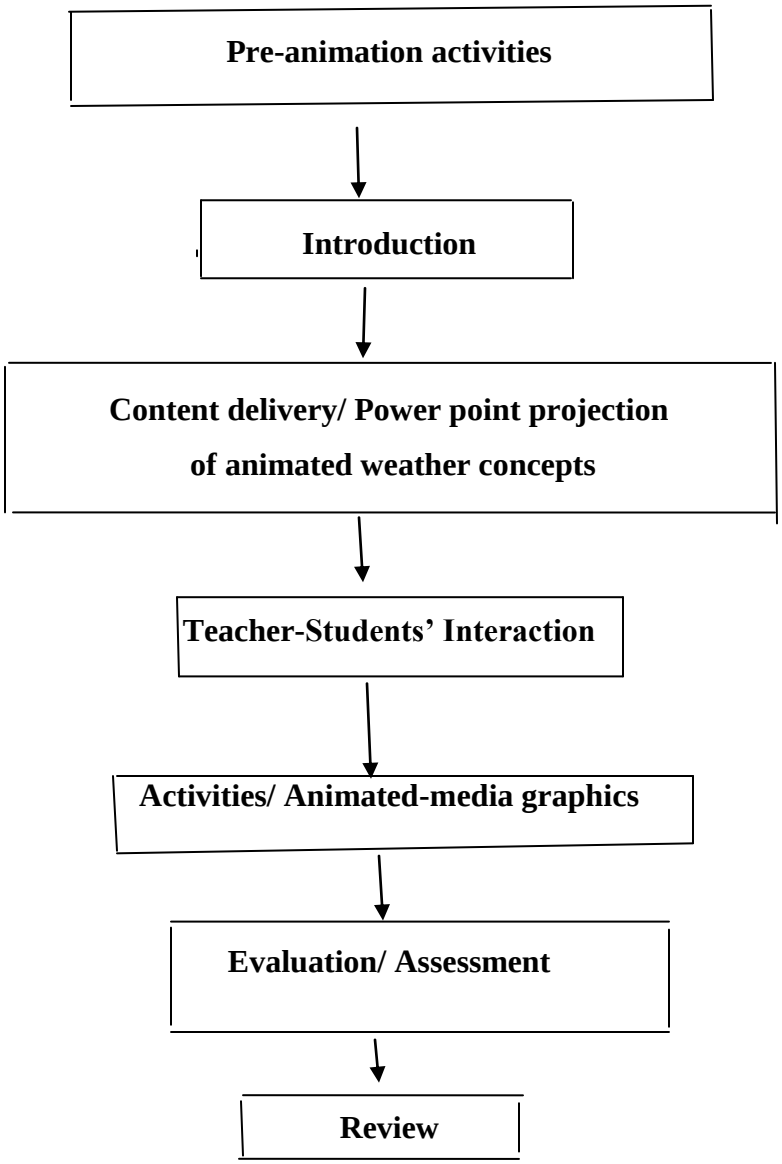


Fig. 3.3: Flow Chart of Animated-media strategy

Source: (Researcher, 2014).

3.6. 2 Teaching the Control Group

The teaching of control group was also conducted by the researcher using lecture method. Prior to the actual teaching, pretest was administered to the group to determine their prior knowledge related to weather concepts and to ensure selection of groups that are not significantly different in abilities. In each lesson, objectives were clearly stated to

students and questions were asked in the introductory part to enable students linked their previous knowledge with the lesson to be treated.

In the content delivery, the presentation involved verbal communication of weather concepts between teacher and students without integrating any media as in the case of experimental group. The same content were delivered to the two a group for a period of six weeks after which posttest was administered to determine students' achievement and interest in weather concepts. After a period of two weeks, another test called post post test was administered to the same group to determine their retention abilities. Detail of the lesson procedure is presented in Appendix G.

3.7 Data Collection Procedure.

During the experiment, two different treatment patterns were applied (teaching using Animated-Media Strategy and lecture method). Lesson plans of both the groups addressed the same instructional objectives based on the same content of weather. However, the experimental plans provided opportunities for small group interaction, activities, and sharing of media resources among the members. Conversely, students in control group received lectures in the class only. The control group was provided with traditional routine situation in the classroom while experimental group was provided with Animated-Media Strategy as treatment. The experiment lasted for six weeks. Soon after the treatment was over, posttest was administered to measure the achievement of the sample subjects. Pretest scores of the sample served as data to equate the control and experimental groups, post-test scores served as data to measure achievement of the students while post-post test to measure the retention ability of the sample as a result of treatment. The period of pos-post test administration was two weeks after posttest. Weather Concept Interest

Questionnaire were administered as pre test to equate the experimental and control groups' interest in weather concept of geography. Students' answer sheet was attached with the question papers in pre-test and posttest while at post-post test students submitted their answer booklet, only. Both the two instruments were administered before treatment. However, WCIQ was administered prior to administering of WCAT to determine students pre-interest in weather concept of geography. Immediately after, WCAT was also administered as pre-test to determine equivalence in students' academic achievement before treatment.

The response of the subjects to Weather Concept Achievement Test was scored using the marking scheme. Each correct response scored one point with maximum score of 60 marks. While Weather Concept Interest Questionnaire has 26 items to measure the interest of students on weather concept of Geography. The items 5- point rating scale involving; Strongly agreed (S.A); Agreed (A); Undecided (U); Disagree (D); and; Strongly disagreed (S.D).

3.8. Data Analysis

Answering Research Questions

The statistical tools used in answering research questions were stated below:

Research Question One: What is the difference in the mean scores of senior secondary school geography students taught weather concepts using animated-media strategy and those taught the same concept using lecture method?

Mean and standard deviation of posttest academic achievement, of the subject in experimental and control groups were computed and compared.

Research Question Two: What is the impact of animated-media strategy on senior secondary school geography students' retention in weather concepts?

Mean and standard deviation of post-posttest retention of the subject in experimental and control groups were computed and compared.

Research Question Three: What is the impact of the use of animated-media strategy on senior secondary school geography students' interest in weather concepts?

Mean Rank and sums of rank of posttest interest of the subject in experimental and control groups were computed and compared.

Research Question One: How does the use of animated-media strategy affects academic achievement of male and female senior secondary school geography students in weather concepts?

Mean and standard deviation of posttest academic achievement, of male and female students in experimental group were computed and compared.

Testing Null Hypotheses

The Null hypotheses formulated were tested at 0.05 level of significance using inferential statistic as follows:

H_{O1}: There is no significant difference in the mean scores of senior secondary school geography students taught weather concepts using animated-media strategy and those taught using lecture method.

Null hypothesis 1 was tested using t-test (independent) statistic at 0.05 level of significance using data of Posttest academic achievement score of students in experimental and control groups. SPSS was used for data analysis.

H_{O2}: There is no significant difference in the retention of senior secondary school geography students taught weather concepts using animated-media strategy and those taught using lecture method.

To test null hypotheses 2, t-test (independent) statistic at 0.05 level of significance using data of post posttest academic retention ability score of students in experimental and control groups were used.

H_{O3}: There is no significant difference in the interest of senior secondary school geography students exposed to weather concepts using animated-media strategy and those taught the same concept using lecture method.

Third null hypothesis were tested using Mann-Whitney U-test statistic at 0.05 level of significance using data of pretest and Posttest interest score of students in experimental and control groups with the aid of Statistical package called SPSS.

H_{O4}: There is no significant difference in the mean scores of male and female senior secondary school geography students in weather concepts exposed to animated-media strategy.

In testing null hypothesis 4, t-test (independent) statistic at 0.05 level of significance using data of Posttest academic achievement score of male and female students in experimental group with the aid of Statistical package called SPSS were used.

CHAPTER FOUR

DATA ANALYSIS, RESULTS, AND DISCUSSION

4.1 Introduction

This chapter focused on data analysis, presentation and discussion of results obtained from the study subjects. Data related to academic achievement and retention were collected using WCAT instrument, while data related to students' interest were collected using Weather Concept Interest Questionnaire (WCIQ). A total number of 580 questionnaires (232 in the pre-test, 232 in the post-test, and 116 in the post post test) were administered to the subject in experimental and control groups with 100% return rate. Data collected were analyzed with the aid of SPSS. Research questions were answered using descriptive statistic (Mean and Standard Deviation) while research hypotheses raised were tested using inferential statistic (t-test and Mann-Whitney U test) at 0.05 level of significant. This chapter therefore is presented in the following sub-headings

- Data Analysis and Result Presentation
- Summary of Findings
- Discussion of Results

4.2 Data Analysis and Results Presentation

The result and analysis of data obtained is presented under the following:

- Answering Research Questions
- Testing Null Hypotheses

Answering Research Questions

The four research questions raised were answered using descriptive statistic. Mean and standard deviations were used in answering first, second and fourth research questions, while mean rank and sum of ranks were equally used in answering third research question.

Research Question One

Research Question one Sought to find difference in the mean academic achievement scores of geography students taught weather concepts using Animated-Media Strategy and those taught the same concept using lecture method. The mean and standard deviation of post test academic achievement of experimental and control group are presented in Table 4.1

Table 4.1: Mean and Standard Deviation of Academic Achievement of Experimental and Control Group

Variable	N	Mean	Std. Deviation	Mean Difference
Experimental	56	41.57	8.48	
Control	60	26.50	3.99	14.7

Table 4.1 above shows that experimental group has a mean of 41.57 and Standard Deviation of 8.48, which is greater than the mean of control group (26.50) with standard deviation of 3.99 and a mean difference of 14.7. This shows that geography students taught weather concept using animated-media strategy achieved higher academically, by mean score of 41.57, than their lecture group counterpart with mean score of 26.50

Research Question Two

Research question number two investigates the impact of the use of animated-media strategy on students' retention ability of weather concepts. Mean, and standard deviation of post-post test of experimental and control group were compared. The result is presented in Table 4.2

Table 4.2: Mean and Standard Deviation of Retention ability of the Subjects in Experimental and Control Groups

Variable	N	Mean	Std. Deviation	Mean Difference
Experimental	56	43.14	9.04	18.81
Control	60	24.33	4.40	

Table 4.2 indicated the mean and standard deviation of retention ability of geography students in experimental and control groups. From the result, the mean retention ability of experimental group is 43.14 with standard Deviation of 9.04, as against that of control group with a mean of 24.33 and standard deviation of 4.40. This shows that geography students taught weather concept using Animated-Media Strategy retained the learned concepts more than students taught using lecture method.

Research Question Three

Research Question 3 sought to establish the extent of students' interest in weather concepts when taught using Animated-Media Strategy. Mean Rank of students post interest score in experimental and control group were compared and presented in Table 4.3.

Table 4.3: Mean Rank Interest Scores of the Subjects in the Experimental and Control Group

Variable		N	Mean Rank	Sum of Rank	Mean Difference
Experimental:	Pre-test	56	37.28	2251.48	
					36.3
	Post-test	56	73.58	4414.50	
Control:					
	Pre-test	60	38.59	2329.48	
					03.76
	Post-test	60	42.35	2371.50	

The table 4.3 showed the change in interest of the subject toward weather concept in experimental and control group. From the table, the mean rank value of 37.28 was obtained in the pre-test of experimental group and 73.58 in the posttest with sum of ranks of 2251.48 and 4414.50. While in the control group, a mean rank value of 38.59 and 42.35 was obtained in the pre and posttests with a sum of ranks of 2329.48 and 2371.50 was obtained. Difference in the mean rank signifies difference in the interest ability of the subject in weather concept due to exposure to Animated-Media Strategy and lecture method. This shows that experimental group developed higher interest in weather concepts than control group as revealed in their mean rank score. Hence, Animated-Media Strategy has a positive impact in generating students' interest towards weather concept.

Research Question Four

Research Question four sought to examine the difference in academic achievement of male and female students in weather concepts taught using Animated-Media Strategy. Here, mean and standard deviation of posttest academic achievement of male and female students in experimental group were compared. The detail of the result is presented in Table 4.4.

Table 4.4: Mean and Standard deviation of Academic Achievement Scores of Male and Female Students in Experimental Group

Variable	N	Mean	Standard Deviation	Mean difference
Male	35	38.72	8.15	
Female	21	39. 54	7.51	-0.82

The Table 4.4 revealed that the mean academic achievement score of male students in experimental group is 38.72, and standard deviation of 8.15 is observed. Female students in the same group have a mean score of 39.54 with standard deviation of 7.51. This shows that both male and females students taught weather concepts using Animated-Media Strategy have almost similar mean academic score in their post test.

Testing Null Hypotheses

Four research hypotheses raised in this research were tested and verified using inferential statistic and presented in Tables 4.5, 4.6, 4.7 and 4.8 respectively. Computer statistic software, SPSS, (Statistic Package for Social Sciences) is used in the analysis. All test were verified at $p \leq 0.05$ levels of significance.

Testing Null Hypothesis One

H_{O1}: There is no significant difference in the mean academic achievement scores of senior secondary school geography students taught weather concepts using animated-media strategy and those taught using lecture method senior secondary school.

In testing hypothesis one, data of post test academic achievement of the subject in experimental and control group were used. Inferential statistic involving t-test analysis and

SPSS package was employed in testing the hypothesis. The detail of the result is presented in table 4.5

Table 4.5: Results of t-test Analysis of Achievement Scores of the Subjects in the Experimental and Control Groups

Variable	N	Mean	S.D	Df	t-value	t-crit	p.	Alpha	decision
Experimental	56	41.57	8.48						
				114	12.36	1.98	0.00	0.05	Sig
Control	60	26.50	3.99						

*Significant at $p \leq 0.05$ level of significant

Table 4.5 results, shows that the t-value computed is 12.36 and the p-value of 0.00 is observed at degree of freedom of 114. Since the critical p-value of 0.00 is less than the alpha value of 0.05, there is a significant difference in the academic achievement of the subjects in experimental and control group. A significant difference implies rejection of null hypothesis and retaining alternate hypothesis. Consequently, null hypothesis that states that there is no significant difference in the academic achievement scores of geography students taught weather concepts using Animated-Media Strategy and those taught the same concept using lecture method. The significant difference is in favor of experimental group as revealed in their mean scores.

Testing Null Hypothesis Two

H_{O2}: There is no significant difference in the retention of senior secondary school geography students taught weather concepts using Animated-Media Strategy and those taught using lecture method.

Table 4.6: t-test Analysis of Retention Ability of the Subjects in the Experimental and Control Group

Variable	N	Mean	S. D	Df	t-value	t-crit	P	Alpha	Decision
Experimental	56	43.14	9.04	114	14.39	1.98	0.00	0.05	Sig
Control	60	24.33	4.40						

*Significant at $p \leq 0.05$ level

From the result obtained in Table 4.6 above, it is observed that the t-value of 14.39 is obtained and the p-value observed is 0.00 at the degree of freedom of 114. The critical p-value of 0.00 is less than the alpha value of 0.05. This shows that there was a significant difference. A significant difference implies rejection of null hypothesis and retaining alternate hypothesis. Therefore, null hypothesis that stated, there is no significant difference in the retention ability of geography students exposed to Animated-Media Strategy in weather concept is rejected. The significant difference is in favor of geography students exposed to weather concepts using Animated-Media Strategy as revealed in their mean score.

Null Hypothesis Three

H_{O3}: There is no significant difference in the interest of senior secondary school geography students exposed to weather concepts using animated-media strategy and those taught the same concept using lecture method.

Mann-Whitney U-test was used to test this hypothesis as presented in table 4.9 below;

Table 4.7: Mann-Whitney U-test Analysis of Interest Change of the Subjects in the Experimental and Control Group

Variable		N	Mean Rank	Sum of Rank	Man-Whitney U-test	P.	Alpha	Decision
Experimental:	Pre-test	56	37.28	2251.48	775.50	0.00	0.05	Sig.
	Post-test	56	73.58	4414.50				
Control:								
	Pre-test	60	38.59	2329.48	420.50	0.06	0.05	Not Sig.
	Post-test	60	42.35	2371.50				

The table 4.7 above compares the interest change of the subject in experimental and control group. From the table, the mean rank value of 37.28 was obtained in the pre-test of experimental group and 73.58 in the posttest. The Mann-Whitney U observed in the experimental group is 775.50 and the p-value observed was 0.00. Since the p-value of 0.00 is less than alpha value of 0.05, there is a significant difference in the interest ability of the subject in weather concept due to exposure to animated-media strategy. The significant difference is in favor of experimental group as revealed in the mean rank score. A significant difference implies rejection of null hypothesis and retaining alternate hypothesis. Hence, null hypothesis that states that there is no significant difference in the interest of geography students exposed to weather concepts using animated-media strategy and those taught the same concept using lecture method is rejected. There is significant difference.

Similarly, in the pre-test of control group, a mean rank of 38.59 was obtained and 42.35 in the post-test. The Mann-Whitney U observed in the control group is 420.50 and the p-value observed was 0.06. Since the p-value of 0.06 is greater than alpha value of 0.05,

there is a no significant difference in the interest ability of the subject in weather concept due to exposure to lecture instructional strategy.

Testing Null Hypothesis Four

H_{O4}: There is no significant difference in the mean scores of male and female senior secondary school geography students in weather concepts exposed to animated-media strategy only.

Table 4.8: t-test Analysis of Academic Achievement Scores of the Male and Female Students in the Experimental Group

Variable		N	Mean	S.D.	Df	t- value	t-crit	p-value	Alpha	Decision
Experimental:	Male	35	38.72	8.15	54	3.25	2.0	0.21	0.05	Not Sig
	Female	21	39.54	7.51						
Control:	Male	35	28.42	3.83	58	2.16	2.0	0.08	0.05	Not Sig
	Female	25	26.60	4.29						

*Significant at $p \leq 0.05$

From the result in table 4.8 above, it is observed that in the experimental group, the t-value of 3.25 is obtained and the p-value observed is 0.21 at the degree of freedom of 54. The critical p-value of 0.21 is greater than the alpha value of 0.05. This shows that there is no significant difference. A no significant difference implies retaining of null hypothesis and rejecting alternate hypothesis. Accordingly, null hypothesis that stated that there is no significant difference in the academic achievement of male and female students exposed to Animated-Media Strategy in weather concept was retained.

In the same table, academic achievement of male and female students in the control group was also compared. From the result obtained, t-value observed is 2.16 and p-value of 0.08 was obtained at degree of freedom of 58. Since the observed p-value is greater than alpha value, there is no significant difference in the academic achievement of male and female students exposed to lecture method.

4.3 Summary of the Results

From the result presented in this study, the summary of the major findings are:

1. Research question one shows a greater mean difference in the academic achievement of the subject in experimental and control group, in favour of experimental group.
2. Research question two revealed disparity in the mean retention ability of the subject in experimental and control group, in favour of experimental group.
3. Research question three proved disparity in the mean interest ability of the subject in experimental and control group, in favour of experimental group.
4. Research question four shows no difference in the mean difference in the academic achievement of male and female students in experimental group
5. There is significant difference in the academic achievement scores of geography students taught weather concepts using Animated-Media Strategy and those taught the same concept using lecture method. Subjects in the experimental group achieved high academically than control group
6. There is a significant difference in the retention ability of geography students exposed to Animated-Media Strategy in weather concept and their lecture group

counterpart. The significant difference is in favour of Animated-Media Strategy group as revealed in their mean score and the t-value.

7. There is no significant difference in the academic achievement of male and female students exposed to Animated-Media Strategy in weather concept.
8. There is no significant difference in the interest ability of the subject in weather concept due to exposure to Animated-Media Strategy and lecture method. This lead to the retaining of fourth null hypothesis, which sought to, established if there is significant difference between mean academic achievement of male and female students in weather concept.

4.4 Discussion of Results

From the findings in Table 4.1, and 4.5, the study reveals that experimental group recorded the highest mean score than lecture group, which shows that there is a significant difference in the academic achievement of the subjects in experimental, and control group. A significant difference implies rejection of null hypothesis and retaining alternate hypothesis. Therefore, null hypothesis that states that there is no significant difference in the academic achievement scores of geography students taught weather concepts using animated-media strategy and those taught the same concept using lecture method is rejected. The significant difference indicates that animated-media strategy recorded the highest mean score than the lecture method. This finding is supported by Feng Feng, Lin and Chung (2006), Aremu and Abiodun (2010), Lin, (2011),Tayo, (2012), Aksoy (2012) and Thomas and Israel (2014). Tayo, (2012)'s finding reveals that Students exposed to developed animated agricultural package performed significantly better than those exposed to the conventional lecture method. In addition, Aksoy (2012), in a study title "Effects of

Animation Technique on The 7th Grade of Erarum MEB Yildizkent IMKB Primary School" confirms that animated media technique is more effective than traditional teaching method in terms of enhancing student's academic achievement. This finding gain further support from the work of Thomas and Israel (2014) on effectives of animation and multimedia teaching on students' performance in science subjects. The finding revealeds that there is significant difference in the academic achievement of students exposed to animated media teaching over the lecture method. Kajuru and Ado,(2012) established that, innovative teaching strategies with integrated resource materials enhance academic achievement of students.

From the findings in Table 4.2 and 4.6, it was revealeds that there is a significant difference in the retention ability of geography students exposed to animated-media strategy in weather concept and their lecture group counterpart. The significant difference is in favor of Animated-Media Strategy group as revealed in their mean score and the t-value. This finding is in concurrence with that of O'Day (2007) and Lin, (2011) who in their separate studies reveals that animations lead to greater long – term memory retention of learned materials. This finding is also in agreement with that of Lawal (2009), who work on the effectiveness of conceptual change instructional strategy and traditional instructional strategy in remediating the misconceptions in genetic concept of senior secondary school. The result of finding confirmed that students exposed to conceptual change instructional strategy retained more knowledge of genetic than the subject exposed to traditional instructional strategy. Mangal (2011) ascertained that retention of learned material can be improve through association of ideas, connection, and systematic thinking in the task of recall.

Table 4.3 and 4.7 compared the interest change of the subject in experimental and control group. From the finding of this table, result revealed significant difference in the interest ability of the subject in weather concept due to exposure to Animated-Media Strategy and lecture method. The significant difference is in favor of experimental group as revealed in the mean rank score and U-value. This finding is in agreement with that of Obeka (2009), Neumann, Neumann and Hood, (2011), Hwang, Tam, Lam and Lam (2012), and Tayo, (2012). Result of studies conducted by Obeka (2009) on EPODEWALAD and Power Simulation games of geographical and environmental education shows that students taught using EPODEWALAD simulation displayed greater interest in the environmental concept of geography than lecture group. Tayo (2012), claims that students interest towards agricultural science is enhanced with the use of the animated instructional package. Hwang, Tam, Lam and Lam (2012), further confirms that animated package surely explain contents more explicitly to students, and make them more interested in the lesson. Difference in the interest observed can be attributed to the use of technology in teaching experimental group as stated by Neumann, Neumann, and Hood, (2011). The use of technology increases student interest and attention towards statistical concepts because it makes you see where it could be more interesting and it is a less boring way of learning.

From the result in Tables 4.4 and 4.8 revealed that there is no significant difference in the academic achievement of male and female students exposed to Animated-Media Strategy in weather concept. This finding is in harmony with those of authorities such as Patrick and Ezenwa, (2000), Haruna, (2000), Maikano,(2007), Mari 2010, Usman, (2010) who in their separate studies in various discipline found that the application of instructional treatment on a mixed gender school population improves the academic achievement of

students irrespective of gender. The findings of Haruna in his study (2000) revealed that there is no significant difference in the performance of gender in chemistry due to exposure to instructional strategy. Maikano (2007), found no significant difference in the academic achievement between male and female students taught ecological concepts using outdoor laboratory instructional strategy. Similarly, Mari (2010), further supports this assertion in his study on entry qualification and performance which shows that male and female students admitted with the same entry qualification have no difference in their performance. In addition, Usman (2010), opines that outdoor laboratory method enhances academic achievement of students in spite of their gender.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter focuses on the following:

- Summary of the study,
- Findings,
- Conclusion
- Contrubution to Knowledge
- Recommendations based on findings.
- Limitation of the Study
- Suggestions for Further Studies

5.2 Summary

This study investigated the impacts of Animated-Media Strategy on senior secondary school geography students' academic achievement, retention, and interest in weather concepts and presented in five chapters.

Chapter one of the study presented the problem of this study. In the background of the study, the research was prompted by persistent low academic achievement of secondary geography students in the subject. The study has four objectives, one of which seeks to examine the impact of animated-media strategy on students' academic achievement in weather concepts of senior secondary geography. This is guided by four research questions, and four hypotheses respectively. The study was delimited to only SS II students of public secondary schools offering geography in Kurfi education zone of Katsina state.

Chapter two of this study reviewed literature on; Concept and scope of geography as discipline at Secondary Schools; Weather Concepts in geography education; Instruments for measuring weather elements; Methods of teaching geography in secondary schools; Academic achievement in geography at secondary schools; Academic achievement and gender in science education; Interest as a factor in science education; as well as retention ability in science education. The review has pointed out that animated- media instructional strategy embrace the use of cartoons, graphic, computer, pictures and text in presentation of lesson. The review has some implications to the present study as it pointed out the persistent low academic achievement, retention, and interest as a gap filled by this research, which the previous researches did not address.

The chapter three of this study presented the methodology employed in carrying out this study. The study adapted pretest posttest quasi-experimental and control group design. Experimental group received experimental treatment using animated- media instructional strategy while control group received lecture method only. A sample size of 116 geography was selected randomly from a population of 699 SS II students for the study. Two instruments namely, Weather Concept Achievement Test and Weather Concept Interest Questionnaire were developed and validated by expert to guide in the data collection. Procedure for data analysis was presented in this chapter.

The chapter four of the study presented the result and discussion of findings. Four research questions raised were answered using mean and standard deviation while hypotheses testing involve the use of t-test and Mann-Whitney U test at 0.05 level of significant. Statistical software called SPSS helped in the analysis of data obtained. From the result of findings, it was confirmed that there is significant difference in the academic

achievement scores of geography students taught weather concepts using animated-media strategy and those taught the same concept using lecture method. Subjects in the experimental group achieved high academically than control group. It was also revealed that there is a significant difference in the retention ability of geography students exposed to animated-media strategy in weather concept and their lecture group counterpart. The significant difference is in favour of animated-media strategy group as revealed in their mean score and the t-value. The result obtained further disclosed that there is a significant difference in the interest ability of the subject in weather concept due to exposure to Animated-Media Strategy and lecture method. The significant difference is in favor of experimental group as revealed in the mean rank score and U-value. The result further confirmed no significant difference in the academic achievement of male and female students exposed to Animated-media strategy, thus the strategy is gender friendly.

Finally, chapter five of this study presented the summary, conclusion, and recommendation based on the findings of the study. The study concluded that animated-media strategy is effective in improving academic achievement, retention, and interest of students toward weather concept. The study contribute to body of knowledge in science education through developing Weather concepts Interest questionnaire, which is unique in this field. The study recommended among others that both Federal and state ministries of education should make adequate provision for computers in secondary schools. Such computers should be properly managed for utilization in animation class.

5.3 Summary of the Major Findings

1. Geography students taught weather concepts using Animated-Media Strategy shows significant difference in their academic achievement scores than their lecture group.
2. There is a significant difference in the retention ability of geography students exposed to Animated-Media Strategy in weather concept and their lecture group counterpart. The significant difference is in favor of animated-media strategy group as revealed in their mean score and the t-value.
3. Significant difference exists in the interest ability of the subject in weather concept due to exposure to animated-media strategy in favor of experimental group.
4. There is no significant difference academic achievement of male and female students taught weather concept using animated-media strategy which lead to the retaining of fourth null hypothesis.

5.4 Conclusion

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

a) Students taught weather concepts using Animated-Media Strategy achieved better academically than using lecture method.
b) Students taught using Animated-Media Strategy exhibit high level of retention in weather concept than lecture method.
c) Female students taught weather concept using animated-media strategy did not differ significantly from their male counterpart.

d) Students show positive interest towards weather concepts when taught using animated-media strategy.

In conclusion, the treatment, animated-media strategy has the potentiality of enhancing senior secondary geography students' academic achievement, retention, and interest in weather concept.

5.5 Contrubution to Knowledge

This study, "impact of Animated-media strategy on Academic achievement, Retention and Interest among secondary school geography students in Weather concepts" has contributes to knowledge in science education and other areas in the following ways:

- The researcher developed Weather Concept Interest Questionnaire (WCIQ) and measured students' interest toward weather concept, which was new in the field of geography education.
- The researcher developed Animated-media package software and Animated-media strategy flow-charts in teaching weather concept and is unique in the field of geography education at senior secondary school level.
- The researcher developed Weather Concept Achievement Test (WCAT) used with Animated-media package software. This was found to be efficacious in improving students' academic achievement and retention in weather concept of geography education.

5.6 Recommendations

Basedon the findings of this study, the researcher recommend that:

1. The use of Animated-Media Strategy in teaching geography in school should be encouraged by stake holders in the education industries such as Federal Ministry of Education, State Ministries of Education; NERDC among others.This can be done through periodic seminars and workshops to teachers on how to use animated media in teaching.
2. Both Federal and state ministries of education should make adequate provision for computers in secondary schools. Such computers should be properly managed for utilization in animation class.
3. Federal and state ministries of education should provide projectors for teaching geography in all secondary schools with immidiate effect. The projector will be use with the aid of computers in power point projection of animated media. The use of this package will facilitate the challenges of limited instructional materials, time of teaching and sustained students' interest at lesson.
4. The Federal Government of Nigeria through its agencies such as the State Ministries of Education, Teacher Training Institutions and professional bodies such as NTI and STAN, to organize a special re-training, workshops, and seminars to geography teachers on developing animated software for teaching, Microsoft power point presentation and general operation of computers.
5. Stake holders and Partners in the education industries such as Federal Ministry of Education, State Ministries of Education, NERDC, Parent Teachers Association, NUT, UNICEF, UNESCO, should encourage teachers in secondary schools to

acquire personal computers (Pcs) through purchase, monthly contribution or granting loan at subsidized rate from their employees or bankers.

6. Curriculum planners and curriculum development bodies in Nigeria like NERDC should design programme and policies that will incorporate the use of Animated-Media Strategy in teaching and learning sciences at Senior Secondary School level.

7. The Association of Nigerian Geographers (ANG) should provide the stand to address the issues of persistent low academic achievement, interest and retention of geography students in the secondary school curriculum as well as promotion of awareness/enlightenment to teachers and students through seminars and workshops and training of geography teachers for the teaching, guidance and counseling of students.

5.7 Limitations of the Study

The following limitations have been observed in the conduct of this study:

1. In the study, only two senior secondary schools were sampled and used which limits the scope of generalization.
2. The samples used for the study were limited to only schools owned by Katsina State Government. Other types of schools like Private and Federal Government Schools were not involved in the study. May be if such schools were involved, the result of finding may be different from the one obtained. This is therefore limitation on the scope of generality of the findings.
3. Subject used for this study were not familiar with Animated-Media Strategy; therefore, time was spent on explaining, clarifying, and involving them in the process of learning.

5.8 Suggestions for Further Studies

From the findings of the study the following suggestions are made for further studies:

1. More studies should be conducted on impacts of Animated-Media Strategy on motivation, attitude, and science process skills in secondary schools and tertiary institutions in Nigeria.
2. Studies are required on developing animated-media strategy by researchers in all the subjects taught at secondary schools and primary schools and observe its impact on classroom management and class size.
3. More studies should be conducted by scholars on the use of Animated-Media Strategy in classroom management and coverage of geography syllabus in secondary schools of Nigeria.

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APPENDIX A

WEATHER CONCEPT ACHIEVEMENT TEST (WCAT)

SECTION A: BIODATA

Name of School…….

Class…….....

Identification No…….....

Gender: **Male [ ]** **Female [ ]**

SECTION B: ITEMS ON WEATHER CONCEPT ACHIEVEMENT TEST (WCAT)

Instruction

Please read the following instructions carefully before you answer the questions..

1. Write your school name, class and identification number provided for the examination in the space provided in the answer sheet.
2. Read each question carefully before answering it. If you find a question difficult, go on to the other questions and finish them first.
3. Shade only one letter for each answer in the objective questions.
4. If you change your mind on any answer, completely erase the first shading.

NOW ATTEMPT THE FOLLOWING QUESTIONS BY CIRCLING THE CORRECT ANSWER

1. The condition of lower atmosphere of a place over a short period of time is called…….

(a) Climate (b) weather (c) temperature (d) latitude

2. The major difference between weather and climate is that weather……

(a) Rain is constant for a long time (b) Change from day to day

(c) Never changes throughout (d) Changes after 35 years.

3…….Is the chief source of atmospheric heat. (a) Cloud (b) Moon (c) Sun (d) Stars.

From the following statement, indicate the nature of weather of the day.

4. If I rest under a tree or air condition, the weather of the day is…….

(a) Snowy (b) cold (c) rainy (d) Sunny

5. I cannot take bath at 6am because the weather of the day is still…..

(a) Sunny (b) Rainy (c) Cold (d) Windy

6. I have to use an umbrella from my hostel/house to geography laboratory; the weather of the day is …..(a) Hot (b) cold (c) rainy (d) windy

7. Gases that exert weights on the earth atmosphere are called……

(a) Air temperature (b) wind (c) rainfall (d) Air pressure

8. The following weather concept can be measured except…….

(a) Air temperature (b) Relative humidity (c) Cloud cover (d)Air pressure

9. Amount of water or in the atmosphere is called…….

(a) Humidity (b) pressure (c) temperature (d) rainfall

10. What is Wind? (a) stable air (b) directional air (c) air in motion (d) unmovable air

11. When temperature decreases with height, it is called…….

(a) Continantality effect (b) ocean current (c) latitude (d) normal lapse rate

12. A place where weather conditions are measured is called……..…..

(a) meteorological station (b) radio station (c) television station (d) home station

13. Hygrometer is an instrument used in measuring which of the following element?

    (a) Atmospheric pressure (b) Relative humidity (c) insulation (d) temperature

14. The wet bulb thermometer always shows……. than the dry bulb thermometer

    (a) high reading (b) long reading (c) Lower reading (d) moderate reading

15. Wind direction is measured by an instrument called…….

    (a) Wind velocity (b) Wind vane (c) Wind anemometer (d) Wind ammeter

16. Air is said to be saturated when it is 100%. Under which condition?

    (a) if the wet bulb indicates a lower reading

    (b) if the dry bulb indicates a higher reading

    (c) if there is no difference between the reading of wet bulb an dry bulb

    (d) if there is high difference between the reading of wet bulb and dry bulb

17. Anemometer is used to measure……

    (a) Wind direction (b) Wind size (c) wind speed (d) wind color

18. A reading of 790mm is regarded as…

    (a) low pressure (b) moderate pressure (c) absolute pressure(d) high pressure

19. Pressure is measure in unit of force called…

    (a) milibars (b) Fahrenheit (c) degree centigrade (d) millimeter

20. The temperature of a place is measured by an instrument called _____

    (a) Rain gauge (b) Barometer (c) Anemometer (d) Thermometer

21. Thermometer works on the principle that alcohol expand when … and contract when …

    a) cooled, heated (b) saturated, heated (c) heated, cooled (d) saturated, evaporated

22. To get accurate records thermometers are kept in a standard shelter called Stevenson screen to protect them from the effect of _____

(a) Radiant heat of the sun and rain (b) wind blows (c) trees and shade (d) collecting accurate data

Use the following data to answer question 23 – 27

Month	J	F	M	A	M	J	J	A	S	O	N	D
Temp (^oC)	40	30	21	25	10	40	48	30	25	30	20	15

23. The month with the highest temperature is (a). December (b). July (c). June (d). May

24. The month with the lowest temperature is (a). December (b). July (c). June (d). May

25. The total annual temperature is ___(a). 331^{oc} (b). 334^{oc} (c). 27.8^{oc} (d). 10^{oc}

26 .The annual range of temperature is__. (a). 331^{oc} (b). 334^{oc} (c). 38^{oc} (d). 10^{oc}

27. The mean annual temperature is_____(a). 27.8^{oc} (b). 334^{oc} (c). 331^{oc} (d). 10^{oc}

28. An SS II student measured soil temperature and found his result to be 16^oc. He was asked to report this finding in degree Fahrenheit. What is his new temperature?

(a) 70.8^of (b) 50.8^of (c) 60.8^of (d) 80^of

29. Convert 50^of to a temperature in degree centigrade…(a) 5^oc (b) 10^oc (c) 20^oc(d) 50^oc

30. The freezing point or the lowest point for centigrade scale is always 0^oc while Fahrenheit is.....(a), 45^of (b) 10^of (c) 0^of (d) 32^of

31. Wind vane is made up of two parts. One part is the _____ on the top, which is free to move with the prevailing wind.....(a) Frame (b) arrow (c) mercury (d) distilled water

32. The vane or arrow point to the direction from which _____ so that wind is named from the direction it blows.

(a) Wind is blowing (b) sun is raising (c) water is falling (d) wind is stationary

33. Wind vane is located in...so that buildings/trees do not defect the wind direction.(a)A wind position(b)grazing position (c)a covered position (d)an exposed position

34. Anemometer consists of three or four _____ attached to the ends of horizontal spaces mounted on a high vertical spindle.

(a) Spherical cups (b) semi circular cups (c) square cups (d) rectangular cups

35. The higher the _____ of the wind, the greater the speed of the cups and vice versa.

(a) Direction (b) speed (c) amount (d) colour

36. Rainfall includes other form of precipitation is measured by an instrument called….

(a) rain gauge (b) nanometer (c) millibars (d) Stevenson screen

Use the following data to answer question 37-40

Month	J	F	M	A	M	J	J	A	S	O	N	D
Rainfall(mm)	10	80	20	120	130	150	200	210	190	18	17	9

37. What is the month with the lowest rainfall? (a). December (b). July (c). June (d). May

38. What is the month with the highest rainfall? (a). December (b). July (c). August (d). May

39. What is the annual range of rainfall? (a). 64mm (b).80mm (c).10mm (d). 201mm

40. What is the mean annual rainfall? (a). 94mm (b). 17mm (c).160mm (d). 16.66mm

41. If Temperature is measured in ^{o}c or ^{o}f, rainfall in cm and mm, pressure in milibers, what is the unit of measuring relative humidity?

(a) Ratio (b) percentage (c) centimeter (d)kilogram

42. In Morning hours, the standard time for fully measurement of weather element is ____

(a) 10:00 am (b) 7:00pm (c) 12:00pm (d) 8:00pm

43. If measurement is to be taken in the afternoon, it is normally done by _____

(a) 2:00pm (b) 3:00pm (c) 4:00pm (d) 5:00pm

44. For the evening measurements, the standard time is normally ____(local time)

(a) 5:00pm (b) 6:00pm (c) 7:00pm (d) 8:00pm

Use the following information to answer question 45-60

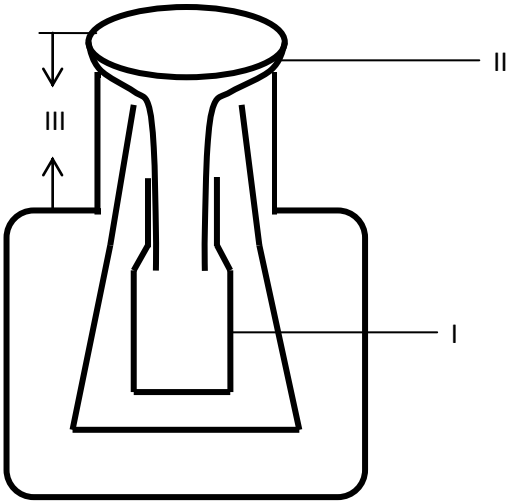


Fig A

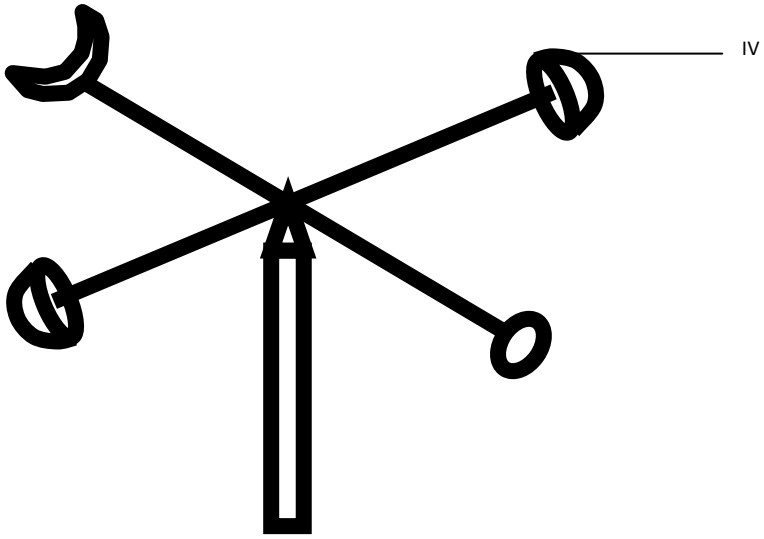


Fig B

45. Identify the instrument named figure "A".

(a) Anemometer (b) Hygrometer (c) Wind vane (d) Rain gauge

46. The instrument labeled fig A is used in measuring _____

(a) Temperature (b) Rainfall (c) Pressure (d) Humidity

47. The part labeled I in fig A is called

(a) jar or glass bottle (b) Stevenson screen (c) measuring cylinder (d) funnel

48. The metal funnel that leads to glass bottle enclosed within a copper cylinder connected to an inner container where the water is collected is labeled as …(a) I (b) II (c) III (d) IV

49. The distance between ground labeled and funnel top is given as _____

(a) 20cm (b) 30cm (c) 40cm (d) 30m

50. Identify the instrument labeled figure B.

(a) Rain gauge (b) Wind vane (c) Anemometer (d) Barometer

Use the following statement about the importance of weather to man and answer question 51 to 60 by simply stating true or false

51. Weather affects human comfort. Temperate areas are more habituated than desert areas because they are hotter. True [ ] False [ ] ?

52. Humid environments do not encourage the growth of micro- organisms that increase ill health. True [ ] False [ ] ?

53. Natural hazards like erosion, wind storm, floods and drought are caused by difference in the climate of a place. True [ ] False [ ] ?

54. Temperature and rainfall are the major factors of the type of plant growth in an environment. True [ ] False [ ] ?

55. Weather condition do not affects the type of cloth people wear. True [ ] False [ ] ?

56. Low cloud covers increase heat in the lower atmosphere. True [ ] False [ ] ?

57. Higher cloud cover decrease heat in the lower atmosphere. True [ ] False [ ] ?

58. Water bodies absorb more heat in the day than earth surface. True [ ] False [ ]?

59. Earth surface retained more heat in the night than earth surface. True [ ] False [ ] ?

60. Environmental lapse rate means that the higher you move in the lower atmosphere, the warmer it becomes. True [ ] False [ ] ?

APPENDIX B

MARKING SCHEME FOR WCAT

1. **B**
2. **B**
3. **C**
4. **D**
5. **C**
6. **C**
7. **D**
8. **C**
9. **A**
10. **C**
11. **D**
12. **A**
13. **B**
14. **C**
15. **B**
16. **C**
17. **C**
18. **D**
19. **A**
20. **D**
21. **C**
22. **A**
23. **B**
24. **D**
25. **B**
26. **C**
27. **A**
28. **C**
29. **B**
30. **D**
31. **B**
32. **A**
33. **D**
34. **B**
35. **B**
36. **A**
37. **A**
38. **C**
39. **D**
40. **A**
41. **B**
42. **C**
43. **A**
44. **D**
45. **D**
46. **B**
47. **A**
48. **B**
49. **B**
50. **C**
51. **T**
52. **F**
53. **T**
54. **T**
55. **F**
56. **T**
57. **T**
58. **T**
59. **T**
60. **F**

APPENDIX C

ANSWER SHEET FOR WEATHER CONCEPT ACHIEVEMENT TEST (WCAT).

SECTION A: BIODATA

Name of School……..
Class……..
Serial Number……
Gender: Male [ ] Female [ ]

SECTION B

Please shade the correct answer as appropriately

1. =A= =B= =C= =D=
2. =A= =B= =C= =D=
3. =A= =B= =C= =D=
4. =A= =B= =C= =D=
5. =A= =B= =C= =D=
6. =A= =B= =C= =D=
7. =A= =B= =C= =D=
8. =A= =B= =C= =D=
9. =A= =B= =C= =D=
10. =A= =B= =C= =D=
11. =A= =B= =C= =D=
12. =A= =B= =C= =D=
13. =A= =B= =C= =D=
14. =A= =B= =C= =D=
15. =A= =B= =C= =D=
16. =A= =B= =C= =D=
17. =A= =B= =C= =D=
18. =A= =B= =C= =D=
19. =A= =B= =C= =D=
20. =A= =B= =C= =D=
21. =A= =B= =C= =D=
22. =A= =B= =C= =D=
23. =A= =B= =C= =D=
24. =A= =B= =C= =D=
25. =A= =B= =C= =D=
26. =A= =B= =C= =D=
27. =A= =B= =C= =D=
28. =A= =B= =C= =D=
29. =A= =B= =C= =D=
30. =A= =B= =C= =D=
31. =A= =B= =C= =D=
32. =A= =B= =C= =D=
33. =A= =B= =C= =D=
34. =A= =B= =C= =D=
35. =A= =B= =C= =D=
36. =A= =B= =C= =D=
37. =A= =B= =C= =D=
38. =A= =B= =C= =D=
39. =A= =B= =C= =D=
40. =A= =B= =C= =D=
41. =A= =B= =C= =D=
42. =A= =B= =C= =D=
43. =A= =B= =C= =D=
44. =A= =B= =C= =D=
45. =A= =B= =C= =D=
46. =A= =B= =C= =D=
47. =A= =B= =C= =D=
48. =A= =B= =C= =D=
49. =A= =B= =C= =D=
50. =A= =B= =C= =D=
51. True [ ] False [ ]
52. True [ ] False [ ]
53. True [ ] False [ ]
54. True [ ] False [ ]
55. True [ ] False [ ]
56. True [ ] False [ ]
57. True [ ] False [ ]
58. True [ ] False [ ]
59. True [ ] False [ ]
60. True [ ] False [ ]

APPENDIX D

WEATHER CONCEPTS INTEREST QUESTIONNAIRE (W.C.I.Q.)

Dear Respondent,

Below is a list of items designated by a master's student to examine the degree of students' interest in weather concepts of Senior Secondary School Geography. You are requested to freely rate yourself to indicate the extent to which the questionnaire items are interesting to you or not. Be informed that information provided will be used strictly for this research only and will be treated with outmost confidentiality.

Please take note of the following keys to guide your responses:

S.A……Strongly Agree

A……Agree

U……Undecided

D……Disagree

S.D…….Strongly Disagree

Thank You.

SECTION A: BIODATA

Name of School……..

Class……..

Gender: Male [ ] Female [ ]

Age……..

Serial Number……

SECTION B: ITEMS ON WEATHER CONCEPT INTEREST QUESTIONNAIRE (WCIQ)

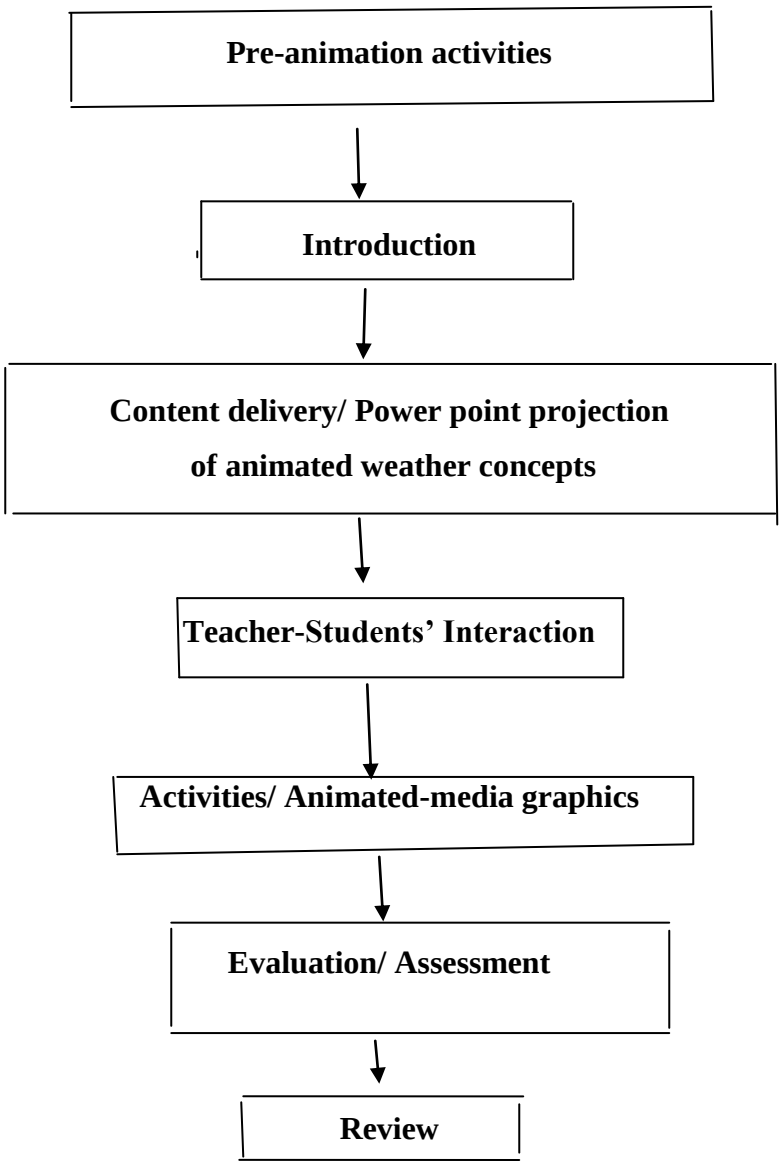
Please mark (□) in the appropriately column of your choice.

S/N	ITEM	S.A	A	U	D	S.D
1.	I am interested in listening to my teachers teaching weather.					
2.	I don't like listening to daily weather report of radio and television services.					
3.	I always enjoy reading newspapers and documents on weather.					
4.	I am not interested in discussing the effects of weather elements on humans and plants.					
5.	Weather focuses in media are faulty; therefore, I do not trust it.					
6.	I like telling my parents the relevance of weather on health, agricultural production, and environment in general.					
7.	I am not interested in observing any weather element in my locality.					
8.	The study of weather and climate is not useful to me nor to my environment.					
9.	Because of my interest in weather, I always read notice board of geography rooms.					
10.	I like participating in my school's weather club.					
11.	I will not study any weather courses in the University.					
12.	Studying weather concept is difficult to me					
13.	It is waste of time to listen to weather related broadcast on media.					
14.	Due to my exposure to weather, I carefully choose the type of cloth I wear.					

15.	I do not like seeing students engage in weather related activities such as weather observation, record, and report.
16.	Weather report should be made compulsory in every assembly in my school.
17.	I want to become pilot due to my interest in weather related concepts.
18.	In planning for any journey, adequate information on weather is not useful.
19.	I always alert my friends and parents the consequences of our activities on our weather and climate.
20.	I do not like geography period when there is weather concepts in it.
21.	I remind my geography teacher when s/he is late in attending a class in which weather concept is to be taught.
22.	I am a member of geography club due to discussion always made on weather.
23.	Weather related concept should be removed from our geography class.
24.	Weather concepts should be taught right from primary school three
25.	Geography teachers need to use simple instructional materials such as chart, maps, globes to teach weather concept.
26.	Weather concept need to be exposed to every member of the society using media.

APPENDIX "E"

FLOW CHART OF ANIMATED-MEDIA TEACHING STRATEGY



Source: (Researcher, 2014).

APPENDIX F

LESSON PLAN FOR EXPERIMENTAL GROUP

LESSON 1

Week	One
Class	SS II
Sex	Males and Females
Average age	17 years
Methodology	Animated-Media Strategy
Subject	Geography
Topic	The concept of weather climate and their associate terminologies
Behavioral objectives	By the end of the lesson, students should be able to: 1. Define the terms "weather and climate". 2. Differentiate between weather and climate. 3. State an example of weather and climate conditions 4. Explain at least two terminologies associated with weather and climate 5. Develop interest in weather concept
Previous knowledge	Students are aware of some changes that naturally occurred in the environment such as season, day, night etc.
Instructional materials	Computer, projector, and animated package of weather.
Introduction	The teacher introduces the lesson by telling students a short story on weather and climate and ask the following questions which are meant to provoke meaningful thoughts from the students in terms of the previous and relevant knowledge they acquire in relation to the topic "weather and climate": 1. What two major changes do you normally observed within 24 hours of the day? Expected answer: appearance of sun make day, when sun set night comes. 2. Why is that in a particular period of a year one must wear tick

cloth?

Expected answer: cold nature of the season. E.tc.

Presentation	The teacher present his lesson based on the following steps:
Step 1	The teacher paste animated chart showing different condition of weather and allow students to carefully observe the animation and comment on the features observed. The teacher interacts with students and explains that the features observed are some conditions of the day in the atmosphere. Some of these features changed within short period of time and the phenomena are term "weather". However, the same phenomena may extent over a long period of time. We called this "climate".
	The teacher than project the definition of weather and climate using power point.
Step 2	Example: 1. Weather is the condition of lower atmosphere of a place over a short period of time. 2. Climate is the average condition of lower atmosphere of a place over a long period of time.
Step 3	Differences between weather and climate: the teacher grouped students into six and distributed two different animated flash card for them to observed differences between weather and climate. Each group should appoint leader to explain group's finding. The teacher, after deliberations of the groups, interacts with the class to show differences between weather and climate.
Step 4	Terminologies associated with weather concepts: the teacher use power point to show and explain to students on some terminologies associated with weather concepts. Some of the terminologies includes: a. Snowy, cold, windy, rainy etc b. Land and see breath c. Environmental lapse rate e.t.c.
Students' activity	The teacher asks students to use the information provided in the animated flash cards and form their animation in their exercise books with some explanations on the animated weather formed.
	The teacher evaluates his lesson by asking students some questions based

Evaluation	on the lesson treated. Example: - What is weather? What is climate? - What is the difference between weather and climate? List the terms associated with weather concept. E.t.c
Conclusion	The teacher conclude the lesson by summarizing the entire lesson, explain some areas of difficulties observed during evaluation and allow students to make their own note on the concepts taught.

Lesson 2

Week	Two
Class	SS II
Sex	Males and Females
Average age	17 years
Methodology	Animated-media instructional strategy
Subject	Geography
Topic	Elements of weather and their units of measurement
Behavioral objectives	By the end of the lesson, students should be able to: Explain the terms weather element. State at least three weather element. Explain each weather element State the unit of measuring each weather element Develop interest in weather elements
Previous knowledge	Students have previously learnt about the definition of weather and climate as well as some terminologies associated with weather concept.
Instructional materials	Computer, projector and Animated package of weather element.
Introduction	The teacher introduces the lesson by asking students some questions based on their previous lesson. Example: What is the difference between weather and climate? What is environmental lapse rate? E.tc.
Presentation	The teacher present his lesson based on the following steps:
Step 1	The teacher paste animated chart showing different element of weather and allow students to carefully observe the animation and comment on the features observed. The teacher interacts with students and explains that the features observed are some elements that we observed and measured about conditions of the day in the lower atmosphere. Such phenomena observe in relation to weather

are terms as “element weather”.

The teacher than project the list of element of weather as follows:

Elements of Weather

Rainfall

Temperature

Wind

Atmospheric pressure

Relative humidity

Cloud cover

Sunshine

Etc.

Step 2

The teacher explains to student on each element using power point projection of animated-media instructional strategy.

Example:

Rainfall: Precipitation refers to the rain of the earth’s surface from the atmosphere

Temperature: Is the degree of hotness or coldness of a place

Wind: Wind is the air in motion characterized by speed and direction

Atmospheric pressure: This refers to the weight of air over time.

Relative humidity: Humidity is the measure of the dampness of the atmosphere due to water in the gaseous state and which varies from place to place at different times of the day.

e.t.c

Step 3

units used in explaining weather elements:

Element	Unit of measurement
Rainfall	millimeters (mm)
Temperature	Degree centigrade (^{o}c), Degree Fahrenheit (^{o}f)
Wind	cardinal points
Atmospheric pressure	millibers

	Relative humidity percentage etc
Students' activity	The teacher asks students to use the experience of the lesson and observed the following: Temperature of the day at 12:30 pm and 12:30 am. Time and direction of Sun rise on three different days Wind direction and speed at 10:05 am on two different days
Evaluation	The teacher evaluates his lesson by asking students some questions based on the lesson treated. Example: What is weather element? What are weather elements? What is the unit of measuring temperature?
Conclusion	The teacher conclude his lesson by summarizing the entire lesson, explain some areas of difficulties observed during evaluation and allow students to make their own note on the concepts taught.

LESSON 3

Week	Three
Class	SS II
Sex	Males and Females
Average age	17 years
Methodology	Animated-media instructional strategy
Subject	Geography
Topic	instrument in measuring weather elements and precautions for using each instrument;
Behavioral objectives	By the end of the lesson, students should be able to: 1. State the instruments for measuring weather elements. 2. Match each instrument with its corresponding element and unit 3. State the precautions for using each instrument 4. Develop interest in weather instruments
Previous lesson	Students have previously learnt about Elements of weather and their units of measurement.
Instructional materials	Animated chart showing weather instruments, animated meteorological station computer, projector and animated package of weather instrument.
Introduction	The teacher introduces the lesson by asking students some questions based on their previous lesson. Example: What is weather element? - What are weather elements? - What is the unit of measuring temperature? E.tc.
Presentation Step 1	The teacher present his lesson based on the following steps: The teacher paste animated chart showing different

instruments of weather and allow students to carefully observe the animation and comment on the features observed. The teacher interacts with students and explains that the features observed are some instruments used in measuring weather elements. They are kept in meteorological station. Some of these instruments (e.g. thermometer) can be kept in Stevenson screen. The teacher than project the animated metrological station together with the list of weather instruments as follows:

Instruments used in measuring Elements of Weather

1. Rain gauge
2. thermometer
3. Wind vane
4. anemometer
5. hygrometer
6. barometer
7. Sunshine recorder Etc.

Step 2

The teacher explains to student on each instrument using power point projection of animated-media instructional strategy.

Example:

1. Rain gauge: This is an instrument used in measuring Precipitation or rain of the earth's surface from the atmosphere.
2. Thermometer: this is used in measuring temperature (Is the degree of hotness or coldness of a place)
3. Wind vane: is an instrument for measuring Wind direction
4. Anemometer: is an instrument for measuring Wind speed
5. Barometer: is an instrument for measuring Atmospheric pressure or the weight of air over time.
6. Hygrometer: is an instrument for measuring Relative humidity which is the measure of the dampness of the atmosphere due to water in the

gaseous state and which varies from place to place at different times of the day.e.t.c

Step 3

Precautions used with weather instruments. The teacher project animated weather instrument and show precautions for keeping each instrument.

Example:

- To get accurate records thermometers are kept in a standard shelter called Stevenson screen to protect them from the effect of Radiant heat of the sun and rain.
- Rain gauge: The distance between ground labeled and funnel top The metal funnel that leads to glass bottle enclosed within a copper cylinder connected to an inner container where the water is collected.

Step 4

The teacher guide students on how to match instruments, elements and their Correspondence units of measurement using animation.

Element	Instruments	Unit of measurement
1. Rainfall	Rain gauge	mm
2. Temperature	Thermometer	^{o}c or ^{o}f
3. Wind direction	Wind vane	cardinal points
4. Atmospheric pressure	Barometer	millibers
5. Relative humidity etc	Hygrometer	%

Students' activity

The teacher asks students to use the animated weather instruments and draw the following in their work sheets:

1. Rain gauge
2. thermometer
3. Wind vane

4. anemometer
5. hygrometer
6. barometer

Evaluation

The teacher evaluates his lesson by asking students some questions based on the lesson treated.

Example:

1. State the instruments for measuring weather elements.
2. What is rain gauge used for?
3. State the precautions for keeping thermometer.

Conclusion

The teacher conclude his lesson by summarizing the entire lesson, explain some areas of difficulties observed during evaluation and allow students to make their own note on the concepts taught.

WEEK 4

Week	Four
Class	SS II
Sex	Males and Females
Average age	17 years
Methodology	Animated-media instructional strategy
Subject	Geography
Topic	Observing, recording analysis, interpretation, and reporting of weather data (temperature, rainfall, and wind).
Behavioral objectives	By the end of the lesson, students should be able to: - Describe procedures for observing and recording weather elements temperature, rainfall and wind). - Convert temperature from degrees to Fahrenheit - Describe the procedure of interpretation and reporting temperature, rainfall and wind. - Develop interest in Observing, recording analysis, interpretation and reporting of weather data
Previous knowledge	Students have previously learnt about instruments used in measuring weather elements.
Instructional materials	Animated Chart showing weather data (temperature, rainfall and wind), computer, projector, rainfall and temperature data.
Introduction	The teacher introduces the lesson by asking students some questions based on their previous lesson. Example: - What is meteorological station? - What are the elements for measuring weather data? - What is Stevenson screen? E.tc.
Presentation	The teacher present his lesson based on the following steps:
Step 1	The teacher displays animated chart on the board and explain to students on technique of observing weather elements on:

Rainfall
Temperature
Wind (finger method) Etc.
The teacher guide students on how to create weather data (rainfall and temperature).
Example: Rainfall data

Month	J	F	M	A	M	J	J	A	S	O	N	D
Rainfall(mm)	10	80	20	120	130	150	200	210	190	18	17	9

Step 2

Temperature data

Month	J	F	M	A	M	J	J	A	S	O	N	D
Temp (^oC)	40	30	21	25	10	40	48	30	25	30	20	15

The teacher explains to students on Interpretation and reporting weather data.

Example:

Conversion of temperature scale.

Step 3

Daily rainfall and temperature.

Monthly rainfall and temperature.

Mean annual rainfall and temperature.

Diurnal temperature.

Local times for observing weather elements e.t.c.

The teacher ask students to formulate three data each on rainfall and

temperature and use it to interprets the differences in the three different sets of data formed

Students' activities

The teacher evaluates his lesson by asking students some questions based on the lesson treated.

Evaluation

Example: A student observed and measured temperature of the year and obtained the following information: 12, 14, 17, 23, 65, 45, 68, 10, 53, 12, 90, 43,56. From the result obtained, what is:

The month with the highest temperature?

The month with the lowest temperature?

The total annual temperature?

The annual range of temperature?

The mean annual temperature?

An SS II student measured soil temperature and found his result to be 16^{o}c. He was asked to report this finding in degree Fahrenheit. What is his new reading?

Conclusion

The teacher concludes his lesson by highlighting some areas of difficulties observed during evaluation and allows students to make their own note on the concepts taught.

LESSON 5

Week	Five
Class	SS II
Sex	Males and Females
Average age	17 years
Methodology	Animated-media instructional strategy
Subject	Geography
Topic	The attributes weather physical and human activities.
Behavioral Objectives	By the end of the lesson, students should be able to: - State the attributes of weather - Explain variability, spatial extent and Duration as an attribute of weather - Explain the relevance of weather elements to physical and human activities. - Develop interest in the attributes of and relevance of weather elements to physical and human activities.
Previous Knowledge	Students have previously learnt about technique of observing, recording analysis, interpretation and reporting of weather data.
Instructional Materials	Chart showing animation of relevance of weather on human and physical development, animated videos, projector, computer, source book, chalk and chalk board.
Introduction	The teacher introduces the lesson by asking students some questions based on their previous lesson. Example: What are the procedures for using finger technique in observing wind direction? What is diurnal temperature? What is mean to be an annual temperature range? What is the appropriate morning time for observing weather element? e E.tc.
Presentation	The teacher present his lesson based on the following steps:
Step 1	Display animated chart for the list and explanation of weather attribute. Variability

	Spatial extent duration .Etc.
Step 2	The teacher display and discuss with class the animated power point projection of relevance of weather element to physical and human activities on; Health; Agriculture; Types of cloth worn.e.t.c
Students' Activities	The teacher asks students to developed animated chart illustrating relevance of weather on agriculture and health.
Evaluation	The teacher distributes flash cards containing animated pictures of relevance of weather on physical and human development for observation and small group discussion. This is followed by asking students some questions based on the lesson treated. Example: Example: Based on the lesson treated and past experiences on weather, simply state your opinion on the following statements: Weather affects human comfort. Temperate areas are more habituated than desert areas because they are hotter. Humid environments do not encourage the growth of micro- organisms that increase ill health. Natural hazards like erosion, wind storm, floods and drought are caused by difference in the climate of a place. Temperature and rainfall are the major factors of the type of plant growth in an environment. Weather condition do not affects the type of cloth people wear. Low cloud covers increase heat in the lower atmosphere. Higher cloud cover decrease heat in the lower atmosphere.
Conclusion	The teacher summarized the entire lesson and allows students to copy board summary in their exercise books.

LESSON 6

Week	Six
Class	SS II
Sex	Males and Females
Average age	17 years
Methodology	Animated-media instructional strategy
Subject	Geography
Topic	weather and environment
Behavioral objectives	By the end of the lesson, students should be able to: - Perform simple exercise using animated charts on weather and environment - Discuss the influences of weather on environment - Develop interest in the concepts taught
Previous knoeledge	Students have previously learnt about the relevance of weather to humanity and physical development
Instructional materials	Chart showing animation of relevance of weather to the environment, animated videos, projector, and computer.
Introduction	The teacher introduces the lesson by asking students some questions based on their previous lesson. Example:What is the relevance of temperature on agriculture? What is the relevance of rainfall on agriculture? How do adverse weather affect planning? What is the relevance of weather on health? E.tc.
Presentation	
Step 1	The teacher present his lesson based on the following steps: Distribute animated flash chart on weather and environment to each group for observation and brief discussion among each group.
Step 2	The teacher displays the animated power point projection of relevance of

Step 3	weather element to environment to guide group discussion.
Step 4	The teacher interacts with students in discussing the effect of weather on environment specifically on transportation and constructions.
Students' activities	Students played the animated package on weather and environment in the computers provided for the lesson while teacher guide the students during the lesson.
Evaluation	The teacher asks students to developed animated chart illustrating relevance of weather on constructions.
Conclusion	The teacher asks students some questions based on the lesson treated. Example: how does weather affect transportation and constructions? The teacher summarized the entire lesson and allows students to copy board summary in their exercise books.

APPENDIX G

LESSON PLAN FOR CONTROL GROUP

LESSON 1

Week	One
Class	SS II
Sex	Males and Females
Average age	17 years
Methodology	Lecture method
Subject	Geography
Topic	The concept of weather, climate and their associate terminologies
Behavioral objectives	By the end of the lesson, students should be able to: Define the terms "weather and climate". Differentiate between weather and climate. State an example of weather and climate conditions Explain at least two terminologies associated with weather and climate Develop interest in weather concept
Previous lesson	Students are aware of some changes that naturally occurred in the environment such as season, day, night etc.
Instructional materials	Chalk and chalk board.
Introduction	The teacher introduces the lesson by explaining the objectives of the lesson to students and asks them some questions in relation to their past experience with weather. Example: Expected question1: What two major changes do you normally observed within 24 hours of the day? Expected answer: appearance of sun make day, when sun set night comes.

	Expected question2: Why is that in a particular period of a year one must wear tick cloth? Expected answer: cold nature of the season. E.tc.
Presentation	The teacher present his lesson based on the following steps:
Step 1	The teacher defines weather and climate while students listen. Example: 1. Weather is the condition of lower atmosphere of a place over a short period of time. Climate is the average condition of lower atmosphere of a place over a long period of time.
Step 2	Differences between weather and climate. Example: Weather can change within a short period while climate deals with average condition of atmosphere for a very long period of time say 35 years. E.t.c
Step 3	Terminologies associated with weather concepts: the teacher explain to students on some terminologies associated with weather concepts. Some of the terminologies includes: Snowy, cold, windy, rainy;Land and see breaze; Environmental lapse rate e.t.c.
Students' activities	The teacher ask students to relate their experiences on environmental lapse rate using previous experiences of trees and mountains climbing.
Evaluation	The teacher evaluates his lesson by asking students some questions based on the lesson treated. Example: What is weather? What is climate? What is the difference between weather and climate?
Conclusion	List the terms associated with weather concept. E.t.cThe teacher conclude his lesson by summarizing the entire lesson, explain some areas of difficulties observed during evaluation and allow students to make their own note on the concepts taught.

LESSON 2

Week	Two
Class	SS II
Sex	Males and Females
Average age	17 years ±
Methodology	Lecture method
Subject	Geography
Topic	Elements of weather and their units of measurement
Behavioral objectives	By the end of the lesson, students should be able to: Explain the terms weather element. State at least three weather element. Explain each weather element State the unit of measuring each weather element Develop interest in weather elements
Previous lesson	Students have previously learnt about the definition of weather and climate as well as some terminologies associated with weather concept.
Instructional materials	Chart showing definition of weather element, chalk and chalk board
Introduction	The teacher introduces the lesson by asking students some questions based on their previous lesson. Example: What is the difference between weather and climate? What is environmental lapse rate? E.tc.
Presentation	The teacher present his lesson based on the following steps:
Step 1	The teacher explains to students on the objective of the lesson. This is followed by explaining the term elements of weather. Example: These are certain things that we observed and measured

about conditions of the day in the lower atmosphere. Such phenomena observe in relation to weather are terms as “element weather”.

The teacher listthe element of weather as follows:

Elements of Weather

Rainfall

Temperature

Wind

Step 2

Atmospheric pressure

Relative humidity

Cloud cover

SunshineEtc.

The teacher explains to student on each element.

Example:

Rainfall: Precipitation refers to the rain of the earth’s surface from the atmosphere

Temperature: Is the degree of hotness or coldness of a place

Step 3

Wind: Wind is the air in motion characterized by speed and direction

Atmospheric pressure: This refers to the weight of air over time.

Relative humidity: Humidity is the measure of the dampness of the atmosphere due to water in the gaseous state and which varies from place to place at different times of the day.

e.t.c

units used in explaining weather elements:

Element	Unit of measurement
Rainfall	millimeters (mm)

	Temperature	Degree centigrade (^{o}c), Degree Fahrenheit (^{o}f)
	Wind	cardinal points
	Atmospheric pressure	millibers
	Relative humidity	percentage etc
Students' activities	The teacher ask students to distinguish between elements, units and instruments for weather with examples	
Evaluation	The teacher evaluates his lesson by asking students some questions based on the lesson treated.	
	Example:	
Conclusion	What is weather element?	
	What are weather elements?	
	What is the unit of measuring temperature?	
	The teacher conclude his lesson by summarizing the entire lesson, explain to the students on major areas of difficulties observed in evaluation	

LESSON 3

Week	Three
Class	SS II
Sex	Males and Females
Average age	17 years
Methodology	Lecture method
Subject	Geography
Topic	instrument in measuring weather elements and precautions for using each instrument;
Behavioral objectives	By the end of the lesson, students should be able to: State the instruments for measuring weather elements. Match each instrument with its corresponding element and unit State the precautions for using each instrument Develop interest in weather instruments
Previous lesson	Students have previously learnt about Elements of weather and their units of measurement.
Instructional materials	Chart showing weather instruments, chalk and chalk board.
Introduction	The teacher introduces the lesson by asking students some questions based on their previous lesson. Example: What is weather element? What are weather elements?
Presentation	What is the unit of measuring temperature? E.tc.
Step 1	The teacher present his lesson based on the following steps: The teacher paste chart showing different instruments of weather and explains that the features observed are some instruments used in measuring weather elements. They are kept in meteorological station.

Step 2	Some of these instruments (e.g. thermometer) can be kept in Stevenson screen. The teacher lists the instruments of weather while students listen. Example: I**nstruments used in measuring Elements of Weather**
Step 3	Rain gauge thermometer Wind vane anemometer hygrometer barometer Sunshine recorder The teacher explains to student on each instrument. Example:
Step 4	Rain gauge: This is an instrument used in measuring Precipitation or rain of the earth's surface from the atmosphere. Thermometer: this is used in measuring temperature (Is the degree of hotness or coldness of a place) Wind vane: is an instrument for measuring Wind direction Anemometer: is an instrument for measuring Wind speed Barometer: is an instrument for measuring Atmospheric pressure or the weight of air over time. Hygrometer: is an instrument for measuring Relative humidity which is the measure of the dampness of the atmosphere due to water in the gaseous state and which varies from place to place at different times of the day.e.t.c Precautions used with weather instruments. The teacher project animated weather instrument and show precautions for keeping each instrument.

Example:

Step 5 To get accurate records thermometers are kept in a standard shelter called Stevenson screen to protect them from the effect of Radiant heat of the sun and rain.

Rain gauge: The distance between ground labeled and funnel top The metal funnel that leads to glass bottle enclosed within a copper cylinder connected to an inner container where the water is collected.

The teacher explains to students on how to match instruments, elements and their correspondence units of measurement.

Example:

Students' activities

Element	Instruments	Unit of measurement
Rainfall	……	mm
Temperature	Thermometer	……
Wind direction	……..	cardinal points
…….	Barometer	millibers
Relative humidity	Hygrometer	……..

Etc

The teacher allow students to ask questions based on the lesson treated.

The teacher evaluates his lesson by asking students some questions based on the lesson treated.

Example:

Evaluation State the instruments for measuring weather elements.

What is rain gauge used for?

State the precautions for keeping thermometer.

Conclusion The teacher conclude his lesson by summarizing the entire lesson, explain some areas of difficulties observed during evaluation and allow students to make their own note on the concepts taught.

LESSON 4

Week	Four
Class	SS II
Sex	Males and Females
Average age	17 years
Methodology	Lecture method
Subject	Geography
Topic	Observing, recording analysis, interpretation and reporting of weather data (temperature, rainfall and wind).
Behavioral objectives	By the end of the lesson, students should be able to: Describe procedures for observing and recording weather elements temperature, rainfall and wind). Convert temperature from degrees to Fahrenheit Describe the procedure of interpretation and reporting temperature, rainfall and wind. Develop interest in Observing, recording analysis, interpretation and reporting of weather data
Previous Knowledge	Students have previously learnt about instruments used in measuring weather elements.
Instructional materials	Chart showing weather data (temperature, rainfall and wind), chalk and chalk board.
Introduction	The teacher introduces the lesson by asking students some questions based on their previous lesson. Example:What is meteorological station? What are the elements for measuring weather data? What is Stevenson screen? E.tc.
Presentation	The teacher present his lesson based on the following steps:
Step 1	Display chart on the board and explain to students on technique of observing weather elements on:Rainfall;Temperature;Wind (finger method)

Step 2 .Etc.

The teacher explains to students on how to create weather data (rainfall and temperature).

Example: Rainfall data

Month	J	F	M	A	M	J	J	A	S	O	N	D
Rainfall (mm)	10	80	20	120	130	150	200	210	190	18	17	9

Temperature data

Month	J	F	M	A	M	J	J	A	S	O	N	D
Temp (^{o}C)	40	30	21	25	10	40	48	30	25	30	20	15

Step 3

The teacher explains to students on Interpretation and reporting weather data.

Example:

Conversion of temperature scale.

Daily rainfall and temperature.

Monthly rainfall and temperature.

Students' activities

Mean annual rainfall and temperature.

Diurnal temperature.

Evaluation

Local times for observing weather elements e.t.c.

The teacher ask students to perform some practical involving temperature and rainfall in their exercise books

The teacher evaluates his lesson by asking students some questions based on the lesson treated.

Example: A student observed and measured temperature of the year and obtained the following information: 12, 14, 17, 23, 65, 45, 68, 10, 53, 12, 90, 43,56. From the result obtained, what is:

The month with the highest temperature?

The month with the lowest temperature?

The total annual temperature?

The annual range of temperature?

The mean annual temperature?

An SS II student measured soil temperature and found his result to be 16^{o}c. He was asked to report this finding in degree Fahrenheit. What is his new temperature?

Conclusion

The teacher concludes his lesson by highlighting some areas of difficulties observed during evaluation and allows students to make their own note on the concepts taught.

LESSON 5

Week	Five
Class	SS II
Sex	Males and Females
Average age	17 years
Methodology	Lecture method
Subject	Geography
Topic	The attributes of weather relevance of weather elements to physical and human activities.
Behavioral objectives	By the end of the lesson, students should be able to: State the attributes of weather Explain variability, spatial extent and Duration as an attribute of weather Develop interest in the attributes of and relevance of weather elements to physical and human activities.
Previous knowledge	Students have previously learnt about technique of observing, recording analysis, interpretation and reporting of weather data.
Instructional materials	Chart, source book, chalk and chalk board.
Introduction	The teacher introduces the lesson by asking students some questions based on their previous lesson. Example: What are the procedures for using finger technique in observing wind direction? What is diurnal temperature? What is mean to be an annual temperature range? What is the appropriate morning time for observing weather element? E.tc.

Presentation	The teacher present his lesson based on the following steps:
Step 1	Display chart for the list of weather attribute: Variability; Spatial extent; duration Etc.
Step 2	Explanation of the weather attribute in step 1 above
Step 3	Relevance of weather element to physical and human activities on: Health Agriculture Types of cloth worne.t.c
Students' activities	The teacher asks students to share their experience on how rainfall resulted in good and poor crops yields.
Evaluation	The teacher evaluates his lesson by asking students some questions based on the lesson treated. Example: Based on the lesson treated and past experiences on weather, simply state your opinion on the following statements: Weather affects human comfort. Temperate areas are more habituated than desert areas because they are hotter. Humid environments do not encourage the growth of micro- organisms that increase ill health. Natural hazards like erosion, wind storm, floods and drought are caused by difference in the climate of a place. Temperature and rainfall are the major factors of the type of plant growth in an environment. Weather condition do not affects the type of cloth people wear. Low cloud covers increase heat in the lower atmosphere. Higher cloud cover decrease heat in the lower atmosphere. e.t.c
Conclusion	The teacher summarized the entire lesson and allows students to copy board summary in their exercise books.

LESSON 6

Week	Six
Class	SS II
Sex	Males and Females
Average age	17 years
Methodology	Lecture method
Subject	Geography
Topic	Weather and environment
Behavioral objectives	By the end of the lesson, students should be able to: Discuss the effects of weather on environment Develop interest the topic taught
Previous knowledge	Students have previously learnt about the relevance of weather to health and agriculture.
Instructional materials	Chart, source book, chalk, and chalkboard.
Introduction	The teacher introduces the lesson by asking students some questions based on their previous lesson. Example: What is the relevance of weather on agriculture?
Presentation	The teacher present his lesson based on the following steps: The teacher explains to the students on effect of weather on environment:
Step 1	1. Transportation 2. Desert encroachment 3. construction
Step 2	The teacher and students discussed the above in the class
Step 3	The teacher allow students to ask questions based on the lesson treated
Students' activities	The teacher asks students to make case from their environment on how wind lead to soil erosion.
Evaluation	The teacher evaluates his lesson by asking students some questions

	based on the lesson treated. Example: How do weather affect transportation? What is the effect of weather on houses and roads constructions? How do adverse weather lead to erosion? Etc
Conclusion	The teacher summarized the entire lesson and allows students to copy board summary in their exercise books.

APPENDIX H

ITEM SUMMARY SHEET FOR WCAT

Test for Difficulty and Discrimination indexes for the 60 items of WCAT

Item No.	$P = \frac{R}{T} \times 100\%$	$D = \frac{Ru - RL}{N}$	Item No.	$P = \frac{R}{T} \times 100\%$	$D = \frac{Ru - RL}{N}$
1	0.61	0.54	31	44	0.50
2	50	0.44	32	50	0.44
3	55	0.43	33	55	0.43
4	43	0.45	34	43	0.45
5	45	0.45	35	45	0.45
6	65	0.42	36	65	0.42
7	42	0.48	37	42	0.48
8	29	0.29M	38	48	0.53
9	31	0.31M	39	46	0.57
10	44	0.50	40	45	0.47
11	50	0.28M	41	47	0.48
12	35	0.35	42	61	0.49
13	43	0.45	43	51	0.53
14	45	0.45	44	57	0.48
15	65	0.42	45	48	0.47
16	42	0.48	46	53	0.73
17	48	0.53	47	62	0.50
18	46	0.27	48	60	0.41
19	29	0.29M	49	54	0.47
20	25	0.52M	50	52	0.52
21	49	0.56	51	45	0.47
22	30	0.31M	52	64	0.50
23	50	0.58	53	52	0.47
24	53	0.70	54	49	0.51
25	55	0.56	55	53	0.49
26	41	0.53	56	48	0.55
27	47	0.51	57	54	0.52
28	50	0.48	58	56	0.58
29	48	0.50	59	46	0.60
30	44	0.50	60	58	0.47

Key: P difficulty index; D descrimination Index; X= Discarded for being too Difficult; M modified and retained