FFECTS OF 5E-LEARNING MODEL ON CREATIVITY, PERFORMANCE AND RETENTION IN ECOLOGY AMONG SECONDARY SCHOOL STUDENTS, ZARIA EDUCATION ZONE, KADUNASTATE NIGERIA

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MARCH, 2021

DECLARATION

I Janet Funke JESULOWO hereby declare that this dissertation entitled 'Effects of 5E-Learning Model on Creativity, Performance and Retention in Ecology among Secondary School students, Zaria Education Zone, Kaduna State Nigeria' has been carried out and written by me in the Department of Science Education, Faculty of Education, Ahmadu Bello University Zaria. The information derived from the literature are duly acknowledged in the text andlist of references provided. No part of this dissertation was previously presentedfor another degree at this or any other Institutions.

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Name and Sign **Date**

CERTIFICATION

This dissertationentitled ‘EFFECTSOF 5E-LEARNING MODELON CREATIVITY, PERFORMANCEAND RETENTIONIN ECOLOGYAMONG SECONDARY SCHOOLSTUDENTS, ZARIA EDUCATION ZONE, KADUNA STATE NIGERIA’ by JANET FUNKE JESULOWO meets the regulations governing the award of the degree of Doctor of Philosophy in Science Education (Biology) of the Ahamadu Bello University, Zaria and is approved for its contribution to Knowledge and literary presentation.

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Prof. T.E. Lawal Date
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DEDICATION

This work is dedicated to my beloved late Parents Pastor and Evang. (Mrs) M.A. Olu Olowoyo for theirlove on my academic progress,my husband Engr. (Dr.) M.B. Jesulowoand to my beloved Children Christianah, Daniel and Mary, l love you all.

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LIST OF ABBREVIATIONS

In the course of this study some words have been abbreviated and were frequently used in the text. They include the following:

5E	-	E1: Engagement,E2: Exploration, E3: Explanation, E4:Elaboration and E5: Evaluation.
WAEC	-	West African Examination Council
NECO	-	National Examination Council

OPERATIONAL DEFINITIONS OF TERMS

The following terms are operationally defined as used in this study:

Effect: A phenomenon that follows and is caused by some previous phenomenon that has power to produce results. A change occurring as a direct result of action by 5E-Learning model.

5E Learning Model: Is a constructivist instructional method of teaching and learning Model of 5 phases of Es' The Es standfor Engagement, Exploration, Explanation, Elaboration and Evaluation.Designed for Pollution, Conservation of natural resources and Pests and Disease of plants and animals which are conceptually linked and developmentally sequenced.

Creativity: The act andidea that change an existing domain into a new one whereby something new and valuable of creativity traits is attained.The skill of each student to convey task in a new way.

Academic Performance: Is the total of individual knowledge that is assessable at the end of a given period of time or formally acquired knowledge in school subjects which is often represented by percentage of marks obtained by the students in examination.

Retention: Ability to hold, secure and recall what individuallearnerslearnt or experiences when evaluated.

Constructivist: Constructivist strategy is a learning strategy that involves students maximally chance of active participation. It is student's centered

Lecture method: Lecture method is a teaching and learning that allows teacher full participation and students listen passively with minimal chance of participation. It is teacher's centered.

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ABSTRACT

The study investigated the effects of 5E-Learning Model on Creativity, Performance and Retention in Ecology among Secondary School II Students in Zaria Education Zone, Kaduna Nigeria. The research design adopted for the study was quasi experimental design pretest-posttest, post-posttest control group. The population was 5180 of co-education students from nineteen schools.Six schools were ramdomly selected and pretested out of which two schools of equivalent classes purposively sampled 100 students was drawn. The instruments were Biology Achievement Test (BAT) and Creativity Assessment Scale (CAS) which were validated byexperts. The reliability coefficients were 0.86 and 0.85for BAT and CAS respectively. The treatment was for six (6)weeks. Six Research Questions and sixnull Hypotheses guided the study.Research Questions were answered using descriptive statistics mean and Standard Deviation on students performance using 5E-learning model and lecture method among others.The null Hypotheses were tested using t-test at significant level of $P \leq 0.05$ among others. The result shows there was no significant difference in performance of students taught Ecology concepts using 5E-Learning Model based on gender.In testing the hypotheses on performance, t-test,2-way MANOVA multiple analyses at $P \leq 0.05$ were used. Mann Whiney test was used for creativity among others.The findings of the study showed that experimental group performed significantly better than those exposed to lecture method.This shows that, 5E-Learning model of instructionwas favorable to students of ecology concept.Recommendationmade thatteachers teachingEcology concept to students should be encouragedto use5E-Learning model of instruction in teaching at SeniorSecondary Schools among others.

CHAPTER ONE

THE PROBLEM

1.1 Introduction

In the 21st century, a rapid change in science and technology has caused living standard of communities and expectations of people to increase in relation to ideas that make change possible through education. Acish, Yalcinand Turgut (2011) stated that, many researchers in Europe, United States of America and Turkey attempted to keep pace with the rapidly changing world through pedagogy and curriculum in science at all levels. Scientists see science as an important agent of technological advancement and social change of any nation for solving socio-economic problems of different types. Science has its limitations because it cannot be used to solve problems that cannot be tested using the five sense organs. Science subjects have been identified as difficult to learn by science students at all levels of education, (Kruager, 2010).

Science has many branches among them is Biology which is the study of natural science that studies life or living organisms. The subject is of importance to science students and teachers since it is a subject taught at senior secondary and tertiary institutions in Nigeria, and it is also a core subject recognized by National Policy on Educationgoals (FRN, 2013) such as cultivateinquiring, knowing and rational mind for the conduct of a good life and democracy, produce scientist for national development, service studies in technology and the cause of technology and the cause of technological development among others.Few objectives of secondary education include providing opportunities to acquire necessary knowledge, skills and attitudes for the development of self and the nation, to build a firm foundation for further education and training, develop ability for enquiry, critical thinking and rational judgement. The subject focuses on natural science hence it is concerned

withmeaningful understanding of laws, theories and concepts. Unfortunately, the students' performance at senior secondary schools certificate examination has been an issue of concern to all its stakeholders. Ibrahim (2014) stated that,Biology can be designed to equip students with skills and attitudes of caring about themselves, the organisms and the environment in which they live. Biology is a scientificand technological process of life thatcould be applied to solve societal problems. This entails that, the subject is taught to students by teachers using different teaching methods.

The subject is therefore taught right from Senior Secondary School (SSS) to tertiary level depending on these teaching approaches. The use of teaching approaches such as discussion, laboratory and inqury methods in secondary schools that would help in getting satisfactory academic performance in West Africa Examination Council results is of interest in research.This is because students performance in West Africa Senior Secondary Certificate Examination (WASSCE)is mostly unsatisfactory. Educators like Adegoke, (2010) state that,many researchers advocated for appropriate approaches while Ibrahim, (2013); Adamu, (2014) have seen the pressing need to reconsider the techniques and methods of instruction at senior secondary school level and recommended instructional systems that are students' centered formeaningful learning if reforming of education is to succeed. Teaching through inquiry and problem solving is considered the science education theme of research (Cornelius, 2012). The National Policy on Education (FRN, 2013) emphasizes that, the teaching and learning of science should lead to the acquisition of scientific processes and principles that aim at providing knowledge, skills, capacity for self-reliance and intellectual development.

Aina (2009) reported varieties of methods of teaching Biology that have been used such as lecture method, inquiry, guided discovery and field trip. The teachers' consistent use of theseteaching methods do not lead to exert meaningful learning of scientific concepts and

their application, this hasbeen revealed through their results. Lawal (2009) reported that, teachers' teaching method, class size, teachers' attitudes, students' attitudes, among others are factors that have contributed to the low academic achievement of Biology students in West African Examination Council results (WASSCE).Lawal, (2010) and Olarewaju, (2012) among others, investigated some areas of teaching and learning biological concepts from secondary level to tertiary levels with the use of various instructional methods and models to boost the academic achievement of the learners still shows there is no significant improvement. That means the secondary school system is still facing a number of challenges and many researchers likeLawal,(2012) andOlajide, Lawal and Umahaba,(2016); Jesulowo, (2015)found out that,the failure rate was alarming and unsatisfactory. In view of this, there are several studies such as that ofIbrahim, (2013) on Teaching and Learning of Biology to Enhance good Performance of Secondary School Students in Nigeria which discovered that the results of these students are still unsatisfactory.Based on observations, educators are still experimenting with other methods to find remedy to this problem.

Anyaegbunam (2012)sees constructivism as an epistemological theory of knowledge, used to explain how learners know what they know. An epistemologist is often concerned with the status of knowledge while a constructivist view of knowledge is that, it 'fit' or to support current theories in the area and if experienced,the changes of knowledge may need to be modified through learning models such as E cycle.The E cycle is applied in the inquiry approach to teaching, into a series of planning strategies (Lawson, 2001). The model was investigated anddiscovered that it helps students to acquire a common set of experiences so that they can compare results and ideas with their classmates (Llewallyn, 2005). Bybee, Taylor, Gardner, Scotter, Powell, Westbrook & Landes, (2006) stated that the 5E Models were known as to Engage, Explore, Explain, Elaborate, and Evaluate which

The teaching cycle model has several ‘‘Es’’ such as 2E, 3E, 4E, 5E, 6E, 7E, 8E and 9E. Mayer, Hackett and Everett (2007) stated that learning cycle model of learning and teaching were discovered since 40 years ago and influenced by Jean Piaget with its application byArkin and Karplus 1962, who applied cognitive development theory and discovery learning to instructional strategies in elementary Science.Also, the first three phase model (3E) consisted of Exploration, Invention and Discovery was first used in the Science Curriculum Improvement Study (SCIS) program. Mayer et al., (2007) noted that 3E terms were modified to Exploration, Concept Introduction and Concept Application. The 4E evolvedthrough modification to include engage, explore, explain, elaborate, which applied andwas used while Exploring LifeEvaluation. Northern (2019) stated the phases as Engage, Explore, Explain, Evaluate.Moyer et al., (2007)noted that KarplusRobert on fifth phase, evaluate, was incorporated into elementary science program developed by the Biological Science Curriculum Study in 1992. This modification gave birth to 5E-Learning cycle. This 5E-Learning model is credited to Bybee (2002)who developed 5E-Learning model which is a standard of all E‘s instructional model based on constructivist approach to learning.The learning model of learning concepts in science is known to eliminate scientific misconceptions and bring about experience that is rewarding to students and teachers (Lawal, 2009). These learning models are designed to increase students concentration as well as process, and retain more difficult materials. Olarewaju (2012) stated types of models asmental model, scale models, analogue models and mathematical models based on nature of what they represent and problem they intend to solve in the teaching and learning situation. The model of learning is therefoere known to provide a framework for understanding complex concept and break it down into discrete and manageable units such asE-learning models. The standard out of all E-Learning models is known as 5E-Learnnig model.

Sam, Owusu-&Anthony-Krueger (2018) study3E and 5E teaching approaches show that students in the experimental groups were instructed through 3E and 5E learning and conventional cycle while those in the control group were instructed on the same concept through conventional approach. The 3E learning cycle were found to be more effective for improving the performance of low achievers. The students exposed to the 3E and 5E approaches showed positive attitudes towards learning cycle when they were interviewed. There has been consistent decline in the performance of students in public schools examinations conducted by WAEC 2011-2018 in Kaduna and other parts of Nigeria. The Chief Examiner for WAEC (2015) attributed the poor results to teacher's methodology as well as inability of students to attempt both practical and theoretical questions correctly. The 5E-Learning method was used to teach Pre-NCE students of FCE (Ibrahim, 2015). SSS2 Chemistry students in Katsina (Olajide, et al., 2016) and Polytechnics(Kauru, Shehu and Ya'u, 2016). Great improvement was recorded.In order to reduce the rate of failure to a minimum, the subject needs effective method of teaching at the Senior Secondary School of Zaria Education Zone.

The method of teaching maybe among single or co-education students. Based on gender,the identified Biological theories of gender stated that, gender is referred to the cultural differences expected by the society or culture of man and woman according to their sex. Based on gender findingsthis shows that,people's sex does not change from birth but their gender can (Mcleod, 2014). Some findings,therefore have shown generally that,academic performancewith regards to instructional strategies shows difference, while others reported no difference. This is an indication that, some methods are gender-friendly while others are not. It is good to determine if 5E-learning model is gender friendly or not among the SSII Biology students in Zaria Education Zone.The teachers need to facilitate desirable changes in learners by moving into the world of learners as this present study requiresthe use of 5E-

learning model of instruction in learning Ecology concepts to male and female students with a viewto studying the effects of 5E-Learning on performance and retention among co-education public schools students in Zaria Education zone.

The co-educational students learn and create new ideas and innovations of ideas. Creativity means to be innovative not only by making new things butit also embraces originality and unique connections. Riechert and Post (2010) in the United States, observed that,time spent by pupils in watching TV and playing computer games affect the development of creativity in schools. The learning of ecology concepts was to promote creativity and teaching lifelong skills such as critical thinking, problem solving, collaboration and communication in core academic subjects. Olorukooba and Lawal (2010) stated that creativity involves a specific kind of thinking such as divergent thinking that involves all mental abilities, process and manipulative skills that could result in the generation of new ideas. The innovation leads to applying the new and creative ideas for service production.Obeka (2011) expanded on the taxonomy of educational objectives by Bloom which is taxonomy of Cognitive, Affective and Psychomotor domains. Cognitive Domain deals with recall of knowledge, intellectual abilities and skills in hierarchy of increasing operational difficulty as follows: Knowledge, Comprehension, Application, Analysis, Synthesis and Evaluation. The Affective domain has receiving, responding, valuing, organization and characterization while the Psychomotor domain lists from the lowest such as reflex movement, basic fundamental movement, perceptual abilities, physical abilities, skilled movements and non-discursive communications. Varah (2012) added that, Biological concept in Nigeria can be creatively provided through beekeeping, floriculture, poultry and Snailtry which are important for providing job security in order to avoid youth restiveness, reduced unemployment and poverty among youth. Olaofe (2013) observed that, creativity is problem solving, self-discovery of facts rather than mere fact giving and spoon-feeding,

that makes learning take place effectively and learners to be independent rather than dependent.

Creativity according to Adamu (2014) is the idea that changes in an existing domain into a new one.It refers to a phenomenon whereby something new and valuable is attained. In order to know the natural world, students should be naturally curious to learn. The consensus among researchers of human traits, like creativity traits cannot grow on its own, but requires stimulation to develop fully in children Cronin (1989) describescreativity ability as what gives opportunities to try out new ideas, new ways of thinking with benefits such as freedom, selfawareness, faith on confidence in our instincts, stress relief, problem solving, help to acknowledge and collaborating our own uniqueness and diversity due to encouraging self expression from personal feelness and experience. (Picasso, 2017).However, lack of creativity among Biology students and teachers is still a missing link in the chain to maximize potentials of Biology students in science education. Biological concepts that are creative and significant to new educational development for students to be self-employed when new idea or a concept is being introduced to produce original, useful and satisfying skills to students. The students creative skills are viewed as crucial for learning rapidly if only the schools concentrate on using strategies of constructivist such as 5E-learning model of instruction that is students centred. This is what the present study aim at finding out the students creativity traits in public Senior Secondary Schools in Zaria Education Zone.In the same vein, the innovative learning models, model of instruction that will help improve the creativity traits, of Ecology concepts by Senior Secondary School students for satisfactory learning, teaching, creativity traits and results were the current concern of this study.The students creativity traits are viewed as crucial for learning rapidly if only the school concentrates on using 5E-Learing model.

The creativity traits may improve academic performance, if being used, therefore, academic performance is the total individual knowledge that is assessable at the end of a given period of time. Also, it is used at school level either in a class, laboratory, library or fieldwork which does not include the extracurricular activities (music, games and recreation). Performance therefore, is a vital human ability that can be improved upon using various strategies. This can be measured using continuous assessment and examination. Academic performance can be used to measure students' level of comprehension during the teaching and learning process. Odubunmi (2006) observed that, learning Biology as well as other science subjects was referred to as subjects that is becoming more essential not only for the well-being of the individual but also for the entire society. Additionally, the contribution of the science of Biology towards the quality of human lifeis justified by itsinclusion in Science curricular of schools in Nigeria.The results of Senior Secondary School Certificate Examination shows no significant improvement over the years as poor performance of students in science subjects mostly Biology (WAEC, 2007-2010) is being reported.These may be affected by many factors such as, students' age, sex, parental economic status, health and relationship between teachers and students. National Examination Council (NECO, 2011) revealed that students' performance in science subjects including Biology is declining at an alarming rate (Zubairu, 2011 & Lakpini, 2012). Reports by Chief Examiners revealedthat the failure rate in the final year examination was high in Biology(WAEC, 2015).Despite the relevance of Biology, research report is replete with information on high level of failure in the subject at the secondary school level. The failure rate is more obvious in the areas often tagged as difficult in Biology (Samba & Eriba,2012). Still on WAEC and SSCE results, lnvestigation in areas of science such as Biology, revealed mass failure and the problem of failure among Biology students is linked to so many factors such as perception of students on difficult topics,

gender in Biology, learning Biological concepts at the primary school that serve as foundation, methods of teaching, class size, instructional materials and students retentive ability (Igboegwu, 2012; Olarewaju, 2012; West African Examination Council, 2012; Nsofor, 2013; WAEC, 2007-2010; 2011-2018 and NECO, 2013-2018). These studies tried to give reasons for poor academic performance of students at Senior Secondary School (SSS) especially in Biology.The downward trend in the performance could be due to the approach or strategies of teaching employed. Educators are still investigating on ways to improve students' academic performance and retention. This study investigates the effects of 5E-learning model on academic performance among Secondary School Biology students. This gap can be traced to the subject learning and pedagogy.

Retention on the other hand, is the ability to remember what was learnt or experienced by an individual which takes place when learning was coded into the memory through several factors. Akinbola and Folasade (2009); Ayanmene and Anyachebelu (2009) argued that when teaching is characterized by rote-learning, it would be meaningless memorizing on verbalism and students make ineffective learning, and the facts thus learned are not retained. Students' retention was referred to as what could arouse and retain through the use of multimedia instructional approach (Adegoke, 2010). Alake (2015) sees retention as what is being organized and meaningful in students as they apply principles, solve problems and interpret experimental data which makes learning become effective and facts learnt are retained with passage of time. The investigation on effects of teaching-with-Analogy on retention of evolution concepts among male and female, Nigerian Certificate of Education (NCE) in Biology revealed that among many students there is significant difference in the retention ability of male and female in favour of male students (Olorukooba, Lawal and Jiya, 2012).

Some schools are still battling with what can boost the morale of students, staff and public because it wasobserved that no tangible improvement on the academic achievement of students in Kaduna State (Zubairu, 2011). In Kaduna State, 26.45% out of eight to nine credits was recorded among the states in Nigeria that score 5 credits and above. This, still points to the decrease in credit level of academic achievement in school results. This was attributed to nonchalant attitude and it related to students' academic achievement (WAEC, 2015). This may be limited to academic method of teachingin secondary schools,therefore, effect of 5E-Learning model of instruction on retention of Ecology concepts among the students in Zaria would be the finding here.

It is always educators' concern to look at the past and present situation in order to have a better perspective of the future.The 5E-Learning model is therefore justifed for being students centre. It is a process by which students learn by doing, involving, creates when there is opportunity, time and space were given by the facilitator. Also, the teaching of science at all levels has been recommended as activity based and child-centeredness (FME, 2013). Therefore, the present study adopts the 5E-learning model which is standard of E learning models.The currentstudy used 5E's model to study its effects on creativity, performance and retention in ecology among secondary school students in Zaria Education Zone, Kaduna State.

1.1.1 Theoretical Framework

The theoretical framework of this study ishinged on Piaget's (1973) ConstructivistTheory of Cognitive Foundation that learning is attained through construction. Constructivism of learning is based on ideal that, knowledge is constructed based on what is experienced by observation.Vygotsky's Activity Theory (1978) of Learning sees learning as appropriation which resides within the learner.Vygotsky theory believes that, children construct

knowledge activelyin relation to their environmentwhich involves inventing, constructing new ideas and explaining theirvision, knowledge and believe in social learning preceeds development. The second idea of the theory is that potential for cognitive development is limited to a Zone of Proximal Development (ZPD). Vygotsky (1978) emphasized on the role of language in cognitive development results. Adult was seen as an important sources of cognitive development and that infants are born with the basic material abilities for intellectual development. The theory does not adhere to the idea that a single abstract principle is able to explain cognitive development.It involved stages of learning. Model as a stage of learning involves mental, scale, analoque and mathematical models.Students work in group within and outside classroom and share process of generating unity.The present study uses 5E learning model to test the potential for cognitive development and higher level of the potential development by exposing the students to the strategies of the model. 5E-learning modelis an example of constructivism strategies in which the students link their previous knowledge to the objects, organisms, substance or the equipment to develop a range of experinces on which to base their thinking.

The teacher is to create environments in which the students can construct their own understanding and act as facilitator who encourages students to discover principles. The learners can connect between their learning experience and the real world. An instructional approach and a good model designed of experimentally rich lessons that are conceptually linked and developmentally sequenced to support the ongoing, progressive refinement in student understanding as it develops over time. Adoption of 5 phases of E learning cycle instruction modelwas required: they are (Engagement, Exploration, Explanation, Elaboration and Evaluation) which is the highest standard out of all E's learning cycles. This agrees with 5E-learning cycle since it emphasizes on active participation in lesson through physical activities and mental engagement. This also links the present study to the

previous knowlege. The present study involves the use of learning models such as the 5E-Learning model.

Guilford theory (1959)stated that, creativity is to bring about the active role of the learners in building understanding and making sense of information for the benefit of the society. It is a proposed theory for the development of creativity framework and hypothesized as a confluence of three kinds of resources such as creativity-relevant skills across the domains, domain-relevant knowledge and skills that is domain-specific and task motivation.The gender biological theories researchershadrevealed through examination of the brain whilst men and women that carried out language tasks found that women used both hemispheres, while men use only left. It appears that in males brain hemispheres work more independently than in females and testosterone influences this lateralization. Gender has been seen as a continuous scale rather than two categories that is determined by two biological factors' hormones and chromosomes.This study therefore,uses5E-Learning model as a learning process of inquiry to discover and measure effects of 5E-Learning model on students' creative traits, academic performance and retention in Ecology concepts among secondary Biology students in Zaria Education zone, Kaduna state.

1.2 Statement of the Problem

Ecologyis a branch of Biology that studies populations and their interactions with each other and their environments. The teaching biology at secondary school objectives is to identifies Scientific interest and career development, to identifies nature of science and scientists, to expresses scientific attitude and appreciation, to present major fats, principles from the knowledge category among others. In the same vein, importance of teaching biology at secondary school such as, it offers students the opportunity to engage with diversity of living organisms and their local and wider environment, to investigating and

exploring the living world among others in ecology among which is part of Biology curriculum, The objectives of teaching are not met leading to persistence poor performance of students creativity and retention more especially ecologyconcepts. Many researchers (Bichi, 2008; Lawal, 2012; Muonene, 2015 and Olajide, Lawal & Umahaba, 2016)have carried out study in the teaching of ecology due to poor performance of SSII students in the concept as well as in their creativity and retention but the poor performance still persist. Therefore this study was carried out to see whether 5E Learning will improve SSII Biology students performance, creativity and retention in ecology concept.

Over the years, thispoor performances of students in biology at the Senior Secondary School have made Kaduna State to embark on a unmber of measures to ensure effective teaching and learning.The Chief Examiner's Report (WEAC 2016) stated that, Biology candidates' results in Nigeria 2015 when compared with 2014 WASSCE, the raw mean score of 29 and standard deviation of 12.37 mean score of 25 and standard deviation of 11.87 indicate poor performance, although the failure rate is noticeable in biology, the students that passed biology at credit level (A1-C6) were consistently less than 50% for the past eighteen years in Nigeria. Several studies still revealed poor performance in Biology at final WAEC/SSCE examination (Muoneme, 2015, Ibrahim, 2015; Lawal and Usman, 2018). The Chief Exerminer's Report of WAEC/SSCE (2018)stated that the performance was slightly poorer than that of 2017.Some of the stated weakness in ecology include poor spelling of some technical terms, poor expression in questions requiring explanation, poor diagrams, inability to compare Biological process appropriately and poor performance in questions that required application of knowledge.The strength of students among others was the ability to answer question precisely, ability to follow instruction stated and explain the terms renewable and non-renewable natural resources. The Students' SSCE Results in Biology is shown in Table 1.1

Table: 1.1 Students' SSCE Results in Biology (2008-2018)in Kaduna.

Year	Total no of cand. that sat.	No of cand. with C6 and above	% of cand. with C6 and above	Percentage fail
2008	1259965	427644	33.94	66.06
2009	1340206	383112	28.58	71.42
2010	1300418	645633	49.64	50.36
2011	1505199	579432	38.49	61.51
2012	1646150	587044	35.66	64.34
2013	1698188	564138	33.22	66.78
2014	1692435	529425	31.28	68.72
2015	9699911	969491	52.29	47.71
2016	1552758	878040	52.97	47.03
2017	1471151	923486	59.22	40.78
2018	1572396	858424	54.59	45.41

Source: West Africa Examination Council Office, Kaduna (2018)

Based on the poor performance shown in Table 1:1 and despite several studies carried out and poor performance still exist. The researcher carried an investigation to see whether 5E-Learning model will enhance SSII biology students in ecology.

1.3 Objectives of the Study

The objectives for the study are to:

(i) determine the effects of 5E-Learning model on performance in Ecologyconcepts among Secondary Schoolsstudents in Zaria Education Zone.

(ii) investigate the effects of 5E-Learning model on students' creativity trait in Ecologyconceptsamong SS2 students in Zaria Education Zone.

(iii) determine the effects of 5E-Learning model on students' retention ability in Ecology conceptsamong Secondary School Students in Zaria Education Zone.

(iv) compare the mean scores of male and female students taught Ecology concepts using 5E-Learning model among Secondary Schools in Zaria Education Zone.

(v) compare the mean scores of male and female students creativity trait taught Ecology concepts using 5E-Learning model.

(vi) Explore the effects of 5E-Learning model on male and female Secondary School students on retention ability.

1.4 Research Questions

The following research questions guided the study:

i. What is the difference between the performance of students taught Ecology concepts using 5E-Learning model and those taught usingLecture method among Secondary Schools students in Zaria Education Zone?

ii. What is the difference in creativity traits betweenstudents' taught using 5E-learning model and those taught using Lecture method among SS2 Ecology Students in Zaria Education Zone?

iii. What is the difference in retention ability of Ecology concept among secondary students taught using 5E-Learning model in Zaria Education Zone?

iv. Is there any difference in mean score between male and femalestudents taught using 5E-Learning model in Zaria Education Zone?

v. What is the difference in the mean scores of male and female students'creativitytrait taught Ecology using 5E-Learning model in Zaria Education Zone?

vi. Is there any difference in retention ability between male and female students taught using 5E-Learning model in Zaria Education Zone?

1.5 Null Hypotheses

The following null hypotheses are formulated for testing:

H_{O1}: There is no significant difference in Performance of students taught Ecology concepts using 5E-Learning Model and those taught using Lecture method in Zaria Education Zone.

$H_{O2:}$ There is no significant difference in Creativity traitsbetween students taught using 5E-Learning model and those taught using Lecture method in Zaria Education Zone.

$H_{O3:}$ There is no significant difference in Retention ability of students taught Ecology concepts using 5E-Learning model in Zaria Education Zone.

$H_{O4:}$ There is no significant difference in the mean scores between male and female students taught using 5E-Learningmodel in Zaria Education Zone.

$Ho_{5:}$ There is no significant difference in the mean scores of male and female students Creativity traits whentaught Ecology concepts using 5E-Learning model in Zaria Education Zone.

Ho_6 There is no significant differencein Retention ability between male and female students taught using 5E-Learning model in Zaria Education Zone.

1.6 Significance of the Study

The findings of this study will hopefully benefit the followings:

Biology Students:learning ability of Ecology concepts would be broaden, and would empower students to construct what they acquire and easily passed to the society. Improve

their learning of Ecology concepts and increases their social skills and Creativity traits,Leading to better academic performance.

Teachers:would be able to help the students build a strong basic knowledge through active participation. To be conversant with 5E-Learning model of instruction. It will motivate Biology teachers to use 5E-Learning model lesson plan for Ecology lesson. This will help to alleviate the problem associated with Ecology concept since the method of learning is step by step,hence students learning centered.

Curriculum Planners: Itpromotes collaborative activity learning for students working together in solving problems and promotes spirit of asking questions, observing and drawing conclusion. It will also add as pedagogy of 5E-Learning model to the teaching of Ecology concepts

Professional Bodies: Will be able to train staff, students on the use of 5E-Learning model of instruction step by step through seminar, workshop and conferences. Such bodies as Science Teachers' Association of Nigeria (STAN),Science Association of Nigeria (SAN), National Board for Technical Education (NBTC), Pre-diploma and Remedial institutions, teachers, Ministry of Education, West Africa Examination Certificate (WAEC) and National Examination Council (NECO) andwill have new area of interest to actualize the vision 2030 for global technological advancement needs in order to implement the pedagogy of 5E-Learning model of instruction.

Researchers: Researchers would be able to investigate students across all ages at secondary schools and tertiary institutions.

1.7 Scope of the Study

The study investigated the effects of 5E-Learning model on creativity, academic performance and retention in ecology among Senior Secondary School Students in Zaria

Education Zone, Kaduna State, Nigeria. The population of the study was nineteen public co-education Senior Secondary Schoolsin Zaria Education Zone.Six schools were pretested out of which two schools that equivalent were selected for the sample of experimental and control group. The SSII Biology students were used because they were more stable and not under stress of any upcoming external examination. The selected Ecology concepts include: Pollution, Conservation of Natural Resources, Pest and Diseases of plants and animals which were selected according to the concept to be taught in the syllabus.5E-Learning modelwas used for 6 weeks as treatment.

1.8Basic Assumptions

The study hasthe following basic assumptions:

(i) The effects of 5E-Learning model is measurable.

(ii) The students under study were using the same syllabus with same method of teaching.

(iii) The creativity traits is measurable.

(iv) The students under study were not yet taught ecology concepts.

(v) Students would understand items of the instruments, the Biology Assessment Scale (BAT) and Creativity Assessment Scale (CAS) to make reliable response to the items.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

This chapter reviewed literature relevant to the study 'Effect of 5E-Learning Model on creativity, performance and retention in Ecology among Secondary School Students in Zaria Education zone' and are arranged under the following subheadings:

2.2 Teaching Biology in the Secondary Schools.
2.2.1 Methods of Teaching Biology.
2.2.2 Lecture Method and Academic Performance in Biology.
2.3 Concept ofEcology.
2.3.1 Teaching of Ecology Concepts at the Secondary School.
2.4 5E Learning Model and Performance in Science.
2.4.1 5E Learning Model and Creativity in Biology.
2.4.25E Learning Model and Retention in Biology.
2.5 Concept of Creativity and Performance in Biology.
2.5.1 Creativity and Retention in Science.
2.6 Gender and Performance in Science.
2.7 Overview of Similar Studies.
2.8 Implications of the Literature Reviewed for the Present Study.

2.2Teaching Biology in the Secondary Schools

Secondary education is the second stage where learners acquire knowledge and skills that prepare them for the higher education which is the manpower base for national development. Education diversifies opportunities to cater for the individual differences in talent and interest toward mouldling the behavior of the learners (Bakori, Yaranci & Umar, 2018). Teaching biology as one of the science subjects at this level is to live effectively in our modern age of science and technology in order to achieve educational objectives for future academic foundation and development. The teaching of Biology in secondary

schoolsis in different stages. Teaching of the practical aspect and theorietical aspect. World wide, the practical teaching is indispensable of theory and it should be effectively taught. Mwangu and Sibanda (2017) pointed out that some studies, such asKibirige and Teffo (2014) stated teachers' attitude towards practical work is pitiable and as a result they do it to fulfil the minimum requirement of the syllabus. In South Africa, Dekkers in Kibirige and Teffo (2014) found thatscience teachers make little or no use of practical lessons. In Kenya Rutto and Kptingel (2014) have revealed that students are less exposed to practical work in science lesson. In Ghana countless teachers have on occasion conducted far more than rudimentary repetition of theory work which is the requirement for examination (Perry, 2015). In Zimbabwe, the past exerminers report (2014) shows the lowest pass rate and the concerns were how was the practical lessons were taught.

In Nigeria,the teaching of Biology commences from senior secondary education to tertiary level. A case study of Enugu South Education Zone revealed the problems and prospect of teaching Biology in secondary schools due to unavailability of instructional materials for teaching Biology in the secondary schools among 340 SSI students. The research questions and hypotheses were tested using chi-square. The results shows the qualities of Biology teachers have a significant effect in the teaching and learning of biology and attitude of students towards the teaching and learning of Biology, affect students academic achievements. It was recommended that all required equipments and facilities such as seats, instructional media, conducive classrooms and good Biology textbooks should be free and available to all students at the secondary level of education (Projectplus, 2017).

Daworiye, Alagoa, Enaregha & Eremasi(2015) worked on factors affecting the teaching and learning of Biology in Kolokuma Opokuma L.G.A. Bayelsa State. The investigation and description of the stady and quality of Biology teaching and learning used 10 public schools of 200 SSI-SSIII students and 21 teachers. The findings and results indicated a gap

between the observed Biology teaching, learning and the ideal school Biology teaching with regards to curriculum, pedagogy, learning and resourse allocation, teachers knowledge and skills, attitudes, professional development and community support pointed major factors as poor facilities for teaching and learning. Recommended on closing the gap between the idea and real teaching and learning is to improve the teaching and learning of Biology in schools.

2.2.1 Methods of Teaching Biology

Psychologists believe that learners differ from one another biologically, psychologically, emotionally, socially and mentally. This fact makes teacher's work to be more complex.Various methods have been in use in teaching Biology within and outside the classroom of senior secondary school students. These are conventional methods and modern scientific methods of teaching. Teachingmethods are the major factor responsible for the level of performance in any subject by the students at any stage. A good Biology teacher could apply defferent types of method and select an appropriate approach to suit a given instructional situation. Generally, the inappropriate methods of teaching have contributed to poor academic performance of students and there is need for better methods of teaching that could be used toteach Biologyto the learners. Students learn better if learning moves from the passive receiver of information to that of active participation in the learning process as this is the basis of activity-based learning where the teacher is a facilitator (Mbanefo, 2019) These teaching methods are as follows:

(i) Lecture Method

(ii) Problem-Solving Method

(iii) Inquiry Method

(iv) Demonstration Method

(v) Simulation Method

(vi) Questioning Method

(vii) Discussion Method

(viii) Comparative Learning Method

Lecture Method

Lecture method is predominant method of teaching in circulating knowledge mostly at all levels of academics in Nigeria. It is the traditional method, the expository method, talk and chalk or conventional method of teaching. This method is one of the oldest and most commonly used methods. Garba (2018) observed that, the method aims at collecting a large bodyof knowledge to be disseminated to a large group of people as possible and in shortest possible time with low cost. Teachers role is directives rooted in authority, knowledge is seen as inert as such students work alone. This means that the instructor is the central focus of information transfer. Such instructor stands before a class and present information for the students to learn. Sometimes, they will write on the board or use an overhead projector to provide visual information for students. Students are expected to take notes while listening to the teaching. Usually, very little exchange occurs between the teacher and the students during theteaching.

The teaching is a straightforward way to impart knowledge to students quickly. The teaher also has a greater control over what is being taught in the classroom being thesole source of information. Students who are auditory learners find that lecture method appeal to their learning style. Students who are weak in note-taking still have difficulty in understanding what they should remember from the teaching. Teachers embrace these methods for easy coverage of the school syllabus and quick manner to communicate scientific information and facts (Adegoke, 2011).It is a method used to introduce students to a new subject, but it

is also a variable method for summarizing ideals, showing relationships between theory and practice and emphasing the main points. Many teachers use this teaching method almost exclusively and consider it most simplest (Garba, 2018). The present study sees it as the most ineffective teaching method to teach senior secondary students Biology, mostly who often need a stages of learning strategy in order to learn effectively. Effective teaching and learning Biology should depend on learning activities.

Various teaching and learning strategies have been developed to accelerate learning process of students. There are, problem-solving method, inquiry method, demonstration method, play Way method, cooperative learning, laboratory activity method, project method, expository method and concept mapping among others.

Problem-Solving Method

Problem-solving is the ability to identify and solve problems by applying appropriate skills systematically. Also, it is a process, an ongoing activity, which will take what we know to discover what we do not know. It involves overcoming obstacles by generating hypothesis, testing those predictions, and arriving at satisfactory solutions. Science presented in the form of the problem will provide motivation to students to learn science more deeply (Ezeaghasi, 2017).For improving problem solving problem abilities, it is important to guide students and provide them with feedback as well as introducing strategic methods and modeling students in the utilization of these method (Seyhan, 2015).Bawa, (2011) stated that,problem solving is a method that lies between open-ended, creative thinking and the focused learning of content. This takes place in the classroom, and when teachers present tasks or challenges that are in some ways complex or for which the path to the solution is not straight forward, the responses of students to such problems as well as the strategies

that teachers used to assist them, showed some of the key failures of problem solving when it is used in school.

Inquiry Method

Inquiry method is the teaching and learning situation whereby students are given the opportunity to discover and find out things for themselves. The students should be able to:

- Develops good communication skills as science requires distinct communication for accurate sharing of methods and findings and finally, students become independent thinkers. Below are some problems experienced in using the inquiry/discovery method of teaching
- It is not cost effective
- It requires a lot of planning before it can be implemented
- It is time consuming
- Unsuccessful attempts at arriving at needed solution may have negative impact on students.

Demonstration Method

Ezeaghasi (2017) described demonstration as what involves, doing or telling the students the point of emphasis. It is mostly used as a technique within a method of teaching and some times as a method of teaching itself. Here the role of the teacher is to illustrate how to do something or illustrate a principle by first explaining the nature of the act verbally, follow by demonstrating the act in a systematic manner and later the students repeats the act. Here students are involved in doing things that will influence their behavior patterns, through demonstrations, and exposed to physical materials that will illustrate some meaning to their cognitive framework. Direct experiences like these go a long way to

enrich learning experience Demonstration is useful mostly in impacting psychomotor skills and lessons that require practical knowledge. The gains of using demonstration method in teaching lies in the fact that it bridges the gap between theory and practice, enables learners to become good observers and arouse their interest; students see immediate progress as a result of the correct method and it enables the teacher to teach manipulative and operational skills. The problems encountered in this method amongst others include the fact that students loose interest and confidence when they fail to repeat accurately; creativity, and originality by students are hindered as they try to do it exactly the same way as their teacher did because they have a limited opportunity to be familiar with learning materials.

Simulation Method

This method entails a real life activity in a simple manner that communicates the idea to the learners. Example, if the "use of money" is the topic in class; the teacher gets two students to act a traderand a customer scene, where the customer buys the items from the trader with the money, in this scene, the use of money is depicted in real life situation. This kind of simulations is better than mere verbal description. The use of simulation methods in classroom situations is devised to help students learn how things operate in reality. Students are encouraged to act out the same roles and make decision similar to real life situations. Therefore, simulation helps students to practice and understand adult roles and also develop the skills necessary for a successful adult life. Students make decisions and learn from success and failures (Bawa, 2011).Simulation and games are used at all levels of education to create both intrinsic and extrinsic motivation in the learner. While simulation methods present the students realities of life in concrete and simple forms, they are innovative and a welcome change in the learning experience as compared to the routine classroom learning. Simulation problem showing areas lies in the fact that it is time

consuming, very expensive, especially in an attempt to purchase a reasonable number of materials for class use. It also requires great classroom management (Dorgu, 2016).

Questioning Method

Ezeaghasi(2017) stated that, questioning generally helps learners to explore deeper level of thinking, knowledge and understanding. Questioning though is more of a technique than a method of teaching, it is used during various methods of teaching. Questioning aids in sensitizing the inquisitive mind of the learners. This method is credited to Socrates, a Greek Philosopher. Questioning methods may be used for the following purposes:

- to arouse interest and curiosity: At the beginning of a lesson, questions can be used to rouse interest and attention of the group on the subject.
- to stimulate discussion: Question that are thought-provoking can get the group to start reactions.
- to channel thinking: By skillful questioning, the teacher can steer the group to the objective he has established, keep them on the right tract and guide their thinking, the teacher can also help the group to move from the known to the unknown by a series of well-prepared questions.
- to determine how well the group understand the material: By the response given to a question, the teacher can determine if the group has absorbed what is being arranged in pairs or small groups for the benefit of all.

Students learn better when instructional process skills is employed. The learning outcome are significantly retained. This is so because the learning activities enable the students to formulate hypothesis, control variable, and make operational definitions and to carry out the various scientific skills and processes.The science educators recommend the teaching

strategies that would involve the learners (Lawal, 2009). Anyemene and Anyemene (2010) stated that, if Biology is effectively taught it will enable learners to understand the facts and principles of science and its applications at the stages of cognitive development, acquired skills, understand the methods and processes that lead to generation and validation of scientific knowledge that relates to the natural environment and local as well as global issues.It aids learners in connecting concepts, increasing awareness, encouraging creative and imaginative thought and making inferences.

Discussion Method

Discussion is a process of exchanging ideas that helps to retain information, fill in gaps and correct misconceptions, and enables the students to have a chance of expoloring solution (Mbanefo, 2019). Discussion according to reasearches pointed out that it is appropriate for topics that are subjectives or controversial, and involves several points of view such as funding of stem-cell research subjected to use of discussion method (Bawa, 2011). The present studyembacked on the theory of Vygotsky (1962) a contructivist psychologists who believed in classroom discussion and outsidesocial interactions of students.

Discovery Method

Wasagu, (2019) stated that discovery method is necessary, but not sufficient to explain what is needed in science teaching. The Discovery Method originated from Jerome Bruner in 1960s. The method emphasized on learning by doing. Students interact with their environment by exploring and manipulating objects, wrestling with questions and controversies or performing experiments.It is highly supported by educational psychologists. They agree with Kant, Piaget Vygotsky and Bruner as well as educational philosopher Dewey (1938) that learning is based on knowing and doing. Students are

actively involved in the process. They are curious and engaged in different forms of direct instruction, rote memorization and knowing information for the test.In which teachers give students a problems and some resources to solve it. The Discovery Learning Method as hands-on, focuses on the process, and encourages students to look for solutions. This learning method is a great choice for behavioural or developmental problems students. Teacher must understand that because something is hands on does not mean mind on learning and mastering of concepts(Inventionallandinstitute, 2018).

Cooperative Learning

Cooperative learning is a strategy in which small teams, each with students of different levels of ability use a variety of activities work together to improve their understanding of a subject matter (Ahmad, 2019).Norah (2015) stated that students completing cooperative learning group's task tend to have higher academic test scores, higher self-esteem and greater comprehension of the content and skills. The studies on cooperative learning teachniques have repeatedly shown increased in academic performance (Olarewaju 2012).This has been subjected to wide varities of subjects areas such as language, health, social studies and Biology.

Cooperative learning has its roots in constructivist theory and theperspective that cognitive changes takes place as students actively work on problems and discover their own solutions. The approach is also known for having three distinctive goals such as academic achievement, acceptance of diversity through independent work and development of cooperative social skills (Bawa, 2011).Teaching methods should be modified to reflect the need of learners. Constructivist Strategies that are needed for teaching is required. Students may perform better in achievement test when they are allowed to discover things for themselves during the use of learning models.

2.2.2 Lecture Method and Academic Performance in Biology

Lecture method is a traditional or conventional method of teaching and learning thatinvolves three stages: introduction, presentation and closure. This method also known as didactic approach in which the teacher present a spoken discourse on a particular subject (Atadoga and Onaolapo,2008 in Isa, 2012). Adesoji, 2009 in Isa (2011) identified (80%) of scientific information or principles that are passed on to students through lecture method andapplied by many teachers. Lecture method helps science teachers to cover bulk of the syllabus and in large class size but delivery has been the most personal problem with individual differences such as clarity of voice, simple and understandable language style, monitoring the students by regularly pausing to explain and ask questions (Isa, 2012).

Olarewaju (2012) revealed that, lecture method with models had a higher mean score than students taught using lecture method only. This results showed significant difference in the achievement mean scores of the two groups. Lecture method with model group achieved significantly better than the students taught using lecture methods. This showed that retention ability was higher when lecture method is supplemented with models rather than lecture method without models. Therefore,Olarewaju (2012) seeslecture method as a way of introducing students to a new subject, for summarizing ideas and to show relationship between theory and practice and for re-emphasizing the main points. The disadvantages such as passive learning on the part of the students, no immediate evaluation of what has been learned was pointed out.He further opined that,teachers are responsible for developing appropriate instructional strategies to help students achieve their expectations, as well as appropriate methods for assessing and evaluating students learning.

The learning of science is not encouraged especially Biology which is more practical in nature.Therefore, teaching is key to student's success. Teachers are viewed as those who provide opportunities for students to develop habits appropriate for science which include a

commitment precision and integrity in observation, experimentation, and reporting, respect for evidence, adherence to safety procedures and respect for living things and the environment. (PDF) while, Ibrahim (2013) revealed that, one of the problems facing students of Biology is the constant use of lecture method.Ogunbote & Adesoye 2006 in Muoneme (2015) investigated the IMB empirical study to enrich lecture methods of teaching in academic achievement and interest of biology students in Rijau Education Zone, Niger State. The use of Interactive Multimedia Board for instruction was used as a catalyst for change from traditional instructional methods to interactive and constructivist methods. The significance was to add new dimension to learning experience because concepts are easier to present and comprehend when the words are complemented with image and animations.

Olatunji (2017) pointed out introduction as first step of lecture method that involves question and answer on the previous knowledge to the new knowledge, description of an event in order to make the students to be comfortable with new topic and arouse certain previous experiences for the betterment of the new experience. The second step is the presentation of the lesson which is referred to as main body for various skills with teaching aids to arouse the students interest and if it fails, the lesson becomes boring. Thirdly is the closure of the lesson which include summary followed by assignment. Olatunji (2017) refers to it as one way of instructional process of presenting ideas, concept, generalization and facts orally used by many schools.

2.3 Concept of Ecology

Ecology is a branch of Biology that studies populations and their interactions with each other and their environments. The ecosphere is the part of the earth and atmosphere where living organisms live either on land (terrestrial) or in water (aquatic). The ecology principle

is that living organisms and their environment are mutually reactive, and affecting each other in various ways. The organisms are selective for growth and decay. Ecology occurs by growth, dispersal, reproduction, death and decay. Some of the reviewed literatures such asUptmor (2019) stated that, the more students learn about the environment the more they will appreciate it and can protect the nature. The nature contains many different ecosystems as community of living organisms and non-living organisms that interact with one another. Within their environment is the study of ecology. stated strategy that can be used to teach ecology such as hand-on enable science students to experience and understand the objectives and guidance and by providing structure that give students objectives they need to learn about the subject via elementary teachers. The best strategies were stated out of others was inquiry-based learning which is a type of active learning where questions guide the activities and discussion for the objectives.

Vance, Miller and Hand (1995) stated that, using constructivist teaching learning strategies in teaching ecology involves an initial exploration of students ideas that can be achieved in a variety of ways such as" Free Write" in which individual writes all their ideas about a particular topic, then form into progressively larger groups to further compare, discuss and explore their concept followed by general class discussion in which the teacher summarizes the main ideas on the board. The aim of implementing constructivist teaching learning strategies is for the students to have good understanding of the topic.

2.3.1 Teaching of Ecology Concept at the Secondary School

Nigeria secondary schools are vested with the responsibility of preparing the youth tobecome useful and responsible citizens through appropriate security, good environmental conservation that involves effective protection for success and quality school system in Nigeria (Jesulowo, 2018).Yucel, and Ozkan, (2015) examined the determination of

secondary school students' cognitive structure and misconception in ecological concepts through "word association" test in Turkey. The age between 12-14years among eighty nine students were taught the keywords of ecological concepts such as Environment, Species, habitat, population, ecosystem, food chain, substance cycle, biological diversity, environmental pollution, global warming, acid rain and greenhouse effect. The study put forward the relation for the given responses to the keywords. Also, most of the students had weak cognitive structure about ecological concepts. The close relations among these concepts with each other could not be built in students' cognitive structure and most of the students' responses were superficial knowledge acquired in daily life and contained many misconceptions. The student were aware of environmental problems. They were deficient in scientific information about reasons and effects of these problems. The findings shows that they did not sufficient knowledge in environmental education and training.

Adawiah and Esa (2013) intevewed season to explore the the ecological literacy among secondary school students in Malaysia. This abserved ecological literacy as the ability to understand the natural system that is related to human life and a way of thinking about the world in terms of interactions within natural systems including a cosideration of the consequences of human actions. It was further stated that the literacy equips students with the knowledge and competence necessary to address solution of environmental issues in an integrated way. The instruments used was several pictures about the environment around them and connecting students to natural system that provides them with a deep sense of surrounding and understanding of their local environment. The findings revealed that students ecological literacy is limited because they can not relates what they leant in class with their surroundings.

Finn, Maxwell and Calver (2002) worked on why does experimentation matter in teaching ecology? Murdoch in Australia. It was found out that common Australian texts included

little coverage was observed controlled experimentation in ecological practical work. The factor responsible was believed to have been logistical and ethical difficulties in designing suitable ecological practicalsand perception that, investigation of the ex interrelationships in ecology requires scientific approaches other than experimentation. It was agreed that experimentation should be a key component of secondary school ecology curricula. The inquiry-based approach was stated as an important component of secondary school Biology curricula and suggested five teaching principles to guide secondary school Biology teachers in providing a more realistic view of possibilities and limitations of ecological experimentation. Other were computer simulations and microcosm experiment that can allow students to design and implement ecological experiments either in classroom or on the field.

2.4 5E-Learning Model and Academic Performance in Science

The 5E was first developed by one of the leading names, the BSCS (Biological Science Curriculum Study, 1992). Bybee (2002) considered the phases as Engage, Explore, Explain, Elaborate and Evaluate. Others are 3E, 4E, 6E, 7E and 9E. The 9E learning is a new model in teaching and learning models which is an enhancement to the previous 7E model. Nuri and Hakan (2016) reported from the study that, 7E learning cycle in science teaching on meta-analysis showed positive effects on students achievement. The effect of 7E was not significant for school level, type of population and duration. The results regarding the subject matter showed a significant difference which implies that the 7E learning cycle was a useful strategy that should be included in science curriculum. The 6E learning model includes enrich phase to provide students with an opportunity to explore in more depth what they have learned and to transfer concepts to more complex problems. Also, the phase during which learners can transfer understanding and purpose to new

situations and applications. Students understand and are able to utilize the concepts Design, Modeling, Resources, System and apply them to “Human Values” (Barry & Burke 2013).

The 4E learning model enable students to begin learning by a Web activity that requires no formal knowledge of topic. The learning phase rouses students interest, and connects the students to the topic on a personal level.The 5E phases of learning model in relation to academic performance is stated as follows: Engage: This phase engages students with questions and creates curiosity. This also helps the teacher assess students' prior knowledge about the content. Explore: In this part, students are encouraged to work and explore the ideas without any direct instruction. Students gather data to make use of 5E-Learning Model as one of the approaches that involves Engagement in which students are engaged in inquiry questions. Exploration is a stage where student plan, design and carry out their experiment and record the experiment data. Explain: In this phase, the teacher encourages learners to explain what they have learned and introduced new terms, ideas, and explanations. Elaborate: In this part, the teacher encourages learners to apply the new knowledge to investigate further and helps students practice the new knowledge. Evaluate: The teacher observes students' performance and products to assess their understanding.

Wasagu (2019) viewed the 5Es teaching cycle for best teachers to begin with the end in mind, and requires teachers and students to practice what theyteach with respect to engagement in scienctific and inquiry practices to enrich their teaching and take their practices to progressively higher levels.Qawasmah and Syouf (2017) study on the effects of using computerized 5E’S learning cycle model on acquiring scientific concepts and thinking skills among fourth graders in Islamic educational college American program Scholastic Aptitude Test (SAT) during second semester 2015-2016. A quasi-experimental design were applied on 48 graders. Two groups were randomly assigned into experimental and control groups of 24 students each. The control group were taught using conventional

5E's learning cycle model strategy while the experimental group were taught using computerized 5E's learning cycle model strategy. Pre-test and post test were carried out with the Master, Eletricity and Magnetism units. The results showed that, there were statistical differences at the level of 0.05. The difference was in favour of computerized 5E'S learning cycle model while no significant differences between the strategy of teaching and gender.Goldhill, (2018) conducted a research and found relatively small behavior, intelligence and personality differences between gender.

Nsofor (2013) researched and pointed out that poor performance in Biology focused only on poor teaching methods, abstract nature of science concept, teachers centered-instruction and non–availability and utilization of instructional material. Aham (2013) in Nwagbo and Aham 2015) studies the effects of constructivist instructional approach on students' achievement and interest in genetics at Enugu education zone. The design of the study was quasi experimental, specifically, the non-equivalent control group design. The sample comprised 200 Senior Secondary School two (SSII) students, randomly drawn from four schools that were purposively selected from the zone. Data were analyzed by means and standard deviation for the research questions and analysis of variance for the four null hypotheses, test at 0.05 level of significance. The results show that the constructivist instructional approach was more effective than the lecture method in facilitating students' achievement and interest in genetics.

Ibrahim (2014) investigated and found out that, to teach Biology effectively, the teacher needs to employ a method such as constructivism that will enable the students to learn more, retain more and apply what is learned by engaging in significant and appealing activities through hands–on strategy that repositions Biology education teaching and learning through practical that shows the nature of Biology in developing science process skills, the problem solving skills and creative thinking abilities to make students to become

effective in their discipline, self-reliant, future scientists, creative thinkers and useful members of the society.The students can then compete favorably with their colleagues in any part of the world. Webster (2014), similarly, sees it as the type of learning by doing something that is by touching in the process of learning rather than learning about it from books or lectures. Constructivists shift to learning facilitator, collaboration, knowledge navigator and co-learner. More options and responsibilities are made available for learning, active participation in the learning process producing and sharing knowledge and learning collaboratively with others. (Farrel in Adamu, 2014) The current study is said to identify if 5E-learning model will enhance students' performance and if more relevant and functional in nature of their retention.

Nsofor (2013) stated that poor performance in Biology has been identified and need to seek better methods in teaching the subject in order to bring meaningful learning and to identify factors responsible for existing problems of low academic achievement.Explanation stage:the students make explanations from the experimental data answer the questions. Elaboration, students extend and apply their findings in a new context especially daily life. Evaluation, students evaluate their experience process and results in a variety of ways such as an activity report, instructor observation during the activity and student presentation of the experiments (Ajaja and Eravwoke, 2012). Lawal (2012) study on performance of two groups of secondary school students taught selected concepts in Biology using two different approaches of an experimental work in two local Government of Kano metropolis. The students responses that were subjected to activity-based method of teaching was analysed using t-test performed significantly better than those of lecture method control. Teachers were encouraged to use activity-based lessons as it enhances achievement. Olarewaju (2012) stated that, Biology could be difficult, especially when it describes things we cannot see like abstract concepts that we cannot fully comprehend at

first time. That some have the notion that Biology is boring with bulky syllabus, complex methods of teaching and the subject needs memory work while others find the subjects irrelevant. Also, discovered retention and stated that, retention of Biology concepts is an essential factor to determine students achievement in a given task or activities carried out and students must retain information from what is learnt in order to benefit the learner there must be meaning or purpose for that information by possessing the ability to assign the correct degree of importance to the materials. Thestudents'retention also referred to amount of participant being affected by practice during the learning. Olorukooba and Jiya (2012) discovered that students achieved and retained more when gap between what the teachers want the students to learn and what they already learnt has been claimed to increase the understanding of Biology concept. The memory retention of the students is thereby aided. If there may be any problem, it might be due to the nature of teaching method fashioned to teach Biology.

Students are expected to apply their new knowledge and skills as they give presentations (Yigit, 2012); Qaiser, Aslam, Sarwar, Lodhi and Hussain (2012) perceive academic performance of the students as a means of how students deal with their studies and how they cope with or accomplish various tasks given to them by their teachers. Academic achievement is the ability of students to recall and present orally or write the test of what they learnt within a given period of time. Academic achievements exist in line with the subject syllabus. In the same vein, Isa (2012) enumerates the functions of constructivist approach for science teachers as follows:

i. allowing learner's thinking to drive a lesson.

ii. shifting activities and content plan to fit students' responses, interest and ideas,

iii. encouraging students' imitation of ideas, display of leadership, and autonomy in planning and doing,

iv. encouraging students to expand and follow up their ideas,

v. allowing adequate wait-time for students to think and propose,

vi. encouraging group work, interaction with other students and others outside the classroom,

vii. using open-ended and thought-provoking questions and,

viii. encouraging students to reflect, analysis and predict

Seeking out existing concepts and using them in teaching and as challenges to misconceptions. Ismet (2012) from the study of Constructivist approach based on 5E-learning model and unusability instructional Physics, discovered that educational level in the world and Turkey used 5E-learning model as educational model. The properties were analyzed and information was preserved.The results presented with descriptive scanning take the grades of objectives, conclusion and education into consideration. Zubairu (2011) investigated student's retention of learned materials among public schools students in Kaduna State and discovered that availability of instructional materials enables teaching and learning desire objectives of Biology at all levels, can give 50% of students' academic work and self-evaluation. Agbenyeku (2011) discovered the level of retention as determined by nature of materials coded and can be studied by measuring the rate at which it declines and can be influenced by some factors like retroactive inhibition which is described as the interference of confusion of the present learning by subsequent learning. He used basic ecological concepts and found that the retention level was significantly higher in those taught ecology concepts than those taught using lecture method and there

was no significant difference in the retention level between male and female taught using ecology concepts. The researcher concluded that retention of concepts helps in reflective thinking and could be used in creative way to solve novel problems.

Biology results revealed that, out of 97,595 students that sat for the examination, 14,000 had credit and consistent poor academic performance generally of senior secondary school O/level is alarming (NECO, 2011).Acish, Yalcin and Turgut (2011) researched on effects of the 5E-learning model on students' academic achievement in 'Movement and Force issues among Erzincan and Ataturk University students in Turkey between the beginning and the end of the semester. The aim was to evaluate the efficiency of students guiding materials that was developed by the researcher based on Movement and Force unit objectives.Ukor (2010) pointed out that, Biology in Benue State, between 2005-2007 academic performance at credit level and above was 67% which was a departure from general poor performance, and statedthat it may be due to examination malpractice which may be due to high ranked state national examination malpractice index. Yusuf and Afolabi (2010), observed that students performed poorly in Biology because the Biology classes are usually too large and heterogeneous in terms of ability level. Additionally Biology syllabus is over loaded, coupled with ill equipped laboratory.

There are two strands of constructivist approaches such as cognitive construction and social construction. The tenets of constructivism as stated by Sunny (2009) is that, when learners prepare visuals aids such as text, graphics, web-sites or activities in which another can participate or endeavor's to explain material to other students or works in a group context, learning is specially powerful. He further stated the constructivism strategy as follows:

i. students come with a world view,

ii. their world view acts as a filter to all their experiences and incoming observations,

iii. changing a world view is tasking,

iv. students learn by doing,

v. when all participants have a voice, construction of new ideas is promising and,

vi. constructivism works best when the learner prepares something for other to see or hear,

Lawal (2009) also revealed that activity oriented teaching strategy known as conceptual change instructional strategy enables retention of concepts learnt. Akinbola and Folashade (2009) in one of their findings on constructivist teaching strategy and traditional method in relation to performance, retention and attitude was shown higher retention level and cognitive performance of more positive attitude of those students exposed to constructivist teaching strategy and retained the learnt concepts significantly better. No significant difference in students' academic achievement with reference to gender and problem solving strategy and traditional method. The recommendations stated that, Biology teachers should build the problems-solving instructional strategy more into mainstream of the classroom practice as it seems to have high potentials for enhancing understanding and achievement on the part of the learners.

Aggarwal (2008) study the methods of measuring retention such as Recall or reproduction, Relearning or saving method that involves calculating the number of trials taken to learn materials in the beginning and note down the savings of trials tract relearning it after some lapse of time. He concluded that a good memory and retention would lead to meaningful learning that enhances the production of series of changes within the entire cognitive structure which modifies existing concepts and forming new linkages between concepts. Ahmed and Yusuf (2008) research work discovered that computer based education in Biology of secondary schools is necessary. The individual and comparative learning setting

package was examined on 120 SS1 students from three private schools in Oyo State. Computer Assisted Instruction on individual or corporate students enhanced learning than those exposed to the conventional method of teaching. The researchers so much desired to know the cause of classroom instruction needed for CAI of students with poor academic achievement in Biology. It was concluded that students can learn at their own pace and not being influenced by their peer groups. Noise distraction could be eliminated so that weak and shy students can readily benefit from personal interaction with the computer. It was also recommended that the use of ICT in the teaching and learning of Biology should be encouraged to equip the students for development in information, communication and Technology. It can also arouse the students' interest which could serve as teaching aids for the teacher and excitement to the learners and to create effectiveness.

In California, at the Department of Education it was found out that there was a significant relationship between academic achievement and the physical fitness among public schools students. The findings were related to reading and scores in mathematics with fitness of graders fifth, (353,000) seventh, (322,000) ninth, (279,000) respectively. Higher achievement was associated with higher levels of fitness at each of the three grade levels. It was recommended thatacademic achievement could be based on different variables that can be justified.In the United States, schools must meet national standards to ensure that students reach a certain level of proficiency and some states set benchmarks as well.

In West Africa, it is called West Africa examination Council (WAEC) or Senior Secondary Certificate Examination Council (SSCE),In Nigeria, this is known as NECO National Examination CommissionThe WASSCE May/June (online) result in Nigeria, recorded a 70% failure. The result of 145,975 out of 1,750,976 candidates was withheld on the grounds of examination malpractice. While in the past four year i.e. 2000-2003, It ranges from 75.06% in 2010, 44.66% in 2011, 61.1% in 2012 and 35.74% in 2013 up to a

whoopping 70% in 2014. It was realized that Kaduna State fell at 26.45% among thestates that scored 5 credits and above in English and Mathematics. It was stated that "the level of unseriousness of students was high, due to the introduction of modern technology that has taken their time. The teachers' low remuneration causes teachers to combine business with teaching which adversely affect the output. The high rate of failure is noticeable in physics results among senior secondary students (Adedayo 2010; Jegede & Adedayo, 2013).There may be a need to tackle the massive failure in biology through the use of learning model that can lead to critical thinking, virtual field trips and outside classroom trip.

Piggot (2007) in Bello (2013) stated that, the presentation to the learner of an appropriate cues, ''jogs the memory'' but how to arrange for the cue which is the difficult and suggested that teachers should provide students with appropriate cues to know when they will manage them without external help in the case of memories, and the rhyme provide the cue. In view of science education mostly Biology students' need to be encouraged to engage in issues pertaining to the impact of science in everyday life and make responsible decision about how to address such issues.

Salisu (2014) stated that, retention in science teaching is like what the educational psychologists have used as one of the criteria of distinguishing between short term and immediate memory based on other investigators. A research work was carried out at Kastina on teaching method of retention in geography among secondary school students. The researcher observed that at the initial stage of memory process in learning without sufficient intelligence for learning, there cannot be retention. Mangal (2011), ascertained that retention of learned material could be improved through:

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

ii. developing self-confidence and never think that you would not be able to recall something,
iii. association of ideas, connection, and systematic thinking are very helpful in the task of recall and,
iv. never strain self for too long to recall something,

Alake (2015) stated that learning that is effective should improve retention while things that lead to confusion or interference among learned materials decrease the speed and efficiency of learning and accelerate forgetfulness and when a material is forgotten it means it has not been retained and hence cannot be remembered at a later period. Therefore, attaining optimum students' retention of what they have learnt might require the use of constructivist method of teaching. The use of activity oriented instructional strategies such as constructivist instructional strategy was suggested by some science educators such as Okebukola (2005) in Wasagu (2019) to enhance the teaching and learning of science strategy which is anchored on theory of learning such as Piaget who articulated mechanisms by which knowledge is internalized by learner. Varieties of methods have been introduced for teaching at both secondary and tertiary levels ranging from lecture, inquiry, demonstration, guided discovery, project, laboratory, fieldtrip, simulation methods among others (Obeka, 2010).

Alshehri (2016) studies the impact of using 5E's Instructional Model on achievement of mathematics and retention of learning among fifth grade students. Semi-experimental method was used. Sample size for the Experimental group was 30 and the control group was 29 students. Pre and post tests were used along with t-test to check the significant difference between the two groups. The two groups were equal regarding their achievement scores in pre-test before the experiment. After, the experiments their was a difference in their achievement test scores in favor of experimental group. Conclusions were made that

there were no significant differences in the experimental group attributed to the post and postponed test three weeks after which shows retention learning among the experimental group students. It was recommended that modern and practical use of 5E learning at the elementary schools and to train teachers to use 5E's instructional model to teach mathematics to enhance active learning.

Mahmud (2017) describes retention as ability to retain and consequently remember things experienced or learned by an individual at a time and this takes place when learning is coded into memory. Scaffold theory is the adequate retention information processing theory which is also a cognitive theoretical framework that focuses on how knowledge is centred stored and retrieved from memory of students. Cognitive psychologists believed that processes influence the nature of what is learned. From the findings, learning was considered as largely an internal process, not an external behavioral change. They looked into how we receive, perceive and store and retrieve information which means ability of students to recall and recognize when subject performance is examined and better performance in recognition is largely due to the fact that a measure of characterization is supplied and recalled of individualto himself (Bello, 2013).

Bybee (2006) proposed 5E constructivist instructional model of learning, that was adopted more precise in nature. The 5E's teaching and learning model is on the 5E's instructional model of Bybee, 1997; 2006 and 2010. The current investigation was exposed to SSII students based on 5E-learning model of instruction to find the effect on creativity, performance and retention in Zaria Education Zone. In this study, the retention level of student taught using 5E-learning model of instruction an example of constructivist teaching approach was investigated and compared with that of students taught the same concepts using conventional or traditional or lecture method.

2.4.1 5E Learning Model and Crativity in Biology

The followings are the general understanding retained in mind from the past experiences of reasearchers findings:

Frost (1992) in a socio-dramatic play stated that a more developed form of symbolic or dramatic play in which children engage in role-playing with other children through imitation and make-believe contribute to the development of creativity, intellectual growth and social skills. Children play with objects which results in divergent production. Akinboye (1997) sees creativity as a means of enabling one to get out of experiences and resources. It focuses on the process of forming original ideas through exploration and discovery. It was stated that creative human can be seen experimentally as a fellow who has a higher score in open ended test than intelligence test. This is not creative. Individual is not intelligent. It is shown that in open-ended test and an intelligent test the creative individual will always score higher in scores than in an intelligent test, this attest to the fact that creative individual is divergent in thinking and productive while intelligent individual is convergent in thinking and productive. Based on the above definitions and discussion on creative skills,this can be developed in learners through using activity based instructional strategy such as:

- Guide discovery method
- Inquiry method and
- Problem solving teaching strategy among others.

Due to the fact that the above methods and strategies give room for learner's to work independently and the teacher to facilitate the process of learning, Mari (2002) looked at why creativity skills are needed by learners and stated that if the skills are well developed it is capable of producing individuals who can take some responsibilities for shaping

positively not only their own living but that of others.Daniel (2005) stated that, creativity would become increasingly important as we enter into new age. This further emphasized fostering, encouraging the right thinking of creativity, emotion over life that resulted to direct thinking like logical and analytical thought. He concluded that, creativity will come out with a new idea better than the former. Creativity means cognitive skill to propose solution to problem or make something useful or has value of novelty, (Hwang, Chen, Dung & Yang, 2007). Wakili (2007) investigated the guided discovery approach which was recommended to provide students with experiences in science process skill that engage the students in active participation in learning. He emphasized on creativity among junior secondary school basic science students and observed that most of the teachers do not adopt instructional techniques and strategies that could stimulate creative thinking skills. White (2008) stated that, imaginative make-believe play, develops the young brain in the areas of symbolic and abstract and allows children to replay their experiences so as to process, understand and internalize them. It also, enables children and adults to form understanding and ideals about the world, to relax and recharge, to imagine new world and concepts and to rebuild the world around them which are valuable factors in the growth and application of creativity. Animashaun (2008) who worked on psycho-demographic variables as predictors of school attendance behaviour using six thinking hats creativity techniques discovered significant and effective ways of eradicating truancy in Osun state, concluded that, creativity is a strong factor in school after dance behaviour because it motivates and allows learners full participation. Whereas Moore *et al.,* (2009) stated that some researchers relates creativity to novelty, variety, and ability to understand some ideas which need divergent thinking in the process to generate new ideas.

Munandar(2012) increased technological advances and population explosion is accompanied by a lack of resources Natural-source creatively requires adaptation and the

ability to find imaginative solutions. It was concluded that through creative thinking someone will be able to use a variety of resource constraints that support the problem solution. Creative thinking skills are higher order of thinking skills. Scholars explained creative thinking skills in different ways, but contain similar concept that is the generation of something or ideas which have value of novelty. The importance of creativity toindividuals and nation building is observed through improvement on self-esteem, motivation, discovering of things by the learners, open to ideals and challenges and achievement of learners. Therefore, there are many academic investigations on academic performance and achievements of students on creativity.

Mark (2012) in his study suggested that, creativity traits such as idea generation, personality, motivation, intrinsic, extrinsic, achievement, confidence, producing and sharing are good learning qualities. Akpan (2013) he further stated that, this hampers students' scientific knowledge, inhibits the acquisition of science process skills and there are scanty research reports on the performance of science education programmes.Ezenduka, Achufusi & Okoli (2014) investigated the enriching creativity among senior secondary schools Biology students through which a learning model was applied. This was conducted among 150 SSII single sex public secondary school in Awka with the used research instrument of Test of creativity in Biology (TOCIB) for data collection, pretest and post- test scores were analyzed by the use of mean and standard deviation and analysis of variance. The results revealed that, the experimental group taught with Generative Learning Model Approach manifested more creative skills than those taught with expository method. Generative Learning Model is one of the constructivist approach to learning which were used on different concepts in Biology and it was gender friendly. The researcher also pointed out that teachers need to be creative in teaching and to

be able to engender or impact creativity in the learners so that they will not graduate as biological illiterates in this globalized economy.

Kuo and Hwang (2014), summarizes the opinion of some researchers that, solving the problem is a complex thought process that involves critical thinking, creativity and reasoning.. Furthermore, in Republic of Korea, more attention was proportionately given in the development of creativity of students but no enough educational support to educate children who have high creativity and special talents in regular schools. Not to be overlooked, but there latent ability and creativity should be developed and supported at the national level based on series of researches conducted in the area of creative thinking and development of education programs for children (Lee & Jun, 2015).

Ezenduka and Achufusi (2015) in their studies assessed the extent at which secondary school Biology teachers can apply innovative methods and assessment techniques in classroom instruction using survey design. They used 120 samples from a population of 228 teachers of six education zones in Anambra State. 18 items structured questionnaire was used and subjected to mean and standard deviation and Z-test to test the null hypotheses at 0.05 level of significance. The result showed that many Biology teachers make use of innovative assessment technique to a higher extent in their class room teaching and recommended conference and workshops for awareness. Findings on teaching methods and assessment as some aspects of STEM Education research and relevance in providing good and qualitative teaching and learning for proper performance of students in sciences (Biology) had been attributed to poor rate of utilization of innovative teaching strategies in classroom instruction as one of the factors that contributed to student poor performance in sscience subjects Biology inclusive.

2.4.2 5E Learning Model and Retention in Biology

The 5E learning model from the literature reviewed pointed out some findings: Sam, Owusu-, &Anthony-Krueger (2018) study identified the effectiveness of 3E, 5E learning cycle and the conventional approaches in teaching a Biology lesson. The mixed method approach were used for the study. Three science classes in three Senior High Schools were randomly selected. The 3E learning cycle was found to be more effective for improving the performance of low achievers. The students exposed to the 3E and 5E approaches showed positive attitudes towards learning cycle when they were interviewed.

Ya'u (2016) investigated the effects of 5Es constructivist model on Polytechnics students' retentive ability and academic performance in genetic concepts in Kaduna State with the aim of improving the teaching of Biology.The findings revealed that there were significant differences between the mean scores of the experimental and control group in retention ability and performance. It was stated that 5Es model favoured the experimental group more.

Ibrahim (2015) investigated the Impact of 5E Teaching Cycle on Attitude, Retention and Performance in Genetics among Pre-NCE Biology Students with Varied Abilities, North-West Zone, Nigeria.The findings of the study showed that Pre-NCE Biology students exposed to 5E teaching cycle in the teaching and learning of genetics concepts in all the ability levels had higher mean performance scores and also retain more than those in the control group exposed to lecture method of instruction.Ajaja and Eravwoke (2012) study 5E learning and retention in Biology and Chemistry reaveled a significant higher retention students taught with 5E learning than thosetaught with lecture method in Deltal State.He concluded that the 5E learning model seems to be an appropriate instructional model that could be used to solve the problems of teaching and learning science.

2.5 Concept of Creativityand Performance in Biology

Creativity is a combination of flexibility, originality and sensibility to ideas which enable the thinker to break away, from usual sequence of thought into different and productive sequence the result of which gives satisfaction to him and possibly to others (Garba 2018). Runisah, Wiralodra & Dahlan (2016) put forward that Creative thinking skills is one of the capabilities required to solve various problems. Creativity triats in students need to be identified by the students and build up the ability to solve different types of situations in students in order to generate new ideals and useful thinking.

Etiubon and Okopide (2015) investigated on the extent of utilization of research findings in science education curriculum for science educators' creative skills in Akwa Ibom in three local governments. Survey research design was used and purpose sampling of 120 Science Educators out of 326 were drawn. Questionnaire was analyzed by mean and standard deviation, Cronbach alpha was used to obtain a reliability coefficient of 0.83. The science educators are aware of these sources, but they hardly utilize them for instructional delivery. The extent of teachers' knowledge on research findings is low as they hardly prepare their lessons using research findings materials to update their knowledge. Also, the spread of information on research findings using different channels are not utilized in science education curriculum. Recommendation was that science educators should sponsor themselves to conference and workshop in order to update their knowledge about current research findings and its integration in classroom activities. It was discovered that teachers lack confidence in themselves as they have little understanding of how to select and modify concepts using research findings to enable learners gain broader perspective of science instruction.There are considering cognitive variables that need to be applied in giving meaning to creativity: examples are ideational fluency, originality of ideas and sensitivity to missing elements(Uzoechi 2014).

Iny and de Brabandere (2013) studied and gave 5 keys to creativity as follows: doubt everything by challenging your current perspective. Probe the possible through exploring option around you. Diverge, generate new and exciting ideas, even if they seem absurd. Converge, evaluate and select the idea that thought it will drive the students. Re-evaluate ideas or concepts relentlessly because no idea is good forever. Olorukooba and Lawal (2010) conducted a research on the effect of the Science Technology Society (STS) approach and lecture method on academic achievement and development of creative traits among junior secondary school integrated science students in Kaduna State. In addition to this, it was stated that creativity goes beyond originating somethings new acceptable to the society. Creativity does not always lead to products that can be observed and judged. Creativity was also observed as a process by which something new, either an idea or an object in a new form or arrangement is produced. They observed that students in experimental group performed well in the academic achievement and creative traits tests(Lawal, 2010)It was recommended based on their findings that integrated science technology should use STS approach in teaching basic science.

Launchpad(2006) revealed experimental work of creative journey within Hastings and St. Leonards Excellence Cluster schools. A project called the "Muse" project that involved the use of four primary schools with professional facilitators. Gumica by Picasso was used with a group of students to create dance and photographs were used in the next schools for poetry. As a result of this, one poem was passed to another school as the basis for art work which in turn inspired creative writing. In the last session, all the groups came together to see the outcomes of the muse project, a creative journey. It was observed that secondary school plans to carry out similar project, as concentrated on class 6 and 7 activities which resulted to "Transition Bridge'' between primary and secondary school. A second muse project proved to be an excellence cluster with infant school.The National Science

Education Standards for science teaching indicate that what students learn is influenced by the instructional methods by which they are taught. The empirical work on Creativity of multi-component process that is mediated through social interaction can be explained by reference to increasingly well-understood mental ability such as cognitive, flexibility and cognitive control that are widely distributed in the population (Uzoechi, 2008). The ability of individuals to generate new ideas that contribute substantially to an intellectual domain is called big-C creativity (Kaufman and Beghetto, 2008)

Creativity is generally categorized into concept, person process and experimental work of creativity. Two approaches predominate the research literature: Process-oriented models of creativity and System-oriented models. The two focus on different facets of creativity, yet they can be seen as complementing each other (James, Lederman & Vagt-Traore, 2004).Creativity can therefore be defined as the idea that changes an existing domain into a new one where by something new and valuable of creativity traits is attained.How it is applied in this study was by the use of quetionniare to test the creativity traits of the respondence. Also, the current study investigated if creativity of students is not to create knowledge transmitter that is not only the content pedagogy of teaching matters but if it might be able to prove creativity traits of students.

2.5.1 Creativity and Retention in Science

Creativity is defined as ability to make new and useful things (Lee& Jun, 2015). The concept of creativity is based on different opinion by different researchers. In education, it is known as innovation, in business it is entrepreneurship, in mathematics it is called problem-solving. Beam (2014) sees creativity as a key pre-requisite in any meaningful learning process. It enhances a learner's capacity to develop a deeper understanding of scientific phenomena. Science educators, therefore, need to develop approaches that can be

used to enhance creativity in lessons. The findings of the current study demonstrate that Cooperative E-Learning (CEL) teaching strategy is an innovative strategy that has the capacity to enhance learners' creativity in Biology lessons.

Adamu (2014) in his empirical work saw creative learners as being able to connect the present situation with the past experience in order to arrive at something that if not new but unknown either leads to principles and inventions as creative person or divergent thinker through creative process. He reported that teachers do not fully recognized some students with creative potential that is left undeveloped or untapped that may be due to uncared attitudes. Sani and Maruf (2012) described a creative person as an individual who presents unique and unusual solutions to problems, setting him or her apart from other people.

Animasahun (2009) investigated the possible psycho-demographic variables (Gender, Age, Family type, Emotional intelligence, Creativity, Motivation and Goal setting) as predictors of school Attendance Behavior among secondary school students in Osun State, of about 626 with age ranges between 10 and 21 years from JSS 1 – SS3. They responded to Family validity and reliability instruments namely, school attendance behaivour, rating scale, students' academic achievement, motivation, goal setting scale, emotional intelligence scale, creativity scale, generalized self-efficacy scale and spiritual intelligence questionnaire with analysis of multiple regression. The results indicated positive correlations among variables and the nine independent variables when taken together contributed 64.6%, while relative contribution revealed motivation as the highest contribution with 0.54, followed by goal setting B = 0.248, emotional intelligence (B = 0235), creativity (B = 189), Age (B = 0.080), self-efficacy (B = 0.042), family type (B = 0.04). Spiritual intelligence shows (B = 0.023) and Gender shows (B = 0.006) respectively. It was then recommended that parents must constantly motivate their children to go to school, while guidance counselors need to organize group concerning. Creativity in

Science must be in the dimensions of Biology concept to suit the societal needs of the learners, such as, problem sensitivity as an opportunity to create problem solving for example, the Ebola virus in Nigeria. Fluency of ideas e.g how could Ebola virus, Lasa fever, Covid 19 virus infectionscould be solved. Flexibility of thoughts, prevention of the disease in diverse ways. Originality is to get new ideas from others. To promote creativity the numerous programs, courses, workshops and techniques can be developed. Programmes to teach students on benefits of western education, goal setting skills, emotional intelligence, creativity, self-efficacy reduce truancy to the barest minimum and encourage school attendance behaviour. Therefore, the current study was to find out if the students creativity traits might be identified in orderto help students better in life.

2.6 Gender and Performance in Science

From the medical search, it was stated that, gender is more difficult to define, but for Navajo, there are four genders namely, Man. Woman, Masculine female-bodies nadleeh and Feminine male-bodied nadleed. The understanding of gender continue to evolve throughout a person's life of interests, activities, clothing and professions. Gender identity and gender role are defined as a personal conception of oneself as male or female. Additionally, we found that boys are more prone to misbehavior than girls, whereas boys academic results are more sensitive to changes in their family, socio-economic status which also explain a significant portion of the gender difference in academic achievement. (Epple, 1998).

Gutierrez, Agudo, Garcia (2018) observed that, recent empirical literature has highlighted that adolescents show gender difference in academic performance. The study intends to disentangle contribution of some less well-known factors responsible for gender difference in the fourth year of secondary education. This lead to recentmethodological advances in

decomposition techniques. It was observed that, girls are less likely to get low scores than boys. Interestingly, gender difference in returns to expectations about the future have been found to explain most of the advantages of girls,while boys rely more on their initial learning skills to pass. Additionally, it was found that, boys' academic results are more sensitive to changes in their family socio-economic status, this also explains a significant portion of the gender differences in academic achievement.

Eshetu (2015) studies gender disparity analysis in academic achievement at higher education preparatory schools; The case of south Wollo Ethiopia.Mcleod (2014) explained that, gender has been seen as a continuous scale rather than two categories that are determined by two biological factors hormones and chromosomes such as testosterones that causes typical male behaviours like aggression, compectitiveness, visuospatial abilities and as stated that an area of the hypothalamus at the base of the brain is much larger in male than female. The brain is divided into two hemisphere left and right. In humans, the left side of the brain is more specialized for language skills and the right for verbal and spatial skills. Oluwagbohunnu (2014) disclosed that, male students performed better than females and the results were statistically significant.Voger and Voger (2014) revealed that, females performed better than their male counterparts and results were statistically significant.

Dahiru (2013) found out that sex played no significant role in performance in science, technology and mathematics, and he raised concern and worries that female performance and achievement in science, technology and mathematics is not all that encouraging.Faroog et al., (2011),on the contrary, Aigbomian 2002 and 2004 reported that, boys have higher levels of achievement than girls in science, technicial and mathematics.Njoku (2004) study on girls acquisition of science process-skills revealed that girls in single-sex group score significantly higher mean in science process skills than girls in mixed sex group. This was

accounted for by the fact that in science classrooms, boys tend to dominate the learning activities especially practical work.

Zalizan, Khadijah, Hazadiah & Ma'rof (2002) reported that, male and female students who possessed different thinking and learning styles have different perspectives on the teaching style of teachers. These researchers claimed that one of the reasons for high dropout rate of male students from schools is female teachers' teaching styles are very much against the male students learning style. This would probably explain the difference of thinking abilities between male and female students. However, more research evidence needs to be gathered before any conclusion can be reached. Previous studies have documented the relationship between brain thinking style the tendency to use the left, right or whole brain to think, learn and creative thinking ability. However the results are inconsistent. Some researchers discovered that right brain thinking style is positively correlated with creative thinking ability (Marshal, Faust, Hendler & Jung-Beeman, 2007; Denny & O' Sullivan, 2007).

The present study was to find out ways to improve the effectiveness of students' Biology learningamong other variables so as to see if sex playssignificant role in creativity, achievement and retention among the senior secondary school II students in ecology conceptswhen exposed to 5E-Learning model ofco-education zone, Zaria.

2.7Overview of Similar Studies

Several studies and researches had been reviewed under related literature, some of which are overviewed which are similar to this present study. These include:

Ergin, Kanli and Unsal (2008) investigated the effects of 5E-Learning model on the academic success and attitude level of students in the topic of inclined projectile motion in Physics lesson of Generative Attitude Transaction Application (GATA) noncommissioned

health officer preparation school's 1st grade. The study was carried out on 84 students who study in GATA and oncommissioned Health officer preparation school's 1st grade of 2004-2005 spring semesters in Ankara-Turkey. 44 students formed experimental group and 40 students formed the control group. Multiple choice success test and attitude scale were used. Analysis showed a significant difference between Inclined Projectile Motion Multiple Choice Success Test (IPMMCST) point in pre and post study in the experimental group on whomthe lesson was performed. Experimental students produced higher mean achievement scores were more successful in the post-test. It was concluded that the experimental group students were more successful than the control group taught using traditional method and more positive attitude towards the subject was shown. The present study was on academic performance not success. Creativity was tested not attitude. The subject was on Ecology in Biology concepts not Physcis. The current topics was on pollution, Conservation of natural resources, Pest and Diseases of 2017/2018 session among senior secondary school students while the previous was 2004-2005 among university students. Analysis of variance, t-test was used but the present study used 2-Sampled t-test, Wilconxon statistical tool, Mann Whinney tool for the collected data.

Faxelian, Ebrahim and Soraghi (2010) investigated the effect of 5E-Instruction design model on learning and retention of science for middle class students in Procedia Nahavand is a county in Hamadan Province in Iran.Two hypothesis were tested of 5E-Instructional design model that increases the retention of science lessons. Population was all middle school students in the city of Nahavand and it was put into two, experimental and control groups. Instruments consisted of researcher made test which was used as pre and post test during ANCOVA and MANOVA. The result indicated that 5E-Instructional design model which had significance increased learning and retention of science lessons. Base on this finding, similar study is needed in ecology concepts among senior Secondary School

Students to investigate the learning method which is better on academic performance, creativity traits and retention among Secondary School Students in Zaria Education Zone, Kaduna Nigeria.

Sadi and Cakiroglu (2010) investigated the effects of 5E-learning cycle on students Human Circulatory System of Students achievements. This was carried on 11th grade students of higher human circulatory system achievement in Ankara-Turkey. Two teachers and four classes and total of 60 students of 11th grade participated in this study. One class, one teacher was assigned as experimental group treated with 5E-learning cycle instruction and other class was assigned as control group treated with traditional instruction. The Human circulatory system achievement test was applied twice as pre-test and after treatment period as post-test to both experimental and control groups to measure students achievement. ANOVA results revealed that 5E-learning cycle instruction improved students achievements in Human Circulatory System compared to traditional instruction. Base on this finding a similar investigation is required in ecology concepts such as pollution, conservation of natural resources, diseases in plants and animals using 5E-Learning model and conventional method to find out which is better when researcher of current study handles the two methods among 100 senior Secondary School Students in Zaria Education Zone. The academics achievement analysis subjected to 2-Sampled t-test was used.

Acisli, Yalcin and Turgut (2011)concluded a research on effects of the 5E learning model on students' academic achievement in 'Movement and Force issues among Erzincan and Ataturk University students in Turkey between the beginning and the end of the semester. The aim was to evaluate the efficiency of students guiding materials that was developed by the researcher based on Movement and Force unit objectives. Quasi-experimental research design was employed. 60 students, 30 in experimental and 30 in control group were used. The control group was given experiment booklets for each experiment in accordance with

the 5E learning model. This was to determine whether there was any differences between the two groups. Instruments used were Academic achievements, Achievement Tests on Movement and Force issueswere applied to the groups both at the beginning and the end of the semester as pre and post-tests. Pre and post test results were compared, using a t-test in SPSS package programme. Results showed a meaningful difference between the groups that is in favour of the experimental group (t_{58}=5.06; p=00<.05). The results showed that, 5E learning model is an effective teaching method among undergraduate students. The recommendationsfor the use of constructivist 5E learning model was on other courses of Physics and prepared materials. This current study focused on public Senior Secondary School ll Biology students. Second term was used in Zaria education zone, Kaduna state. Same quasi-experimental design was employed on population sample of 100. This involved experimental group of randomly selected 50 students and 50 control group students. Post-test was compared with post post-test after pre-test and it was found to be the same. The research uses of creativity achievement scale and Biology Achievement test on performance and retention. To fill the gap of differences in terms of level of students, location, subject matter and statistical tools used was t-test but the current study used2-sampled t-test, wilconxon testanalysis, 2-way ANOVA OF MANNOVAR statistics and analysis of covariance ANCOVA.

Yigit (2012) studies the Effect of the 5E Model in Writing on Achievement and Motivation. The aim of the study was to find out the effect of writing instruction based on the 5E Model on achievement and motivation. This thesis, which is a quasi experimental action research, explores the probable effects of the 5E Model-based writing activities on promoting the achievement of students' writing skills in prep class of students at School of Foreign Languages.Trakya University, a.k.a University of Thrace at Edirne Turkey. The participants of the study consisted of the total 70 students in three classes of 23, 23 and 24.

The department of the students is English Language Teaching and Interpretation and Translation at Trakya University. The study was conducted in the first term of the academic year of 2010-2011.The study was carried out two hours aweek for 10 weeks. The students were given a pre-test before the implementation in order to determine how successful they were in writing skill and then they were given the same test at the end of the study as a post-test in order to find out how much they could improve their writing skill. The results were statistically analyzed. According to the results, the 5E Model-based Writing Instruction had a positive effect on promoting writing skills of the students and fostering motivation in writing. Present study is to fill gap of differences in terms of location, year, subject matter, number of students in experimental group and control group and the different. level of students, number of weeks and statistical tools used was t-test.But the current study utalized 2-sampled t-test, wilconxon test analysis, 2-way ANOVA OF MANNOVAR statistics and analysis of covariance ANCOVA.

Cornelius (2012) studied the 5E-Learning cycle and students' understanding of the nature of science in Montana State University Bozeman-Montana. He used teaching technique known as 5E learning cycle. In the study, learning cycle used were reported and it heavily relies on the teacher using inquiry in the classroom to support the students learning of Nature of Science (NOS). The result indicated a marked improvement of students growth in NOS. Post 5E data showed an increase in district assessment grade of 0.233. The study provided evidence of 5E learning cycle had a strong effect on students' knowledge and use of the nature of science. This present study used 5E-Learning on creativity, performance and retention among Secondary school student II Biology in Zaria Education zone, Kaduna state.

Çimer (2012)stated what makes biology learning difficult and effective: Students' viewsin Turkey and the research aims at determining the biological topics that students have

difficulties in learning. The reasons why secondary school students have difficulties in learning Biology, and ways to improve the effectiveness of students' performance in Biology. For these purposes, a self-administered questionnaire including three open-ended questions were employed to collect the data. They were administered to 207 11th grade students in the district of Rize, Turkey. The data were analyzed both qualitatively and quantitatively. There were five topics that the students had the most difficulties in learning: Matter cycles, endocrine system and hormones, aerobic respiration, cell division, and genes and chromosomes. The main reasons for learning difficulties were the nature of the topic, teachers' style of teaching, students' learning and studying habits, students' negative feelings and attitudes towards the topic and lack of resources. To overcome these difficulties and make their Biology learning more effective, the participants suggested such strategies as teaching Biology through the use of visual materials, teaching through practical work, reducing the content of the Biology curriculum, using various study techniques, teaching Biology through connecting the topics with daily life, making Biology learning interesting, and increasing the number of Biology questions in the university entrance examination. To fill the gap of differences in terms of number of topics of ecology concepts, location, year, subject matter, number of students in experimental group and control were observed to differ. They include level of students, number of weeks, statistical tools was t-test different from the current study which used2-sampled t-test, wilconxon test analysis, 2-way ANOVA OF MANNOVAR statistics and analysis of covariance ANCOVA.

Ajaja and Eravwoke (2012) worked on the effect of 5E-Learning cycle on students achievement in Biology and Chemistry in Abraka-Delta State, Nigeria. The purpose was to determine the effects of learning cycle as an instrument strategy on Biology and Chemistry students' achievement. As a guide to this study, six research hypotheses werestated and

tested at 0.5 level of significance. The design used wa 2x2x3x6 pretest post test non-equivalent control group and experimental design. It involves two instructional of experimental and control groups. Sex includes male and female, represented testing such as pre, post and fellowship tests. Six weeks of experiences, six senior secondary schools, 112 science students and 12 Biology and Chemistry teachers from the samples of the study. The instruments used for study were Teachers questionnaire and their learning cycle. (KULC); and Biology and Chemistry Achievement Test (BCAT). The data collected showed simple percentage analysis of covariance (ANCOVA) and students t-test statistics the major findings of the study included that only 30.43% and 26.31% of Biology and Chemistry teachers have the knowledge that learning cycle is an instructional method. All the Biology and Chemistry teachers sampled have never used learning cycle as an instructing method, learning cycle has a significant effect on students achievement in Biology and Chemistry Students taught with learning cycle significantly achieved better in Biology and Chemistry post-test than those taught with lecture method. The post-test scores of students in the learning cycle group increased over the period of experiences. Non-significant difference in post-test scores between males and females taught with learning cycle. The results shows non-significant interaction effect between males and females on achievement and a significant higher retention of Biology and Chemistry knowledge by students taught with learning cycle than those taught with lecture method. It was concluded that the method seems to be an appropriate instructional model that could be used to solve the problems of science teaching and learning since it facilitates learning, retention and effectiveness is not limited by sex.

Olarewaju (2012) carried out a study on effects of cooperative learning strategy with model on academic achievemenmt and retention of Biology concepts among Pre-National Diploma students in Kaduna State Nigeria. The population of the study is 149 of

2010/2011 andsample size is 100, male 25 and female 25. They are grouped into three experimental groups and one control group. Ticket Sampling Technique where yes or no written and concealed in small pieces of papers was used. The students who picked yes participated and those that pickedno were dropped. All Federal Agriculture and Technical Monotechnic Colleges form the schools for the study. The schools were intact samples. Biology Achievements Test (BAT) was used.The research questions among others stated that, What is the effects on the performance mean scores of Pre-Nd students taught Biology using cooperative learning strategy with models (CLS+M) and their counterparts taught using cooperative learning strategy (CLS) without model?Discriptive statistics have shown that the results indicated group taught using cooperative learning strategy with model had higher mean score than the group taught using cooperative learning strategy without model.The hypothesis stated Ho There is no significant difference in the academic performance in Biology between students taught using cooperative learning strategy with model and those taught using cooperative learning strategy without models. The t-test analysis results showed significant difference between the group taught using cooperative learnimg strategy with model and the group taught using cooperative learning strategy without models in their achievement means score in Biology.

Ajaja (2013) examineswhat strategy best suits Biology teaching? Lecturing, Concept mapping, Cooperative learning or learning cycle? The purpose of the study was to compare the achievement of students taught with concept mapping, cooperative learning, 5E learning cycle and lecture methods with the intention of identifying which one among them could be most suitable for teaching Biology in Abraka-Delta State, Nigeria. To guide this study, four research questions were raised and tested at 0.05 level of significance. The design used for the study was pre-test, post-test, delayed post-test, quasi experimental repeated measures design. The sampled were four mixed secondary schools, 259 students

and eight Biology teachers. The major findings show significant effect of the four instructional methods on achievement and retention; students in the 5E learning cycle and cooperative leaning groups significantly outscored those in the concept mapping and lecture groups on achievement and retention tests; students in concept mapping outscored those in lecture group both on immediate achievement and retention tests; students in 5E learning cycle and cooperative learning groups did not significantly differ on achievement and retention tests; males and females in all the four groups did not significantly differ on the achievement tests; and a non-significant interaction effect between sex and method of instruction on achievement. conclusion was reached on the adoption of either 5E learning cycle or cooperative learning strategies may be appropriate for the teaching and learning of Biology. The current study was to fill the gap of Creativity, location, and study on effect of 5E-learning model, using lecture method on the control group.Four methods of teaching were compared amongSecondary School Biology students on Performance and Retention. Use of research design pre-test, post-test, delayed post-test, quasi experimental repeated measures was designed while the current study used quasi experimental control design pretest, posttest, post-posttest in Zaria education zone.

Madden, Baxter, Beauchamp, Bouchard, Habermas, Huff, Ladd, Pearon, Jill and Plaque (2013) have in their investigation on rethinking STEM Education: An Interdisciplinary STEAM Curriculumon undergraduate students of science education creativity and innovation based on STEM at State University of New York Potsdam developed a multidisciplinary programme of creativitive thinking through exploration of models in higher education and industry. They stated that, this comprisesstudies in Arts, Humanity, and STEM fields students along with model that could generate innovations in modern science and technology in order to focus on complex problems facing humanities to develop a curriculum of scientific training with creativity to promote innovative cognitive

skills in the students in modern science and technology necessary to address the complex problem facing human society. The creativity was defined in terms of fluency, flexibility and originality of cognitive processes in which older students are better able to engaged in divergent thinking which makes a post-secondary program an ideal vehicle for promotion of creativity. Convergent thinking as a process to reach one solution to a problem and divergent thinking involves exploring many possible solutions to a problem. The present study defines creativity as the act and idea that change an existing domain into a new one where by something new and valuable in creativity traits is attained.

Ityokyaa (2015) investigated the measurement of creativity of science education students at the Federal University of Agriculture Makurdi was made. A random selection of 150 students of 300 level who offer biology, chemistry, physics, integrated science and mathematics education at Federal University of Agriculture Makurdi. The instruments of a 10 domain Creativity Achievement Questionnaire (CAQ) of 80 items were used for data collection on creativity from the students. Two research questions and two hypothses were used. The statistical tools used were descriptive statistics, factor analysis and zero-order correlation statistics for the data analyses. The research question stated that what underlying creativity leads the students to respond to the questions on the creativity achievement questionnaire? Descriptive statistics of mean and standard deviation were used. The hypothsis was tested via the use of factor analyses zero-order correlation statistics.The findings from the results showed that the mean score of the students in CAQ was generally low. The highest mean score of the female students was .41 for the music domain. This showed that music (.493), theatre and film (.456) and culinary arts (.455) had a factor loading above the cutoff point of .40. Recommendation made among others was that science and mathematics teachers should use CAQ at all levels of education to identify and encourage creative talent in students. The present study differs with this one for it was

on creativity traits using creativity assessment scale instrument among senior secondary school students in Zaria educational zone, Kaduna State.

Sadi and Cakiroglu (2014) investigated relationship of cognitive and motivational variables among students in Human Circulatory system Achievement. The study aimed at investigating the relationships among students, relevant prior knowledge, meaningful learning orientation, reasoning ability, self-efficiency, locus of control, attitudes towards Biology and achievement with human circulatory system, (HCS) using the Learning Cycle (LC) and the traditional classroom teaching. The study was conducted with two teachers and four classes with a total of 60 11^{th} grade students from Junior High School students in Indramayu City, Indonesia.

One class for the teachers was assigned as an experimental group and treated with 5E-Learning Cycle instruction (TI). The Human Circulatory System achievement Test (HCSACT) was administered twice as a pre-test to the experimental and control groups. The learning approach questions Test logical thinking, self-efficiency scale, locus control and attitude toward Biology scale were also admistered to all students. The results indicated that the Learning Cycle (LC) improved students achievement in HCSACT compared to TI. Stepwise multiple regression analysis revealed that in the learning classrooms the main predictors of achievement on the HCSACT were students reasoning ability (45.8%) and their prior knowledge, (15.9%) in the traditional students meaningful learning orientation (40%), locus of control (9.8) were the main predictors of achievement.Retention ability, brain electrical activity can help evaluate learning skills in non verbal Angelman patients as published in brain and cognition. Orphan Drugs, Colombia University New York Nacio shows the feasibility of using auditory event-related potentials to investigate learning and memory in non-verbal individuals with Angelman-Syndrome. The present study examinesecology concepts such as pollution, conservation of

natural resouces and diseases in plants and animals among senior secondary school students in Zaria educational zone, Kaduna State. Pre-test was administered once before treatment.

Runisah, Wiralodra and Dahlan (2016) study aim to described enhancement and achievement of students' Creative Thinking Skills inMathematics (CTSM) as a result of 5E Learning Cycle with Metacognitive Techniques (LCM). Thisresearch used a quasi-experimental design with pretest-posttest control group. The population of the researchin Junior High School students in Indramayu City, Indonesia. The sample is eighth grade students from twoschool levels, amounted to 173 students. The instruments used consisted of CTSM tests andobservation sheet. The study reveals that in terms of overall and in all school level, the enhancement andachievement of students' CTSM who received LCM is better than those who received 5E Learning Cycle(LC) and Conventional Learning(CL). Likewise the enhancement and achievement of students'CTSM whoreceived LC is better than those who received CL. There is no interaction effect between learning model and school level towards enhancement and achievement of students'CTSM.Present study searched forachievement of students' Creative traits using Creativity Assessment Scale (CAS) as a result of 5E-Learning Cycle on experimental group andlecture method on control group. This research used a quasi-experimental design with pretest-posttest and postpost-test control group among senior secondary school students in Zaria.

Piaw's (2013) researched on effects of gender and thinking style on students' creativity thinking ability in Kuala Lumpure, Malaysia.The study has the following aims: (1) to explore the relationships between gender and brain thinking style with creative thinking abilityof a group of lower sixth students (n=216), and (2) to identify the interaction effect of the two personal factors on creativethinking ability. Brain thinking style of the students was measured by the Styles of Learning and Thinking test while creativethinking ability

was measured by the Torrance Test of Creative Thinking. By controlling three moderators, i.e. ethnicity,academic major and critical thinking ability, results of the MANCOVA test indicate that gender was significantly correlated withcreative thinking ability, while right brain thinking and learning style was positively and significantly correlated with all of thefive components of creative thinking ability, i.e. originality, fluency, elaboration, abstractness of title and resistance to prematureclosure. Results indicate that gender and thinking style were significant factors of creative thinking ability. However, nosignificant interaction effect of the two variables on overall creative thinking ability was found. The present study creativity objectives stated that, toinvestigates the effects of 5E-Learning model on students' creativity trait in Ecology concepts among SS2 Ecology students in Zaria Education Zone. Also to compare the mean scores of male and female students creativity trait taught Ecology concepts using 5E-Learning model.The sampling technique used to select 2 schools from six of 1614students out of 19 public senior secondary co-education schools of 5180 students were randomly selected and pre-tested. The research instrument used was Creativity Assessment Scale (CAS). The findings among the secondary school students taught with 5E-Learning model performed higher than the control group taught with lecture method.

Ezenduka, Achufusi and Okoli (2014) worked on the effectiveness of Generative Learning Model (GLM) in enhancing creativity among single sex public senior secondary schools II students of Awka South Local Government Area of Anambra State. Research technique was subjected to purposive sampling technique to select 4 from 150 students out of 18 secondary schools in the Local Government Area of 1125 students. The research instrument used was Test Of Creativity In Biology (TOCIB) on Conventional Biology Curriculum. TOCIB was used to collect data for pretest and posttest in which mean standard deviation was used to answer the research questions with analysis of covariance

(ANCOVA) to test the hypotheses at 0.05 level of significance. The result of the study reveals that students taught with GLM had more creative skills than their counterparts that were exposed to expository method there was no significant difference between male and female effects on the creative skills. The study concludes that, continuous use of expository method will encourage students to acquire good scientific skills and attitude. Current study was based on creativity traits among male and female public senior secondary schools II students of Zaria Education zone Kaduna State. The research instrument used Creativity Assessment Scale on both experimental and control groups. The result shows that, students taught with 5E-Learningmodel had more creative traits than their counter parts that were taught with lecture method.

Gyuse, Achor and Chianson (2014) investigated the creativity of the secondary school students? This was investigated from state capital Makurdi, in Benue State, Nigeria. The research design was a survey of 300 students purposively selected were 10 students from Junior and Senior Secondary were chosen. A validated measuring questionnaire of 28 items modified version of Torrance was used for data collection. Modification included a test for influence of cultural inclinations on creativity. Data were analyzed by t-test, standard deviation and analysis of variance. The results pointed out that, many students saw creativity as creating ideas to solve problems. Being skillful and imaginative to get something new had (29.33%), those who claimed about moderately creative had (27.33%), (91.0%) and those who rated themselves just being creative (43.34%) while secondary school students that cannot recognize creativity reflects (70.33%-95.67%). There was no significant mean difference in creativity level among the science, non-science and group of students that were not sure of their creative level. Teachers were encouraged to provide motivating and creatively challenging tasks as source of intrinsic and step towards helping the students become more creative in class. Since up to 95% of the students could not

recognize creativity and there was no significant mean difference,the present study considered 5E learning model of instruction to introduce Ecology students to be aware of creativity traits in them. Junior secondary schools were not involved in the present study but senior Secondary Schools Students are involved. Analysis of variance was used to analyse the data. Adapted Creativity Assessment Scale was used. The research design was a survey design on creativity while performance and retention were quasi-experimental control design.The location of learning was Zaria education zone, Kaduna State.

Orora, Keraro & Waclanga (2014) studied the Cooperative E-Learning Teaching Strategy to enhance students' creativity in Secondary School Biology: Astudy of selected schools in Nakuru Coluily Kenya. The Creativity and innovation were among the key pre-requisites for industrialization. One of the major objectives is to define features of the 21st century in use of information communication technologies (ICTs) in every sphere of life the study is one of the keys. For Kenya to realize her vision 2030 of transforming to a newly industrialized, middle-income county that provides a high quality life to all citizens by the year 2030,there is need to integrate the use of ICTs in education. To enhance creativity and innovation and spur industrialization and economic growth, this study investigated the effects of Cooperative E-Learning (CEL) teaching strategy on students' creativity in Biology. Solomon Four Non-Equivalent Control Group design was used. The study involved four County secondary schools in Nauru County and focused on Form Two (second grade in the secondary school cycle) students. Convenience sampling was used to select the four schools. A total of 200 students participated in the study. The instrument used in this study was a Creativity Achievement Test (CAT), with a reliability coefficient of 0.98. Data generated was analyzed using Analysis of Variance (ANOVA) and t-test. Statistically significant values were accepted at α=0.05. The findings show that the students exposed to CEL teaching strategy were more creative than students exposed to

conventional teaching methods. It is concluded that CEL is an effective strategy that can enhance creativity and innovation should be incorporated in the teaching of school Biology and teacher education programs.

Lee and Jun (2015) investigated the developmental characteristics of creative thinking ability and creative personality of elementary school children in Korea. Population of the study was statistically analyzed of 2,782 out of randomly sampled of 3,200 from the big cities (Suwon, Pohang, Cheonan, Ansan) medium-sized cities namely Seosan, Yeosoo, Icheon, Asan, Namyangju and small cities in Korea nationwide. Ages 6 to 11 year old were used. The instrument used was 'The Integrated Creativity Test for Elementary School Children' which measured creative ability and creative personality. '3-3-3 Model for Creativity Measurement' that were invented by the researcher was used. The test was scored by trained teachers and university students. The creativity test was administered to identify the developmental characteristics of creative thinking ability and creative personality. The data was analyzed by total scores and factor score by SPSSWIN 10.0 Statistical package. Pearson's correlation coefficient and ANOVA was used. The developmental trends of creativity were identified as the result of statistical analysis. The research questions include: What is the relationship between the sub-factors of creative personality (fluency, flexibility and originality) and the sub-factors of creative personality (curiosity, sensitivity, task commitment)? The second question is how does creative thinking ability and creative personality change by grade? In each and every factor of creative thinking ability and personality, differences were statistically significant $p<.01\neg p<.001$). Creative thinking ability were related partly to creative personality and there was a difference in creative thinking ability was creative personality. It was advocated for teachers to teach elementary school children and design education programs with the help of the study. Hypotheses tested are: H_{0_1}: There is no statistically significant

effect of teaching methods (5E learning cycle and conventional method) on the population mean of collective dependent variables of 10th grade science in major public Anatolian high school students' posttest scores of achievement, conceptual understanding and alternative conceptions about 'cell division and reproduction concepts' after adjusting for pre-existing difference in students' science process skills.

Fazelian, Ebrahim and Soraghi, (2010) investigated the effect of 5E instructional design model on learning and retention in sciences of middle school students. In this regard, two hypotheses were tested: 1) 5E instructional design model that increases the learning of students. 2) The instructional design model that increases the retention of science lessons. Population was all middle school students in the city of Nahavand. Sample was selected by cluster sampling method and it was put into two experimental and control groups. Instrument consisted of a researcher made test which was used as pre and post tests during a six week period. Collected data was analyzed by ANCOVA and MANOVA. The result indicated that 5E instructional design model had significantly increased learning and retention of science lessons. Nowadays, instruction is quite different from the past mainly because it has been more specific and professional.

Ibrahim(2015) investigated the Impact of 5E Teaching Cycle on Attitude, Retention and Performance in Genetics among Pre-NCE Biology Students with Varied Abilities, North-West Zone, Nigeria. The population was 2,231 Pre-NCE Biology students made up of 1,168 males and 1,063 females. Simple random sampling technique by balloting method was used to select two schools out of the eleven co-educational colleges of education that served as population of the study. Federal College of Education Zaria served as experimental group while Federal College of Education Katsina served as the control group. Fifty five (55) Pre-NCE Biology students (38 males and 17 females) were selected from each college for the study as guided by Central Limit Theory which proposed that

thirty or more subjects are considered as large sample for experimental research of this nature. Quasi-experimental and Control group Design involving pretest, posttest and post-posttest was used for the study. A total of one hundred and ten (110) students were used for the study. Equal numbers of subjects were selected for each group in order to have a fair representation of the subjects in the study. Pretest was administered on the subjects, before they were exposed to the treatment, 5E learning cycle was used if they arenot different significantly in their ability level. The experimental and control group subjects were assigned to sub-groups according to their ability levels by stratifying sampling technique after the pretest. The ability grouping was carried out by categorizing the subjects into high, average and low ability groups where students who scored 60-100 range of scores comprised high ability, those that scored 40-59 were categorized as average ability and those with 0-39 comprised low ability subjects. The experimental groups were exposed to 5E teaching cycle while the control group was exposed to lecture method. The posttest was given to determine the effects of exposure to 5E-learning cycle which was for experimental and control groups. The Post-posttest was administered after two weeks from the administration of the Post-test in order to determine the retention ability of the subjects in the study. Two instruments, namely Genetics Academic Performance Test (GAPT) with reliability coefficient of 0.79 and Students Attitude Genetics Questionnaire (SAGQ) with reliability of 0.82 were used for data collection. Five research questions and five hypotheses guided the study. One of the research questions was: What is the difference in the mean achievement scores of Pre-NCE students of varied abilities taught with 5E teaching cycle and those taught with lecture method? One of the hypotheses include: There is no significant difference in the mean achievement scores of Pre-NCE students of varied abilities taught with 5E teaching cycle and those taught with lecture method. These were

tested using Mean scores, Two-way Analysis of Variance (ANOVA) and Kruscal Wallis test statistics at $P \leq 0.05$ level of significance were deployed.

The findings of the study showed that Pre-NCE Biology students exposed to 5E teaching cycle in the teaching and learning of genetics concepts in all the ability levels had higher mean performance scores and also retain more than those in the control group exposed to lecture method of instruction. On the issue of gender differences, the study revealed that male and female in all ability groups exposed to 5E teaching cycle performed equally well and had also no difference in their retention abilities. The attitude of the experimental groups improved significantly in all the three ability levels. Recommendations were made based on the findings source of which is: The teaching of Biology especially genetics should be conducted using 5E teaching cycle for students learn meaningfully which enhances better retention of knowledge and develop positive attitude towards the subject. It should, therefore, be incorporated into the main stream pedagogy in the teaching of Biology at Pre-NCE level of colleges of education.

Nwankwo, Esemua and Orefor (2015) study on Secondary School students' level of awareness of the need for conservation of natural resources in Awka South local Government Area of Anambra State. The study use simple ramdom sampling techniques. A 12-item researcher-structured questionnaire was arranged in three cluster and it used Spartan's link different methods. Data collected was analysed. Based on the findings, it was show that there was a low level of awareness of conservation of natural resources. In conclusion, different subjects were identified and investigated at tertiary and secondary school levels though those carried out in Biology did not consider the creativity traits of students and Biology concepts of pollution, conservation of natural resource, pest and diseases in plant and animals. The present study fills the gap by using 5E-Learning model

on creativity, academic performance and retention to educate the students, teachers, stakeholders among others and the needs to sustainnew pedagogy in Nigeria.

Shadeen, Alam, Mushtag and Bukhari (2015) examined the effect of inquiry based learning on the performance of students' at elementary level in Rawaipindi city in Pakistan. The study investigated an experiment work on the effect of inquiry based learning on the performance of students at elementary level in Rawalpindi city. To find out inquiry based learning on performance of students in science and effects of lecture method on students' performance the research compare the effectiveness of inquiry based learning and lecture method on performance of students in science. Science students of 6^{th} class of SLS school Rawalpindi district were the population. 50 students of grade 6 from a random selected SLS school were sampled. Aim of the study was to help the teachers to choose innovative teaching methods, to improve their teaching skills. This helps the students to perform better academically, increase their critical thinking, make them feel more confident and their learning more interesting and creative. Pre-test control group design was used for experimental research. A simple random simple technique was used. Students were pre-tested, provided treatment (5E learning model IBL) to experimental group and post tested. Questionnaire instrument was used for the study. Data collected were analyzed by using t-test. Results and findings have shown that Inquiry Based Learning model (IBL) was more effective as compared to traditional lecture method. The conclusion was that students of elementary level should be taught by innovative teaching method. like IBL for better learning of scientific concepts. The method was strongly recommended for better learning.

Ya'u (2016) investigated the effects of 5Es constructivist model on Polytechnics students' retentive ability and academic performance in genetic concepts in Kaduna State with the aim of improving the teaching of Biology. Quasi-experimental with Pre-test-Posttest Control Group Design were used. Out of 5,000 National Diploma Two (ND II) students

400 students were randomly selected as samples. Three research questions and three hypotheses were formulated. Genetics Performance Test (GPT) was used to measure the academic performance of the students and Genetics Retention Test (GRT) was used to measure the retentive ability of the students. The data were subjected to Test-retest the reliability and Pearson Product Movement Correlation Coefficient (PPMCC) and it was found the reliability co-efficient to be 0.83. The content and face validities of the test items as stated, was moderated by science education lecturers at Ahmadu Bello University, Zaria. The research questions were answered using Descriptive Statistic of means and Standard deviations while inferential Statistic of One-Way ANOVA was used to test the null hypotheses at u = 0.05 level of significant. The results from the analysis showed that there were significant differences between the mean scores of the experimental and control group in retention ability and performance. It was stated that 5Es model favored the experimental group more. Recommendations were made that students should be engaged on practical teaching such as mind-on so that they can create and discover genetics concepts by themselves. The current study used 100 sampled students, randomly selected and grouped into experimental and control groups. Instead of three formulated research questions and hypotheses, five were formulated. Biology Achievement Test was used while it was Genetic Achievement Test (GAT) for the former. The Test-retest reliabily and Pearson Product Movement Correlation (PPMCC) of co-efficientat 0.86. Research questions were answered with same descriptive Statistic of means and Standard deviations and inferential statistic of ANOVA and were used to test the null hypotheses at 0.05 level of significant. The current study results showed from the analyses that there were signicant difference in retention ability and performance. Both experimental groups favoured 5E-learning model. Therefore, from this present study 5E-learning model of teaching were used among senior secondary school students in Biology Achievement Test (BAT) in teaching of Biology

concepts such as pollution, conservation of natural resources, pest and diseases not Genetic Achievement Test (GAT). The group consisted of higher institutions National Diploma II (ND) while Senoir Secondary Student II were for current study,both in Kaduna State.

Arslan (2014) examinedthe Effect of 5E-Learning Cycle Instruction on 10thgrade students' Understanding of Cell Division and Reproduction Concepts in Ankara, Turkey. The purpose of the study was to investigate the effect of 5E learning cycle instruction (LCI) and gender on 10th grade students' understanding and achievement in cell division and reproduction concepts, and their alternative conceptions on these concepts compared to conventional classroom instruction (CCI). The sample consisted of 241 students from two public high schools at Ankara. The classes wererandomly assigned to CCI and LCI groups. In the LCI groups, 5E learning cycle model was used, whereas in the CCI groups conventional classroom instruction was used to teach cell division and reproduction concepts throughout 10 weeks. Cell Division and Reproduction Achievement Test (CDRAT), and Cell Division and Reproduction Diagnostic Test (CDRDiT) were administered to both CCI and LCI groups as a pre-tests and post-tests. In addition, Science Process Skill Test (SPST) was administered to all participants to assess their science processing skills before the treatment. After the treatment, 12 students were interviewed using semi-structurally interview.Multivariate Analysis of Covariance (MANCOVA) was used for analysis of variance hypotheses and the qualitative data was transcribed, coded and categorized. The results indicated that 5E LC instruction showed significantly superior effect over CCI for improving students' conceptual understanding in the cell division and reproduction concepts and discarding alternative conceptions. Drawings and the interview results supported these findings. However, there was no difference found between CCI and LCI group students' post-achievement scores. In addition, no statistical evidence is found that the effect of the treatment on students' understanding the concepts differs across

gender. advantages of males in Biology, general science, and physics, but no significant differences in mixed science content, geology and earth sciences. Similar to these findings some of the studies indicated no significant gender difference (Hupper, Lomask, & Lazarowitz 2002) but some of them showed significant gender differences (Cavallo, Potter, & Rozman, 2004). The result pattern of these studies is not clear that favored males in some studies and females in others.

Maikano, Bichi and Shaibu (2015) examine gender related differences in academic achievement of male and female SSS 3 taught ecology using the outdoor and indoor instructional strategies in Zaria, Kaduna Nigeria.They discovered that there was no difference in the academic achievement of male & female students exposed to indoor and outdoor laboratory instructional strategies which implies both teaching methods are friendly. This study therefore seeks to investigate the gender effects of an academic performance and 5E-learning Model among secondary school Biology students taught using 5E-Learning model of instruction in Zaria Education zone, Kaduna State Nigeria.

Olajide, Lawal and Umahaba, (2016) investigated the impact of 5Es learning Cycle Model on academic performance and Gender among Senior Secondary School Chemistry students (SS2) in Katsina metropolis Nigeria. This is as a result of poor academic performance in Chemistry and the report of WAEC Chief Examiner on the poor performance in Chemistry of 2003-2012. Out of 753 students' population sampled in 164 co-educational students. Ten (10) schools were sampled randomly and divided andsubjected to experimental and control groups. The experimental group was exposed to 5E's learning cycle model while the control group was taught with lecture method based instruction. Chemistry Performance Test (CPT) was developed with a reliability coefficient of 0.82 The data in pretest, posttest, and gender equivalent were used to test the three null hypotheses. The data analysis used t-test statistic at significance level of $P<0.05$. The result indicated that the

experimental group Performed significantly better than the control group in their academic performance after undergoing the experimental treatment with 5E's learning model. Secondly, the treatment with 5Es learning model had no significant effect on gender. This implies that it is gender friendly. Recommendations were made based on the findings that there is a need for the improvement on or in Chemistry learning and teaching in Nigerian senior secondary schools. Different teaching methods and models such as 5Es learning model which is a constructivist approach to teaching and learning should be used instead of the conventional lecture method of teaching to improve students thinking skills. The present study also used 5E learning model on Biology students not Chemistry in public senior secondary schools II in Zaria metropolis Kaduna State. The Biology concept taught was subjected to Biology Achievement Test (BAT). The data was collected via pre-test, post-test and post-test from which the null hypotheses is generated. Data was analysed through t-test statistic, ANOVA and ANCOVA on 5E learning model on gender, creativity, performance and retention.

Cakır (2017) study is on Effect of 5E Learning Model on Academic Achievement, Attitude and Science Process Skills: Meta-analysis in Mugla, Turkey. The increase in interest has led to the development of the methods, techniques, and approaches that enable the students to be active in question and construct knowledge. For this purpose, all the Master's, doctoral theses and articles in Turkish and English languages which were carried out in Turkey between 2006 and 2016 which were suitable for the research problem have been scanned and included in the scope of the study. "5E learning" model between 2006 and 2016, designed with quantitative design and published in reference journals with essential statistical data was deployed.5E-Learning model was used as one of them. Meta-analysis was used to reveal how each work has impacted on the situation and make generalization. There had to be quantitative data such as mean, standard deviation, and sample size and

they had to be applied only in science courses. Research Questions such as what is the effect of the 5E learning model on the academic achievement of students?. The meta-analysis study was to evaluate the effect of the 5E learning model on academic achievement, retention and scientific process skills. The data obtained from the articles and theses were meta-analyzed and was determined that the 5E learning model had an effect on the students' academic achievement, attitude towards science and science process skills. In this context, studies should be conducted in order to limit the studies and to perform the meta-analysis, in which semi-experimental design with experimental and control groups is planned, t-test was applied only in science courses. When scanning, keywords including both Turkish and English "5E learning model", "Structural approach", "5E" were typed in the study title and both the Turkish and English theses were reached. A total of 74 dissertations were reached, but the number of theses reached from the dissertation center and from the researchers is 21.11 and of these theses are master's degree and 10 of them are doctorate these. Only theses written for science courses were included in the study. 10 theses on the effect of the 5E learning model on the academic achievement of students, 6 theses on the students' attitude towards lesson and 1 thesis on the science process skills of students have been included in the meta-analysis study. Analyzed data obtained from the articles and the theses, a general evaluation was made about the effect of the 5E learning model on academic achievement, attitude toward science and science process skills. Meta-analysis method has been used in the study. In addition, descriptive analyses have been made by whom, in what year and in which publication type the studies were performed. Comprehensive Meta-Analysis (CMA) program were used for meta-analysis. The results of more than one independent study are translated into a common measuring system. As a result of the study, the effect of the method applied for each dependent variable was found to favor the experimental group. The present study had quantitative data such as mean,

standard deviation, and sample size applied in Ecology concepts among SSII Biology students.

Sen and Oskay (2017) studied the Effects of 5E Inquiry Learning Activities on Achievement and Attitude toward Chemistry in Ankara, Turkey. The study investigated the effects of 5E inquiry learning activities on students' achievement, attitude toward chemistry. A non-equivalent control group design was used in the quasi-experimental sesearch. A total of 34 (8 males and 26 females) undergraduates in Turkey voluntarily participated in the study. The 5E Inquiry Learning Activities were applied to the experimental group and lecture-based traditional activities were applied to the control group. The two groups were taught by the same instructor usingthe same books. The Chemical Equilibrium Concept Test (CECT) and the Attitude toward the Subject of Chemistry Inventory (ASCI) were applied to both groups as pre-test and post-test. The results of the study revealed that 5E inquiry learning activities were more effective in improving the achievement in chemical equilibrium compared to lecture-based traditional activities. In addition, the results showed that there was no statistically significant mean difference between experimental and control groups with respect to attitude toward chemistry. Independent t-test was used in finding whether or not there were any significant differences between students'pre-test scores for CECT and ASCI administered prior to teaching with 5E Inquiry Learning Activities. Yet, the assumptions such as the independence of observations and normality assumptions were examined prior to thet-test. The skewness and kurtosis values were calculated for normal distribution. Following the analyses, it was found that the skewness and kurtosis values remained in the +2 and -2 interval, and it was regarded that the data had normal distribution.

Sam, Owusu andAnthony-Krueger (2018) study sought and identified the effectiveness of 3E, 5E learning cycle and the conventional approaches in teaching a Biology lesson. The

mixed method approach was used for the study. Three science classes in three Senior High Schools were randomly selected. For the quantitative aspect, a pre-test-post-test non-equivalent quasi-experimental design with two experimental groups was used. The qualitative part constituted an interview to find out students' views with regards to the3E and 5E teaching approaches. The students in the experimental groups were instructed through 3E and 5E learning cycle while those in the control group were instructed on the same concept through conventional approach. ANCOVA and independent t-test were used to analyse the data. The results of the study showed that the experimental groups performed better on the post-test as compared to the control group. The results also revealed that the learning cycle approach was more effective in teaching the Biology concepts than the conventional approach. The 3E learning cycle was found to be more effective for improving the performance of low achievers. The students exposed to the 3E and 5E approaches showed positive attitudes towards learning cycle when they were interviewed. The work recommended that teachers should be encouraged to learn and use the learning cycle approach in the teaching and learning process of Biology concepts. The study did not include 3E Learning instead it used Lecture method.

Ong, Govindaay, Salleh, Tajuddin, Rahman and Borhan (2018)investigated 5E Inquiry Learning Model and Its effects on Science Achievement among Malaysian Year 5 Indian students. The study aims to establish the effectiveness of 5E Iquiry Learning model since Science teachers failed to implement inquiry learning despite its effectiveness. Teachers were comfortable with didactic, transmission method. They stated the teaching sequence using the context of energy change which was structured in such a way that follows the characteristics of each phase in the 5E inquiry learning model, namely engage, explore, explain, elaborate (expand), and evaluate. The conventional approach, by contrast, was characterised by the teacher-centred teaching. Reasearch Question among others was stated

as: what is the effects of 5E Inquiry approach on the Science achievement among year 5 Indian students. Stated hypothesis among others was that the science achievement of the Year 5 Indian students who have participated in the 5E inquiry approach is significantly higher than that of the Year 5 Indian students who have participated in the conventional teacher-centred teaching. The research design employed was that of a quasi-experiment, non-equivalent pretest-posttest control group design.Tamil National-type Primary Schools or, SJK(T) in Gombak district, and SJK(T) were selected using the cluster random sampling. A total of 40 students (19 girls and 21 boys) in the experimental group and 40 students (28 girls and 12 boys) in the control group drawn from a rural Tamil National-type Primary School in Selangor participated in the study.The science achievement was measured by means of an author-developed 20-multiple-choice-item test of which the items were drawn from the past standardised national examinations based on the learning objectives of the concept of energy change. Its validity was safely assumed. The pretest was administered before the intervention while the posttest was administered after the one-week intervention. The findings indicate that the analysis of the pretest and posttest data using Analysis *of* Covariance(ANCOVA) yielded an F of 593.35 which is significant ($p = .000 < .01$), signifying that the adjusted mean obtained by the experimental group (90.32) is statistically significant higher than the adjusted mean obtained by the control group (52.53). The present study investigated effects of 5E-learning oncreativity, performance and retention in Ecology among SSII Biology students in Zaria education zone Kaduna State Nigeria. Using t-test, ANOVA among others to analyse theresearch question and hypotheses were tested. The similarities is of pedagogy in 5E learning model, design experimental and control groups.

Lawal and Usman (2018) examine gender effect on academic performance and science process skills acquisition in Biology among secondary school students in Kaduna state

Nigeria. The Population comprised of 1,672, 12 public Secondary School Studentsof Sabon Gari Local Government Area of Kaduna State out of which 83 students 38 females and 45 males students of the same School used Practical-Based Instructional Strategy taught on Animal Nutrition. The two instruments were Animal Nutrition Academic Performance Test (ANAPT) and Science Process Skills Acquisition Test (SPSAT) of 30 validated items with reliability coefficients of 0.87 and 0.79 were used for data collection. Two research questions and two Null hypotheses guided their study. The hypothesis stated that there is no significant difference in the main performance of male and female Biology students in animal nutrition using the practical instructional Biology test. Means and Standard deviation were used to answer the research questions. The t-test was used to test the null hypotheses at 0.05 level of significant. The results indicated that there is no significant difference in the academic performance of male and female students. There was also no significant difference in the science process skills acquisition scores. Recommended workshop, seminar and conference to acquaint Biology teachers for the use of Practical Based Instructional Strategy for teaching secondary school Biology concepts. This study therefore seeks to investigate the gender effects of an academic performance, and 5E learning model strategy among secondary school Biology students taught through 5E learning model of instruction in Zaria Education zone, Kaduna State Nigeria.

Ihejiamaizu, Ukor and Neji, (2018)studiedutilization of 5Es' constructivist approach for enhancing the teaching of difficult concepts in Biologyin Calabar, Cross River State Nigeria,show that students perform poorly at the secondary school level in Biology. The conceptsconsidered as difficult contribute more to the poor performance. The fact remains that the topics relatedto these concepts are found to be difficult by the teachers teaching them. The undesirable trend hasbeen attributed among otherreasons for ineffective pedagogy among teachers of Biology. This problem led to an upsurge of research into

innovative approaches that can alleviate the situation. One suchemerging approach advocated here is the use of 5Es' Constructivist Approach. The approach advocatesproblem solving learning atmosphere where learners are effectively guided to take responsibility for theirlearning, the effective utilization of which can enhance Biology teaching and learning. This workfocused on how this approach could be applied in teaching one of the identified difficult concepts in Biology namely; respiration. Some empirical studies on the effectiveness of the constructivist-basedmethods when compared with other approaches were reviewed. A sample of note of lesson using the5Es' approach and guide was designed. It was recommended, among others, that government as well asprofessional associations should organize training for Biology teachers on the use of 5Es' learning cycleas effective teaching approach.

Umahaba (2018) investigated the Impact of 5Es Learning Model on AcademicPerformance in Chemical Equation Concept amongSecondary School Students, Katsina Metropolis, Nigeria. Quasi-experimental pretest and posttest control groupresearch design, featuring two groups as experimental and control groups were employed. The experimental group was exposed to 5Es learningmodel in the concept of balancing chemical equations while the control group was taught using lecture method. The studysampled eighty one (81) SS2 chemistry students, from two secondary schools in Katsina Metropolis drawn from population of753 students. The instrument developed and used to collect data for the research was the Balancing Chemical EquationPerformance Test (BCEPT) with reliability coefficient of 0.79. The two research questions were formulated to guide the study,which includes; what is the difference between the mean academic performance scores of Chemistry students exposed to 5Eslearning model and those taught with lecture method?Two null hypotheses were also formulated for testing at a significantlevel of $P \leq 0.05$, one of them states that there is no significant difference between the mean score of

Chemistry Students academicperformance when exposed to the 5Es Learning Model and those taught with lecture method. The data collated were analyzedusing t-test statistic.

The result obtained shows that students of experimental group performed significantly better thanthose in control group. And the treatment in relation to gender was found to be gender friendly. Based on the findings, it is recommended, among others, that the State Government, institutions and professional bodies such as National TeachersInstitution, Science Teacher Association of Nigeria and National Union of Teachers, should organize seminars, workshops, inserviceand re-training programme for teachers on the effective use of Activity- based, students-centered teaching strategythat focus on constructivist learning approach in the teaching of Chemistry. The current study was to fill the gap of Creativity, location, subject, subject matter, and study on the effect of 5E-learning model not impact, but using the same public secondary school students II in Zaria Education zone, Kaduna State.

2.8Implications of Literature Reviewed for the Present Study

Ergin, Kanli and Unsal (2008) investigated 5E learning on academic success and attitude among 2004-2005Physics university students. Analysis of variance, t-test were used. The present studyuses5E learning on the investigation of academic achievement, Creativity, retention among male and females in Biology SS II.The current topic was on pollution, conservation of natural resources, pest and diseases in 2017/2018 session in Zaria education zone.Students of different creativity traits are found in the same classroom and usually exposed to the same test and expected to perform the same creative trait and retain. Those students that have high creativity trait could dominate the activity based lesson and the average learners could be hindered from participating better. Many reviewed resaerchers work found out that, 5E learning inquiry and cycle help learning and retention

of Science concepts. The use of models improves learning and retention of concepts in Biology. From the literature reviewed, it shows that regardless of grade and subject matter it was found to be helpful in students' retention and improve unity of good relations among students. It also foster good relationship among students and the teachers.

Constructivism is often associated with variety of educational and pedagogical approaches in the literature and teachers are expected to prepare for the use. Some examples were generated out of literature on poor performance in Biology students in Senior Secondary Schools (Umoke & Nwafor, 2014)The related literature review on the study has broaden the mind of the researcher into models of constructivist method of 5E-learning model on creativity, academic performance, retentionamong male and females students of different categories and location worldwideand this has meaningful implications on the current investigations. The 5E-learning approach used by science educators such as Ergin et al., 2008; Cornelius 2012; Ibrahim 2015; Lee and Jun 2015; Ya'u 2016;Cakir 2017 and Umahaba, 2018 on academic success, attitude, Creativity, performance and retention in Biology, Physics, Chemistry in Montana, Turkey, Katsina and Zaria respectively becomes relevant.

The aim of this study on Effects of 5E-Learning Model is for additional relevant experiences that led to positive changes, improve creativity traits, and innovation to guarantee an all-round education for the learners in terms of pedagogy.The gap between students' fundamental skills in Biology and scheme required to excel in terms of teaching strategy, creativity traits identification and imrovements among males and females students of Biology SSII is what the research intends to fill. A provision is always made for revisional cycle by which the entire stages of review are revisited in a sequential order. The research aims at providing solution to the problem facing Nigerian youth in terms of understanding the concept of ecology that could increase creativity in the field of skill

acquisition and entrepreneurship. Moreover, this could lead to bearabledecrease in failure rate. Efforts in reforming teaching and learning in education for all students need to succeed if we must focus on findings that are students centered.

From the findings, the present study find out that so much investigation was done on 5E-learning model on creativity using secondary school students II.Also, ecology concepts such as pollution, conservation of natural resources and pest and diseases plants and animals have not been examined in the previous works.The academic performance has been done mostly on other subjects like Chemistry, Mathematics and Physics. In Biology only Pre-NCE and Polythethic students were studied. The current study focused on Secondary School II Biology studentsin Zaria Education Zone using 5E-learning model of instruction on creativity traits, academic performance and retention in Ecology.The work seeks to evaluate the environmental problems and challenges that man could find possible solutions by creating awareness through pedagogy to the society. It also aims at enlightening the schools, curriculum planners andteachers generally on such pedagogy.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter presents the research methodology. The study investigated the effects of 5E-Learning model on academic Performance, Creativity, and Retention of Biological concept among Secondary School Students in Zaria Education Zone, Kaduna State, Nigeria. This iscarried out under the following sub headings:

3.2 Research Design.

3.3 Population of the Study.

3.4 Sample and Sampling Techniques.

3.5 Instrumentations.

3.5.1 Validity of Instruments.

3.6 Pilot Testing

3.6.1 Reliability of the Instruments.

3.6.2 Item Analysis

3.7 Administration of Treatment.

3.8 Procedure for Data Collection.

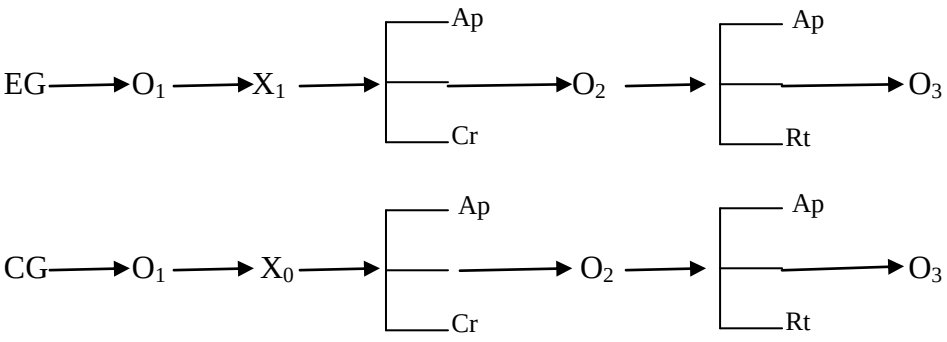
3.9 Data Analysis Technique.

3.2 Research Design

The study made use of research design known as quasi-experimental and control Pretest, posttest, postposttests (Kerlinger, 2000).Simple random technique by balloting method was used to select sixco-educational schools out of nineteenpublic senior Secondary Schools were pretested out of which two schools of high equivalent purposively sampled 100 students was drawn. These two co-education of high equivalent schools served as

population in Zaria Education Zone. Two schools ofA,served as experimental group while School B,served as control group. 25 males and 25 females were selected from each school under study due to gender determination of each class. The method of learning is step by step activity based on student centre, as guided by Central Limit Theory as proposed by(John and James, 2011),for each student to have equal chances to participate actively in the study in order, to have unbiased assessment of students performances (John and James, 2011).In order to have a fair representation of the subjects in the study (Sambo, 2008), total students used were 100 for the study. The subjects were pretested followed by posttest treatment of 5E-Learning Model on students' academic Performance and Creativity in Ecology concept from data collected for the study and postpost test for confirmation of the data generated results.The independent variables were manipulated to see their effect on the dependent variables. The research design is represented in Figure 3.1:

Figure 3.1: Research Design.



Sambo (2008)

Where:

EG = Experimental group

CG= Control Group

O_1= Pre test

O_2= Posttest (BAT)

O_3 = Post Posttest (BAT)

X_1= Treatment (5E-Learnig Model of Instruction)

X_0 = Treatment (Lecture method)

AP = Academic Performance.

Cr= Creativity

Rt = Retention

The design is suitable for the study because of the significance identified by Lakpini (2006) There is the pretest scores giving indication as to see whether the groups are equalin the concepts they hold before interaction was given.Secondly, the superiority of one instructional strategy over the other can easily be tested.

3.3 Population of the Study

The population of the studywas 5180 SSII students from 19 co-education public Secondary Schools in Zaria Education Zone, Kaduna State Nigeria.In Public Secondary Schools, teaching and learning condition is relatively the same such as environment, class-size, laboratory, facilities and uniform.The schools were coeducational schools in Zaria educational Zone.The students were considered suitable for this study by virtue of their age and academic experience. The average ageis 16 years. The public schools are shown in Table 3.1

Table 3.1 Population of the Study:

S/No.	Sch. Type	Public Location (Urban)	SSII Enrolment		
			Male	**Female**	**Total**
1.	GSS Zaria	Zaria	200	050	250
2.	GSS Gyellesu	T/Wada	201	045	246
3.	GSS T/Wada	T/Wada	170	052	222
4.	GSS Muchia	S/Gari	201	099	300
5.	GSS Chindit	S/Gari	250	045	295
6.	GSS K/Jatau	Zaria	240	056	296
7.	GSS Samaru	Zaria	201	058	259
8.	GSS K/Doka	Zaria	251	087	338
9.	GSS Pada	Zaria	200	055	255
10.	GSS Aminu	Zaria	198	045	243
11.	GCC	S/Gari	150	140	290
12.	GSS K/Bana	Zaria	180	056	236
13.	GSS T/Jukun	T/Wada	180	070	250
14.	GSS K/Gayan	Zaria	175	060	235
15.	GSS Kaura	Zaria	160	051	211
16.	GSS Chikaji	S/Gari	153	056	209
17.	DSS ABU Zaria	S/Gari	361	102	463
18.	GSS Dakace	Zaria	207	127	332
19.	GSS Bomo	Sabon Gari	200	50	250
	Total		3878	1304	5180

Source: Education Inspectorate Division, Zaria, (2018)

3.4 Sample and Sampling Techniques

The Zaria Educational Zone has 19 co-education public senior secondary schoolsof total number5180 students. Six co-educational schools comprised of total number 1614 were randomly selected and pre-tested. After the pretest, two schools were selected,tested for equality of means. Result of Multiple mean comparison showed that,school A and School B had the significant higher Pretest mean scores,as shown inAppendixIX Table3.2; 3.3 and 3.4

These two schools were randomly assigned into experimental and control groups. Out of 546 SSII Biology students from the two co-education Secondary Schoolswere purposively

sampled hundred (100) students of which50 were experimental group and fifty (50) werethe control group while 91 responded.The groups were pretested using Biology Achievement Test (BAT) to ascertain if the groups were of comparable ability before the treatment. Equal member of subjects were selected in order to have a fair representation (Sambo, 2008). Students worked in group and stages of learning.This is to avoid disparity. The 5E-Learning model was used to teach the Experimental group while the other served as the controlusing lecture method. The subjects are viable for this study which is in accordance with Central Limit Theorem Sambo (2000), John & James(2011) who observed that, sample size of minimum of thirty subjects is viable for experimental study of this nature. Details of the sampled used for the study are presented in Table 3.2

Table 3.2 Sample for the Study

S/N	Name of School	No. of students	Male	Female	Total Selected
1	SchoolA (Experimental)	300	201(25)	099 (25)	300(50)
2	School B (Control)	246	201(21)	045(20)	246(41)
	Total	546	402 (46)	144 (45)	546 (91)

Source: Field Study, 2019

3.5 Instrumentation

Twoinstrumentswere used for data collection in this study:

1. Biology Achievement Test (BAT)
2. Creativity Achievement Scale (CAS)

3.5.1 Biology Achievement Test (BAT)

Biology Achievement Test (BAT) comprises 40 objective Questions and Answers adapted from Biology objectives past question papers of(1998-2008; 2009-2013;2000-2016 WAEC, SSCE, NECO, GCE, JAMB)SeniorSecondary Revision Questions, New System

Biology textbook. The multiple choice items known as Biology Achievement Test (BAT) was used at three different stages. First, for pre-test, Secondly, post-test in order to determine the effectiveness of the treatment and thirdly, post post-test to determine the retention ability of the Biology concepts by the students. The reliability coefficient of the instrument was 0.76 and it consists of 40 objective questions with four response options (A,B,C, and D).One out of A-D served as correct option. The three left options were distracters as shown in Appendix X and XI.

3.5.2 Creativity Assessment Scale (CAS)

The Creativity Achievement Scale (CAS) was adopted by the researcher, from Akinboye (1977) It comprised of 89 items of four divisions A-D as follows: Ideative Flexibility Scale, Ideative Originality Scale, Ideative Fluency Scale and Creativity Motivation Scale. Cronbach alpha analysis on reliability of creativity statistics is 0.77 and all variable of creativity items reliability statistics is .85.The students were expected to evaluate themselves by the use of a 10-point scale to rate themselves on the items listed most descriptive of themselves. This is to show low in descriptive and high in an increasing order of magnitude (6, 7, 8, 9) and to rate item least (4, 3, 2, 1, 0) descriptive of themselves low in decreasing order of magnitutes. Zero being the rating for an item that is totally unlike the students. The item students were not sure of were rated 5. The measuring scale is shown in Appendix 1. The 89 items were allocated 20 munites. Students who scores 60 and above were classified as divergent thinkers, meaning a creative students, while those that score below 60 were not very creative.

3.5.3 Validation of the Instrument

The instrument Creativity Assessment Scale (CAS) was used as Questionniare to assess the creative traits attainment of the students. Biology Achievement Test was used to measure

the academic achievement of the students in Ecology concepts. These two instruments werevalidated for the purpose of this study by four seasoned Professors,three from Science Education Department and one from Psychology, Faculty of Education, Ahmadu Bello University, The questionnnaire content validations were carried out by three Pofessors in Science Education Department, Faculty of Education, Ahmadu Bello University Zaria who determine the suitability of instruments. To examine the test items for the following: (i) faces validity (ii) Content validity, (iii) Appropriateness of the items (iv) Clarity of the statement (v) To give advice that would improve the quality of the test items (vi) to take to the correction, and appropriately effects the noted correction. A language education specialist proof read to ascertain the clear, precise and unambiguitiees of the contentbased on the objectives of the study.The validatorscriticizedthe questionnaires in order to expatiate on the research design keys.The Creativity Assessment Scale were validated by dropping student's name, date, class, and occupation or profession for student. The two instruments were used for pre-test, post-test and postpost-test. The test items were assessed whether or not related to the objectives of the study.

3.6 Pilot Testing

The pilot study was carried out in Government public Secondary Schools due to benefits received by the students andteachers. They are managed by the same board, the same Syllabus and the same standard of teaching equipments, laboratory, and controlled by the same governmental body. Two schools were used GSS A and GSS B Zaria.The instruments for the study 5E-learning model of instruction and Lecture method were manipulated to see their effects on the academic Performance, Creativity traits and Retention. 5E-Learning model was used based on selected students for gender determination. Also, this model is step by steps way of learning. It is learning centred model of instruction. Then the data from pilot study was analyzed using quasi-experimental

designed. Pearson Product Movement Correlation Coefficient (PPMCC) was used to ascertain the reliability of the instrument at 0.75 which was against Sambo (2005) 0.86 of the same instrument. Cronbach Alpha Analysis on reliability of creativity statistics is.77 and all variable of creativity items and reliability statistics are .849 that to present one coefficient and test-retest statistics for two different reliability.

3.6.1 Reliabilities of the Instruments

The data generated from the pilot study is used to determine the reliability coefficient of the BAT test items.The Resaerch instruments used by the researcher for the study was Biology Achievement Test (BAT) and Creativity Assessment Scale (CAS) with a reliability coeffient of all variable of creativity items reliability statistics were .85,academic achievement 0.86 and Retention is 0.89 while reliability output on these was confirmed to be close to the conventional reliability and this was applied for the study.The topics selected were SSII topics according to their syllabus from the unit of Ecological Management Organisms and its Environmentsuch as:i) Pollution ii) Conservation of natural resources to determine the beauty of our environment, problem of the environment, solution to the problems. iii) Pest and diseases. Test-retest reliability and Pearson Product Movement Correlation Coefficient (PPMCC) were used to find the reliability co-efficient.

3.6.2 Item Analysis

Difficulty Indices

The standard instruments were used, Biology Achievement Test was determined by WAEC, SSCE, GCE and JAMBand NECO examiners who had satisfied the difficult indices of 0.85 while items with the Difficult indices are 0.25 or less. Satterly 1986 in Adamu (2014) stated that items with difficult indices between 0.30 and 0.80 are appropriate for achievement test. The study accepted and adopted the questions and

answers as seen in Appendix VII.It must have been by the formula given by Furst (1958) in Adamu (2014)

$$D = \frac{RU+RLx}{N} 100$$

Where

D = Difficulty Indices

RU = the number among the upper 27 percent of the respondents who scores the items correctly.

RL = the number among the lower 27 percent of the respondents who scores the items correctly.

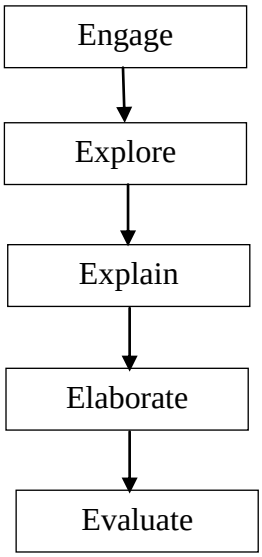
N = the total number of respondents in each of the upper and lower groups (not the entire students that sat for the test).

3.7 Administration of Treatment

The experimental group students were exposed to the use of 5E-Learning model of instruction and the control group to lecture method. The teaching was carried out by the researcher for a period of six weeks of 80 minutes per week. To ensure effective use of the instructional method of teaching,one lesson plan for each of the topics for six weeks of experimental and control group wasused as presented in Appendix VII-VIII, Pre-test by given Biology Achievement Test Apppendix IX, CreativeAssessment Scale Questionnaire Appendix I, to make sure the students areready for the study. The responses were retrieved to determine their performance and creativity in ecology concept of Biology. Permission wasrequired from the school principal of selected schools. Cordial relationship was maintained between the students and their Biology teachers. Students were briefedon students selected based on gender determination, method of activity step by step 5E-learning andhow to fill the questionnaire.The subject matter wasselected using simplerandom method.

Adopted questionnaire on Creativity scales was addiministed to measure level of perception in a qualitative data which was analysed using non-parametric.Also, students have ability to create and experience the level of motivation in creating, having new acts, ideas and trust in their ability to create. Divergent questions were used to develop creativity traits in students.Performance and Retention are quantitative data which was analysed using Parametric tests. The 5E-learning Model of instruction was exposed to students of experimental group using the Bybee's 5E-lesson Planning Model as shown in Figure 3.2:

Figure 3.2: Flowchart of Bybee et al (2006)



The detailed procedures of the lesson plan for this group is seen in Appendix II using Bybee's 5E-Learnig Model. The model leads students through the five phases starting with letter E. Llewellyn (2005) stated that, 5Es isInquiry Based Teaching (IBT) approach model,While lecture method was exposed to students of control group and the lesson plan is seen in Appendix III.

Phase	**Summary of Pedagogical Function**
Engagement	The teacher or a curriculum task assesses the learners' prior knowledge and helps them become engaged in a new concept through the use of short activities that promote curiosity and elicit prior knowledge. The activity

	should make connections between past and present learning experiences, expose prior conceptions, and organize students' thinking toward the learning outcomes of current activities.
Exploration	Exploration experiences provide students with a common based activities within which current concepts (i.e misconceptions), processes, and skills are identified and conceptual change is facilitated. Learners may complete lab activities that help them use prior knowledge to generate new ideas, explore questions and possibilities, and design and conduct a preliminary investigation.
Explanation	The explanation phase focuses students' attention on a particular aspect of their engagement and exploration experiences and provides opportunities to demonstrate their conceptual understanding, process skills, or behaviours. This phase also provides opportunities for teachers to directly introduce a concept, process, or skill. Learners explain their understanding of the concept. An explanation from the teacher or the curriculum may guide them toward a deeper understanding is a critical part of this phase.
Elaboration	Teachers challenge and extend students' conceptual understanding and skills. Through new experiences, the students develop deeper and broader understanding, more information, and adequate skills. Students apply their understanding of the concept by conducting additional activities.
Evaluation	The evaluation phase encourages students to assess their understanding and abilities and provide opportunities for teachers to evaluate student progress towards achieving the educational objectives.

Source: Bybee et al. (2006)

The constructivist teacher sets up problems, guide, and monitor to promote new pattern of thinking.Six schools were selected from the population of the study and pre-tested, out of the six schools, two with close academic performance equivalence were selected as the sample of this study from Zaria education zone. Due to coexistence nature of the study, the schools were sorted into experimental and control groups based on group with no significant difference. The two groups were drawn test-retest due to experimental pre-test to determine the equivalence of performance between ability of the two groups at the start of the experiment. The postpost test was given to the groups two weeks after the administration of the post-test. To determine their retention level, the students scores on Biology Achievement Test were recorded and these formed the data for testing the stated hypotheses of the study.

3.8 Procedure for Data Collection

The procedure for data collection of this study involvesuse of Biology Achievement Test (BAT) for Posttest and post posttest on performance and Retention. The items were markedand scored over 40 as seen in Appendix X, thiswere used to determined the effects of 5E-learning on Academic Achievement and Retention among male and femaleof public Secondary Schools Students.Creativity traits were determinedusing Creativity Assessment Scale (CAS) questionnaire and arranged for the analysis.

3.9 Data Analysis Technique

The statistical design of experiment was an efficient procedure on data obtained and analyzed to yield valid objectives research questions and research hypotheses stated for the study. The Research Questions statistics tools are used. The research questions were answered using: Descriptive statistics of Mean and Standard Deviation while inferential Statistic of parametric was used to test the null hypotheses on performance and retention

and subjects are from a random sampled and they are independent from each other. Also, the subjects are normally distributed within each group. The sample in each group is large (>30) at P< = 0.05 level of significant.

The test-retest reliability and Crobarch Alpha analysis were used to ascertain the reliability of the instrument due to the nature of the data collected that is, continuous coefficient data.

The data collected were analyzed using multiple research design. 2-Sample t-test,were used to find if there is a significant deference in the mean scores of the two groups or samples at alpha value (P< = 0.05) level of significance of 5E-learning model on academic performance while non parametric test of Wilcoxon test on effects of difference in creativity.2-Sample t-test of Mean and Standard Deviation on retention and2 Way ANOVA are used to determine thegender. Man Whitney non parametric statistics on creativity, Analysis of Covariance ANCOVA and Descriptive statistics of male and female student's Retention scores were discovered.

The following null hypotheses are tested at P<0.05

H_{O1}: There is no significant difference in performance of students taught Ecology concepts using 5E-Learning Model and those taught using Lecture method in Zaria Education Zone.

2- Sample t-test statistics was used to analyze this hypothsis.

$H_{O2:}$ There is no significant difference in Creativity traits between students taught 5E-Learning model and those taught using Lecture method in Zaria Education Zone.

Wilcoxon test statistical tool was used to analyze this hypothesis.

$H_{O3:}$ There is no significant differencein Retention ability of students taught Ecology concepts using 5E-Learning model andthose taught using Lecture method in Zaria Education Zone.

2-Sample t-test statistics was used to analyze this hypothsis.

$H_{O4:}$ There is no significant difference in the mean scoresbetween male and female students taught using 5E-Learning model in Zaria Education Zone.

2- Way ANOVA statisticswas used to analyse this hypothsis.

$Ho_{5:}$ There is no significant difference in the mean scores of male and female students creativity traits when taught Ecology concepts using 5E-Learning model in Zaria Education Zone.

Mann Whitney non parametric statisticswere used to analysed this hypothsis.

Ho_6 There is no significant difference in Retention ability between male and female taught using 5E-Learning model in Zaria Education Zone.

Analysis of Covariance (ANCOVA) and Descriptive Statistics on gender were used to analyse this hypothsis.

CHAPTER FOUR

DATA ANALYSIS,RESULTS AND DISCUSSION

4.1 Introduction

This study examines the effects of 5E-learning model on performance, creativity and retention among Secondary School Biology students in Zaria Education Zone, Kaduna State, Nigeria. The focus of this chapter is to analyse the data collected to answer the 6 research questions and test the 6 null hypotheses. The chapter is presented under the following sub-headings:

4.2 Data Analysis and Results Presentation

4.2.1 Answering the Research Questions

4.2.2 Testing the Null Hypotheses

4.3 Summary of Findings

4.4 Discussion of Results

4.2 Data Analysis and Results Presentation

Two types of instruments BAT and CASwere used to generate data for this study, namely:

(1) Biology Achievement Test was used as pre-test to generate data to establish group equivalence before the start of the instrument and to generate Post-test and Postpost-test data.

(2) Creativity Achievement Scale was used as instrument to generate data on creativity traits on Ecology concepts of the male and females students exposed to 5E-Learning modelof learning and Lecture method.

4.2.1a Answering the Research Questions

Research Question One

Research Question One: What is the difference between the performance of students taught

Ecology concepts using 5E-Learning model and those taught using Lecture method amomg Secondary Schools student in Zaria EducationZone?

To answer research question one, post test data generated via Biology Achievement Test were subjected to descriptive statistics of Means and SD were computed and were used to draw Table 4.2.1a

Table 4.2.1a:Mean and SD of Post test Data of the Experimental and Control Groups

Groups	N	Mean	SD	MD
Experimental	50	12.20	4.03	
				2.84
Control	41	9.34	3.48	

The descriptive statistics of Mean and SD in Table 4.2.1arevealed that difference exists(2.84) in the performance between students taught using 5E-Learning model and those taught using lecture method, in favor of experimental group which has higher mean of 12.20 compared to control group with mean of 9.34..

4.2.1b Research Question Two

Resaerch Question Two: What is the difference in creativity traits between students' taught using 5E-Learning model and those taught using Lecture method among SS2 Ecology Students in Zaria Education Zone?

To answer Research Question 2 Post test data generated via Creativity traitsquestionnaire were subjected to Mean Rank test of Post test Data of the Creativity traits of both Experimental and Control Groups Exposed to 5E-Learning model and lecture method.computed and were used to draw Table 4.2.1b

Table 4.2.1b:Mean Rank test for Post test score of Creativity for Experimental and ControlGroups

Groups	N	Mean Rank	Sum of MR	MRD
Experimental	50	55.32	27.66	20.68
Control	41	34.63	14.20	
Total	91			

Thecomputed Mean Rank of post test data of the creativity traits computed Mean creativity traits are 55.32 and 34.63 respectively, between students taught Ecology conceptsusing 5E-Learning Model and those taught using lecture method. TheMean Rank Difference (MRD) is 20.68.This shows that students taught Ecology concepts using 5E-Learning model has higher creativity traits than their counterparts taught using lecture method.

4.2.1c Reasearch Question Three

What is the difference in Retention ability of Ecology concept among secondary students taught using 5E-Learning model in Zaria Education Zone?

To answer this question 3 Post test data generated via Biology Achievement Test were subjected to descriptive statistics, Means and SD were computed and were used to draw Table 4.2.1c

Table 4.2.1c:Mean and SD of Post Post Test Scores Retention Ability of Experimental and Control Groups expose to 5E-Learning Model and those in control group.

Study Groups	N	Mean	SD	MD
Experimental	50	24.18	4.82	3.67
Control	41	20.51	4.74	

From the outcome of the descriptive statistics,effects exist in the retention between students taught using 5E-Learning model and those taught using lecture method. Indicating a mean retention difference of 3.67 in favour of those taught with the 5E-Learning method.

4.2.1d Research QuestionFour

Is there any difference in mean score between male and female students taught using 5E-Learning model in Zaria Education Zone?

To answer this question Post test data generated via Biology Achievement Test were subjected to descriptive statistics. Means and SD were computed and were used to draw Table 4.2.1d.

Table 4.2.1d: Means and SD of Post test Data of Male and Female Students in Ecology concepts Experimental and Control Groups expose to 5E-Learning model

Descriptive Statistics Dependent Variable: performance					
Groups	**Gender**	**N**	**Mean**	**SD**	**MD**
	Male	25	13.04	3.63	0.52
Experimental	Female	25	12.52	3.52	
	Total	41	12.78	3.55	
	Male	14	10.50	2.88	0.24
Control	Female	17	10.26	3.79	
	Total	50	10.34	3.48	
	Male	39	12.13	3.56	0.78
Total	Female	52	11.35	3.81	
	Total	91	11.68	3.70	

The descriptive statistic of mean, standard deviation and mean difference shows that there is difference in the academic performance of students by gender taught Biology concepts using 5E Learning and those taught using lecture method with mean difference of 0.52,

0.24 and o78 respectivelyThis comparative performance of the male and female of two groups in favour of. Those in Experimental group.

4.2.1e Research QuestionFive

What is the difference in the mean scores of male and female students' creativity trait taught

Ecology using 5E-Learning model in Zaria Education Zone?

To answer the research question Post test data generated via Creativity Achievement Test questionnaire on gender were subjected to descriptive statistics of Means and SD were computed were used to draw Table 4.2.1e

Table 4.2.1e: Mean Rank Test on Male and Female Students' Creativity Traits Taught Ecology Concepts using 5E-Learning Model and Lecture method

	GROUPINGS	N	Mean Rank	MRD
Experimental	Male	25	65.50	1.36
	Female	25	63.14	
Control	Male	21	33.83	1.65
	Female	20	35.48	
	Total	91		

The Mean Rank statistics test showed that there is no gender difference in the creativity traits attainment of students taught Biology concepts using 5E-Learning and those taught using lecture method with mean Rank difference of 1.36 and 1.65 respectively. This implies that both male and female have closely related increased in creativity traits as compared to the male and female for the control group. This shows that the 5E-Learning model is effective for both male and female students at increasing their creativity traits.

4.2.1f Research Question6

Is there any difference in Retention ability between male and female students taught using 5E-Learning model in Zaria Education Zone?

To answer the research question 6 Postpost test data were generated via Biology Achievement Testand were subjected to descriptive statistics, Means and SD were computed and were used to draw Table 4.2.1f

Table 4.2.1f: Mean and SD Statistics Test on Difference in Retention Ability of Male and Female taught using 5E-Learning Model

Group	Gender	N	SD	Mean	Differences
Experimental	Male	23	4.67	23.61	0.96
	Female	27	4.98	24.67	
	Total	50	4.82	24.18	

Result of the descriptive statistics in Table 4.2.1fshows that there is adifference of in the 0.96 retention scores of male and femalestudents taught Biology concepts using 5E-Learning model.From the descriptive statistics, this shows that,both male and female students have difference of 0.96, which could be described as no much difference.

4.2 Hypotheses Testing

H_{O1}: There is no significant difference in performance of students taught Ecology concepts using 5E-Learning Model and those taught using Lecture Method in Zaria Education Zone.

To test this Hypothesis, post test scores of the Experimental and Control were subjected to 2-Sample t-test. Summary of the analysis is shown in Table 4.3.1a

Table 4.2.2a2- Sample t-test Statistics on Difference in the Performance Between Students Taught Using 5E-Learning Model and those Taught Using Lecture Method

Study Groups	N	Mean	Std. Dev	Mean Diff.	Df	P	Remark
Experimental	50	13.55	1.93	1.69	89	0.00	S
Control	41	11.86	2.03				

Significant αP≤0.05

Results of the 2-sample t-test statistics in Table 4.3.1a revealed that significant difference exist in the performance between students taught using 5E-Learning model and those taught using lecture method. Reasons being that calculated P-value of 0.00 is less than the alpha level of 0.05. Their computed Mean performances are 11.86 and 13.55 among students taught with lecture method and those taught with 5E-Learning respectively. Thus the null hypothesis is rejected. The significant difference is in favour of students taught Ecology concepts using 5E-Learning model.

H_{O2}: There is no significant difference in Creativity traits between students taught using 5E-Learning model and those taught using Lecture method in Zaria Education Zone.

To test this Hypothesis, post test scores of the Experimental and Control were subjected to Wilcoxon test. Summary of the analysis is shown in Table 4.3.2b

Table 4.2.2b: Wilcoxon test on Difference in Creativity Trait Attainment between Student Creativity before and after being Taught Ecology Concepts using 5E-Learning model

	N	Mean Rank	Sum of Ranks	W-value	P	Remark
Pre test	51	45.66	2283.00	6.46	0.00	S
Post test	45[b]	55.34	2767.00			
Ties	5[c]					
Total	50					

Significant *α*P≤0.05

Outcome of the Wilcoxon Non parametric test showed significant difference in creativity trait attainment after being taught Ecology concepts using 5E-Learning model. This is because the calculated P-value of 0.00 is less than 0.05 alpha level of significance. Their computed Mean Rank level Creativity Traits are 45.67 and 55.34 pretest and posttest being taught Ecology concepts using 5E-Learning model respectively. There is a significant difference in favour of Creativity traits of students taught using 5E-Learning model than those taught using Lecture method. Thus null hypothesis is rejected.

H_{O3}: There is no significant difference in retention ability of students taught Ecology concepts using 5E-Learning model in Zaria Education Zone.

To test this Hypothesis, post test scores of the Experimental and Control were subjected to 2-Sample t-test. Summary of the analysis is shown in Table 4.3.3c

Table 4.2.2c: 2-Sample t test Statistics on Difference in the Retention between Students Taught using 5E-Learning Model

Groups	N	Mean	SD.	Mean Diff.	Df	P	Remark
Experimental	50	13.88	5.91	2.35	89	0.04	S
Control	41	11.53	4.08				

Significant αP≤ 0.05.

Results of the 2 Sample t-test statistics above revealed that significant difference exist in the retention between students taught using 5E-Learning and those taught using lecture method. Reasons being that calculated P-value of 0.04 is less than the alpha level of 0.05 and the computed t-value of 2.35 is greater than 1.96 t-critical value at df 89. Their computed Mean retention are 11.53 and 13.88 among students taught with lecture method and those taught with 5E-Learning respectively. This is in favour of the experimental group as revealed in the mean scores. The null hypothesis is rejected.

H_{O4}: There is no significant difference in the mean scores between male and female students taught using 5E-Learning model.

To test this Hypothesis, post test scores of the Experimental and Control were subjected to 2-Way ANOVA statistics. Summary of the analysis is shown in Table 4.3.3d

Table 4.2.2d: 2-Way ANOVA Statistics on the Gender Difference in the Academic Performance of Students taught Ecology Concepts using5E-Learning Model

Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Remark
Corrected Model	PRETEST	215.753[a]	3	71.918	9.123	.000	S
	POSTEST	223.797[b]	3	74.599	7.971	.000	S
Intercept	PRETEST	30898.017	1	30898.017	3919.580	.000	S
	POSTEST	21175.220	1	21175.220	2262.591	.000	S
Groups	PRETEST	88.645	1	88.645	1.245	.071	NS
	POSTEST	140.797	1	140.797	15.044	.000	S
Sex	PRETEST	40.593	1	40.593	1.149	.065	NS
	POSTEST	28.618	1	28.618	3.058	.082	NS
Groups * Sex	PRETEST	79.202	1	79.202	1.047	.062	NS
	POSTEST	62.059	1	62.059	2.031	.081	S

Not Significant α P≥0.05.

Result of the 2-Way ANOVA statistics shows that pre-test and post test analysis of gender.No significant gender difference in the academic performance of students taught ecology concepts reasons being that on account of gender versus group statistics the p value of 0.08 is greater than the 0.05. and its computed F value of 2.03 is less than the 2.60 F critical value. Thus the null hypothesis which stated there no significant difference between male and female academic performance is retained. Therefore, the use of 5E-Learning is gender friendly.

Ho_5: There is no significant difference in the mean scores of male and female students creativity traits when taught Ecology concepts using 5E-Learning model.

To test this Hypothesis, post test scores of the Experimental and Control were subjected to Mann Whitneynon parametric statistics. Summary of the analysis is shown in Table 4.3.3e.

Table 4.2.2e: Mann Whitney Non Parametric Statistics Test on Gender Difference in the Creativity Traits Attainment of Students Taught Ecology Concepts using 5E-Learning Model

Sex	N	Mean Rank	Sum of Ranks	Mann-Whitney	M	P	R
Male	25	31.26	781.50				
				1 .50	2.80		
Female	25	30.00	775.00			0.08	NS
Total	50						

Not Significant $\alpha P \geq 0.05$

Outcome of the Non parametric test of Mann Whitney test showed that there is no significant gender difference in the creativity traits attainment of students taught ecology concepts using 5E-Learning. This is because the calculated p value of 0.08 is greater than the 0.05 alpha level of significance. Also, the computed Mann Whitney test value of 1.50 is less than the MannWhieney value of 2.80. Therefore the null hypothesis stated is retained.

Ho_6: There is no significant difference in Retention ability between male and female students taught using 5E-Learning model.

To test this Hypothesis, post test scores of the Experimental and Control were subjected to ANCOVA and Descriptive Statistics. Summary of the analysis is shown in Table 4.3.3f.

Table 4.2.2f:Analysis of Covariance (ANCOVA) Statistics Test on Gender Difference in the Retention Scores of students in Experimental and Control Groups

Dependent Variable: Retention

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Remark
Corrected Model	405.644[a]	3	135.215	6.08	.00	S
Intercept	43554.900	1	43554.900	1958.24	.00	S
Group	332.740	1	332.740	14.960	.00	S
Gender	90.318	1	90.318	1.06	.07	NS
Group * Gender	20.522	1	20.522	.92	.34	NS
Error	1935.037	87	22.242			
Total	48522.000	91				
Corrected Total	2340.681	90				

Not Significant α P≥0.05.

Result of the Analysis of Covariance (ANCOVAR) statistics showed that there is no significant gender difference in the Retention scores of students taught ecology concepts using 5E-Learning and those taught using lecture method. The null hypothesis stated no significant gender difference in retention ability is therefore retained.

4.3 Summary of the Major Findings

The followings are the summary of Major Findings of the study

1. This study revealed that there is significant difference exists in the performance between students taught using 5E- Learning and those taught using Lecture method. Students who are taught with the 5E-learning have significantly higher mean performance than those taught with lecture method. (Table 4.2.2a)
2. This study revealed that there is significant difference existsin creativity trait between students taught Ecology concepts using 5E-Learning model and those taught using Lecture method. Students taught Ecology concepts using 5E-Learning model have significantly higher creativity traits than their counterparts taught using lecture method(Table 4.2.2b).

3. The Study revealed that there is significant difference exists in the retention between students taught using 5E- Learning and those taught using lecture method. Students who are taught with the 5E-learning has significantly higher mean retention than those taught with lecture method (Table 4.2.2c).
4. The Study revealed that there is no significant difference in the academic performance of male students taught Ecology concepts using 5E-Learning model and female taught using Lecture method. Both male and female students academic performances have relatively the same level of increased performance(Table 4.2.2d).
5. The Study revealed that there is no significant difference in the creativity traits attainment of students taught Ecology concepts using 5E-Learning model and those taught using lecture method. The 5E-Learning model is effective for both male and female students to increase their creativity traits attainment. (Table 4.2.2e).
6. The Study revealed that there is no significant difference in the Retention scores of students taught Ecology concepts using 5E-Learning model and those taught using Lecture method. Both male and female students have relatively the same level of increased retention. (Table 4.2.2f.)

4.4 Discussion of the Results

This current study examined the effects of 5E-Learning model on creativity, performance and retention in Ecology among secondary school students, Zaria Education Zone, Kaduna State, Nigeria.

The Table 4.2.2a indicating a mean performance difference of 1.69is in favour of those taught with the 5E-Learning model. This shows that students who are taught with the 5E-Learning model has significantly higher mean performance than those taught with Lecture method. Consequently, the null hypothesis which states that there is no significant

difference in the performance between students taught using 5E-Learning model and those taught using lecture method, is hereby rejected. The experimental group were taught with the 5E-Larning model, while the control group were taught with Lecture method. The experimental group, therefore, had significantly higher performance in their Ecology concepts than their counterparts in the control group. This shows that there is significant effect of 5E-Learning model over the Lecture method.This is because all Biology students taught Ecology concepts showed better performance when compared to those not exposed to it.The learning outcomes in learners are expected to producedbetween students and students activities. Diferences between students and teachers also exist difference but when it is not it becomes problem such as increase in failure rate.The findings results confirms the study of (Acisli and Yalcin, 2011; Isa, 2012; Ibrahim; 2015; 2016) who discovered that students experimental group that were exposed to inquiry method using 5E teaching cycle performed significantly better than those in control group. Umahaba (2018) and Wasagu (2019) stated thatthe result obtained shows students in experimental group performed significantly better than those in control group. The findings of Rigdeway 2004 and Idiris 2012 stated that there is no significant difference in the mean achievement scores of students among experimental and that of control groups when 5E-learning cycles were used. The present study significance is due to the use of 5E-learning model that involves stages of learning as students worked in groupand teacher acts as facilitator if not, the treatment administered could have shown same performance of experimental and control group. Understanding of the subject is known to be determined by the performance of the students examinations. Since the experimental group performance shows significantly higher means performance it means that using of 5E-Learning model among the SSSII Biology students improved their academic performance in ecology concepts. It shows appropriation as it recides within the students.

In Table 4.2.2bof Hypothsis Two, this shows that students taught Ecology concepts using 5E Learning model have significantly higher creativity traits than their counterparts taught using Lecture method. In the same vein, their computed Sum of Ranks are 2283.00 and 2767.00 before and after being taught Ecology concepts using 5E-Learning respectively. The null hypothesis which states that there is no significant difference in creativity traits attainment between students taught Ecology concepts using 5E-Learning model and those taught using Lecture method is rejected. Among the experimental group, at their pre-test level they were not exposed to the 5E-Learning model, but at their post test level they were taught with the 5E-Learning model hence a significant increase in their scores compared to their pretest scores.This shows that students' creativity traits increased after being taught Ecology concepts using 5E-Learning model. This supports the study of (Wakilli 2007; Animashahun 2008; Olorukooba and Lawal 2010; Ajaja 2013; Adamu 2014; Lee & Jun, 2015). The success of 5E-Learning model in effective teaching and learning might be due to the fact that students had positive right to learning and no negative interest. This must have helped them to recognized their ideas, share their ideas and facilitate their understanding as well as encourage their creativity traits. Also, creativity relevant skill, shows that ecology is relevant concept knowledge gained.The current study,therefore,sees the need for secondary school students creative traits to be more developed by the use of constructive learning method like 5E-Learning model. Due to the importance of creativity of individuals and nation building,this needs encouragement to be able to open to ideals and challenges and achievement of learners. Therefore, development of creativity trait of students must be encouraged to have high creativity in regular schools. This creativity should be developed and supported at the national level which can give room for more research study in the area of creative thinking traits.

In Table 4.2.2c of Hypothsis Three, indicating a mean retention difference of 2.35 in favour of those taught with the 5E-Learning model. This shows that students who were taught with the 5E-learning has significantly higher mean retention than those taught with lecture method. Also, as the experimental group were taught Ecology concepts using 5E-Learning, while the control group were not, hence the experimental group students had significantly higher retention level than their counterparts at the control group. This shows the effectiveness of the using 5E-Learning over the lecture method in the learning of Ecology concepts. This shows that students who are taught with the 5E-Learning has significantly higher mean retention than those taught with Lecture method.Consequently, the null hypothesis which state that there is no significant difference in the retention between students taught using 5E-Learning and those taught using lecture method, is hereby rejected.The present study has been inline with student's retention such as Yalcin et al., 2011; Ismet, 2012; Bello, 2013; Ibrahim, 2015; Alsheri, 2016 and Olajide et al., 2016. The result indicated a marked improvement on students retention. The study provided evidence of 5E-Learning model had a strong effect on students' knowledge and its impact on the study Ecology concept. The result is in agreement with Baser 2008 and Pulat 2009in Ajaja 2013 that stated that 5E-Learning model improves students achievement test and enhance retention of students in science knowledge.

In Table 4.2.2dof Hypothsis Four the Posttest scores in the Control group are 3.06 and 3.87 by male and female respectively. The experimental group posttest scores increased to 4.87 and 4.12 by male and female respectively.This shows that both male and female students academic performances have relatively the same level of increased performance at the post test level in the experimental group.The reason for the outcome of the above is that at the pretest level both control and experimental groups had the same level of scores for both male and female students. However, at the post test level the scores of both male and

female at the experimental group have their scores relatively increased at the same level, because both male and female have been exposed to the 5E-learning strategy hence the increase for both male and female. Therefore,the null hypothesis states that there is no significant difference in the academic performance of students taught Ecology concepts using 5E-Learning and those taught using lecture method, is hereby accepted and retained.

This shows that both male and female students academic performances have relatively the same level of increased performance. This agreed with Ibrahim 2015; Umahaba, 2018; Bichi, 2006; Lawal and Usman 2018. The present study discovered same level of increase which implies when equal opportunity is given to coeducational students performance may be same level.Disagreed with Mari 2007; Mari and Usman 2008 that stated male performed better than girls. Goldhill (2018) stated that there is a relatively small difference between gender behavior, intelligence and personality due to homones and chromosomes differences.

In Table 4.2.2e of Hypothesis Five,It shows that both male and female students taught Biology concepts using 5E-Learning model have the same level of interests.Their computed Mean Rank level creativity Traits are 31.26 and 30.00 among male and female students taught ecology concepts using 5E-Learning model respectively. In the same vein their computed Sum of Ranks are 781.50 and 775.00 among male and female students taught ecology concepts using 5E-Learning model respectively. Therefore, the null hypothesis which state there is no significant gender difference in the creativity traits attainment of students taught Ecology concepts using 5E-Learning, is hereby accepted and retained. The creativity of both male and female students at the experimental group is the same because both male and female students as both were taught Ecology concepts using 5E-Learning., implying that that the use of Ecology concepts using 5E-Learning, is effective for both male and female students alike.This implies that both male and female

have the same relatively increased creativity traits as compared to the male and female creativity in the control group. This shows that the 5E-Learning model is effective for both male and female students in increasing their creativity traits attainment Consequently, the null hypothesis which states that there is no significant difference in the creativity traits attainment of students taught Biology concepts using 5E-Learning model and those taught using lecture method, is hereby accepted and retained. It shows that the traits of creativity in the Ecology students were recognized and could have facilitated their knowledge and understanding as well as encouraged the creative traits. This may be due to the students positive right to learning.

In Table 4.2.2f of Hypothesis Six,it shows that both male and female students have relatively the same level of increased retention.Reasons being that on account of gender the p value of 0.067 is higher than the 0.05 In the same vein the Groups versus gender p value of 0.34 is higher than the 0.05 alpha level and its computed F value of 0.92 is lower than the 2.60 F critical value.From the descriptive statistics Table, the control group their retention are 19.76 and 20.75 among male and female respectively indicating an insignificant difference of 0.08, While, on the other hand, the performances of experimental group are 23.61 and 24.67 among male and female respectively indicating an insignificant difference of 0.9580. This shows that both male and female students have relatively the same level of increased retention. Therefore,the null hypothesis states that there is no significant gender difference in the academic retention of students taught ecology concepts using 5E-Learning and those taught using lecture method, is hereby accepted and retained. This comfirms the study of Isa 2012, Bichi 2002, Lawal, 2009, Lakpini, 2008 who discovered in their findings that there is no gender difference in academic performance of senior secondary school students exposed to Problem solving, science process skills, constructivist, inquiring. Usman, (2010) believed that equal

opportunity is given, both gender will performe equally well. Lawal, and Usman (2018) studied gender effect on academic performance and science process skills acquisition in Biology among secondary school students in Kaduna State Nigeria. The results indicated significant difference in the academic performance of male and female students. Current findings reported no gender influence in Ecology concept achievement. Umahaba (2018) conducted a research on gender performance in Chemistry and it showed that the treatment in relation to gender was found to be gender friendly.The present study shows significant difference among experimental group on performancefor students are allowed to investigate on their own, it motivates and makes learning meaningful. It also allow them the ability to recognize their ideas, share ideas by brainstorming.While among males and female no significant difference. Some researchers findings showed that females performed better than males in problem solving activities such as (Bichi, 2008 & Oludipe, 2012) In the same vein, Timothy, (2013) discovered that, the performance of male students was slightly higher than that of their female counterparts in trends academic performance SSCE in Ikorodu Lagos. This current studyis not in agreement with Mari 2007, Olorukooba, Lawal and Jiya 2012, Ibrahim, 2012 and 2015 who reported a significant difference among male and female performance of the experimental group-favouring male of the experimental.The 5E learning model has been found to have a broad effect on the academic achievement of students as is gender freindly.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter summarizes the whole study as presented in the following sub-headings:

5.2 Summary

5.3 Conclusions

5.4 Contribution to knowledge

5.5 Recommendations

5.6 Limitations of the study

5.7 Suggestions for Further Studies

5.2 Summary

This study investigated the effects of 5E-Learning model on performance, creativity traits and retention in Ecology concept among secondary school students in Zaria education zone Kaduna State Nigeria.

The relevant literatures that were available for the present study were reviewed. These literatures concluded that creativity traits, academic performane and retention can improve the students Ecology concepts using 5E-learning model of instruction that encouraged active participation of students to construct their knowledge.

The design of the study was quasi-experimental and control group design employing pretest, posttest and postposttest (Kerlinger, 2000)The total population of the study comprised of all mixed Senior Secondary School Students totally5180 students of male 3878,female 1304. In all the coedutional senior secondary schools were selected from Zaria education zone in Kaduna State and sample was derived using simple ramdom sampling for selection of teaching and selected sampled by using random sampling technique by

balloting method and these were assigned to experimental and control groupsof 100 students.

Two instruments were used Biology Achievement Test (BAT) and Creativity Assessment Skill (CAS) for the data collection. The BAT consist of 40 item multiple choice questions on Ecology concept with reliability of 0.86, while the student creativity achievement scale was 0.85. The questionnaire of CAS was used on the SS2 biology student to test for effect on performance, creativity trait and retention after using 5E-Learning model. the reliability coefficient used was found to be 0.89 using Pearson-Product moment correlation coefficient statistic. The treatment was employed for 6 weeks consisting of 6 periods of 80 minutes. Subject taught on ecology concept such as pollution, conservation of natural resources, pest and disease of plant and animals using 5E-Learning adapted from Bybee et al (2006) while the control group where taught using the same ecology concept using lecture method, at the end of the treatment, the participant were posttested and post-posttested using two sample t-test, Wilcoxon test, two-way ANOVA Statistics to determine the significant difference in academic performance creativity trait and retention on males and females. The data was subjected to analysis. The result shows that the academic performance, creativity trait and retention of biology students taught ecology concept using 5E-Learning model was significantly better of experimental group than control groups while gender had no significant effect in their performance creativity and retention. The six hypotheses, three were rejected while three were retained.

5.3 Conclusions

On the basis of the findings from the study, the following basic conclusion could be deduced, these are:

1. The 5E-Learning model has positive effects on students'Ecology concept performance. It could be concluded that, a better understanding of Ecology concept was provided by 5E-Learning model.
2. The 5E-learning model has positive effect on the SS2 students creativity traits inEcology concept.
3. The retention level ability of students is greatly enhanced when they were taught with 5E-Learning model as when compared with their counterparts taught with lecture method.
4. The 5E-learning model is genderfreindly as it is very effective for the enhancement of both male and female students performance in Ecology concepts.
5. The 5E-learning model is not gender biased as it is very effective for the enhancement of both male and female students creativity traits in Ecology concepts.
6. The 5E-learning model is not gender biased as it is very effective for the enhancement of both male and female students level of retention in Ecology concepts.

5.4 Contribution to Knowledge

The study has the following contributions

1. The study has provided new information to existing literature in teaching and learningEcology using 5E-Learning model.
2. 5E-Learning model helps step by step ways of teaching and learning of Ecologytoenhance creativity traits of students of the secondary school in ecology. that it is,effective in increasing knowledge and understanding of Ecology oncepts.
3. The 5E-learning model is gender freindly as it is very effective for enhancement ofperformance among students in Ecology concepts.
4. The researcher developed Biology Achievement Test which could be used by otherresearchers for further study.

5. The lesson plandeveloped on ecology concepts using 5E-Learning model was developedby the researcher and could be used by other researhers when carrying out similarstudies.

5.5 Recommendations

The following recommendations are made from the findings of the study

1. Biology teachers should be motivated intrinsically and extrinsicallybyadministrators, curriculum and time table planners in order to be able to use of 5E-Learning model in teaching SS2 students ecology concept for the purpose of enhancing their performance, retention ability and creative traits.
2. The use of the standard 5E-Learning model should be encouraged among the students through supervisionby school administrators.
3. Since this learning model is efficient, it can be emphasized more in the school syllabi and curriculum.
4. Since the 5E-learning model is gender friendly, co-educational schools should be encouraged to use such.
5. There should be seminars and workshops organized for in-service training for Biology teachers on the use of 5E-Learning model.
6. Parents Teachers Association of Nigeria (PTA) Non Govermental Organisation(NGO) should endervor to assist in providing teaching materials for effective use of 5E-Learning.
7. Textbook publishers should add 5E-Learning in the book productions.

5.6 Limitation of the Study

1. Time constraints would not allow the use of the entire State schools for the study but limited to Zaria Education Zone.

2. Due to inadequate materials for the use of 5E-Learning model the sample was limited to 100 participants.

5.7 Suggestion for Further Studies Based on the course of this study the followingsuggestions are made:

1. The whole states can be used.
2. Other topics in Science can use used.
3. Also, other topics in biology can be used.

REFERENCES

Acisli, S., Yalcin, S.A. & Turgut, U. (2011). Effect of the 5E-Learning model on students Academic achievement in Movement and Force Issues.Procedia Social and Behavioral Science 15 1-4 2459-2462. doi:10,1016Ijsbspro.2011.04.128. Published by Elsevier Ltd. Retrived from http://www.sciencedirect.org.

Adamu, G.J. (2014).Effect of Problem-solving Instructional Strategy on Self-Efficacy, Creativity and Academic Performance in Genetics among NCE Students in North West Nigeria. An unpublished Ph.D Dissertation, Ahmadu Bello University. Zaria.30-60.

Adawiah, R, & Esa, N. (2013). Ecological Literacy among Secondary School Students. Onlinesearch. Retrived from https://www.googleweblight.

Adedayo, J.O. (2010). Effects of teacher's Qualification on the Performance of Senior Secondary School students in Physics: Implication on Technology. A paper presented at the 6th annual conference of the Nigerian Educational Research Association University of Nigeria, Nsukka; 5th -7th November.

Adegoke, B.A. (2010). Integrating Animations, Narrations and Textual materials for improving students learning outcomes in Senior Secondary School Physics.*Electronic Journal of Research in Educational Psychology*, 8 (2): 725-748.

Agbenyeku, P. (2011). Effect of Advance Organizers on Performance and Retention of Ecology concepts among Senior Secondary School Students in Giwa Education Zone, Kaduna State. 41-62.

Aggarwal, J.C. (2008). Essential of Educational Psychology. New Delhi: VKAS Publishing House.Retrievedfromhttp://www.vikaspublishing.comeducation

Aham, A.C. (2013). Effect of Constructivists' Instructional Approach on Students' Achievement and Interest in Genetic in Enugu Education zone of Enugu State. An Unpublished M.ED. Thesis University of Nigeria, Nsukka.

Ahmad, S. (2019). Effect of Cooperative Learning Strategy on Performance in Chemistry among Secondary School Students in Zaria. *Proceedings of Science Teachers Association of Nigeria.* 370

Ahmed &Yusuf, M.O (2008). in Yusuf, M.O. and Afolabi, A.O. (2010). Effects of Computer Assessment Instruction on Secondary School Students Performance in Biology. *Turkish online Journal of Educational Technology,* 9 (1): 62.

Aina, M.E. (2009). *General Teaching method:* Lagos: National Open University of Nigeria.

Akinbola, A.O. & Folashade, A. (2009). Constructivist Problem Based Learning Technique and the Academic Achievement of Physics Students in Nigerian Secondary Schools. *Eurasian Journal of Physics and Chemistry Education,* 1 (1): 45-51.

Akpan, B.B. (2013). *Science Education in Nigeria Education in Nigeria:From the beginning to the future.* A book of Readings.77-104.

Ajaja, O. P & Eravwoke O. (2012). Effects of 5E learning cycle on students achievements in Biology and Chemistry.Retrieved from http://www.researchgate.net/publication

Ajaja, P.O. (2013). Which Strategy Best Suit Biology Teaching? Lecturing, Concept mapping, Cooperative Learning or Learning Cycle? *Electronic Journal of Science Education.* 17(1): 1-23. Retrived fromhttp://ejse.southwestern.edu.

Akinboye, J.O. (1977). *Guidance and Councelling Strategies for handling Adolescent and Youth Problems.*Ibadan. Ibadan University Press LTD.

Alake, E. (2015). Efficacy of Laboratory Instructional Strategy on Students Geometry Performance, Retention and Attitude in Junior Secondary Schools, Zaria, Kaduna State, Nigeria. An unpulished Ph.D Dissertation, Ahmadu Bello University, Zaria.

Alshehri, M.A. (2016). The Impact of Using (5E's) Instructional Model on Achievement of Mathematics and Retention of Learning among Fifth Grade Students. *IOSR Journal of Research & Method in Education.* 6(2):43-48. E-ISSN:2320-7388 Retrived from http://www.iosrjournals.org

Animasahun, R.A. (2008). Effectiveness of Six thinking Hats and Practical Creativity Techniques.Retrieved from http://www.pdfs.semanticscholar.org.

Animasahun, R.A. (2009). The Social Sciences Psycho Demographic predictors of school attendance Behaviour among Secondary School Students in Osun State Nigeria Publication 4: 622-672.

Anyaegbunam, N.J. (2012). Effect of Constructivist Theatre Instruction on students' knowledge of HIV, AIDS and Sexual Behavior in Enugu State of Nigeria. An unpublished Ph.D Dissertation, University of Nigeria, Nsukka.

Ayamene, A. & Ayamene, (2010). Students' Learning Studies and Achievement in Integrated Science. *Nigerian Journal of Education Management*.

Arslan, H.O. (2014). The Effect of 5E-Learning Cycle Instruction on 10TH grade students' Understanding of Cell Division Aand Reptoduction Concepts. Retrieved from http://www.edt.lib.metu.edu.trouploadpdf1-280.

Atadoga, M.M.& Onaolapo, A.O. (2008) in Isa, Y.B. (2012). Effect of a Constructivist Instructional Strategy on the Academic Achievement, Retention and Attitude of Physics among Secondary School Students of Different Ability Levels in Kano State, Nigeria. An unpublished Ph.D Dissertation, Ahmadu Bello University, Zaria. 53-54.

Atkin, J.M., & Karplus, R. (1962). Discovery or invention? The Science Teacher, 29(5), 45-51.

Ayamene, A. & Anyachebelu, F.U. (2009). Effects of use of Advance Organizer of Students achievement and Retention in mathematics. Unizik. *Journal of STEM Education,* 1 (1): 58-64.

Bawa, M.R. (2011). Effects of Problem Solving instructional Strategy on academic achievement and Retention in Ecology among Secondary School students with Different Cognitive preferences in Zaria Educational Zone. An Unpublished Ph.D Dissertation. Science Education, Faculty of Education, Ahmadu Bello University Zaria. 16-71.

Bakori, M.H., Yaranci, B.M. & Umar, A. (2018). Exploring Creativity and Problem Solving Method in Teaching Secondary Education Curriculum as a Panacea for Global Security and Socio-Economic Development. Being a paper presented at International Conference Held at the Faculty of Education. Ahmadu Bello University. 24th -29th September, 2018. 2.

Barry, N.B (2013). The 6E-Learning by DeSIGN™Model. Retrieved from ITEEAhttp://www.linkengineering.org.

Bello, A. S. (2013). Effects of Enrichment package on Mathematics achievement, Retention and anxiety among junior secondary school students in Adamawa. Unpublished Ph.D Dissertation. Science Education, Faculty of Education, Ahmadu Bello University Zaria.

Beam, C. (2014). Creativity is a key pre-requisite. *International Journal of Education and Practice*2(6): 137-146 ISSN(e): 2310-3868Retrieved from *http://www.creativityretrived13/4/2019*.

Bichi, S. S. (2002). The Effect of problem solving strategy in enhancing curriculum on Students' Academic Performance in Evolution concept among Secondary School Students. Unpublished PhD. Thesis Faculty of Education, Ahmadu Bello University, Zaria.

Bichi, S.S. (2008) in Usman (2010). The effects of indoor and outdoor laboratory instructional methods on academic achievement of Junior Secondary School Integrated Science Student's in Zaria Local Government Area of Kaduna State. *Journal of Studies in Science and Mathematics Education* 1(1): 67.

Bybee, R.W., (2002). Scientific Enquiry, Student Learning an thr Science Curriculum: Learning Science and Science of Learning. Arlington VA: NSTA Press.

Bybee, R.W., Taylor, J., Gardner, A., Scotter, P., Powell, J., Westbrook, A., & Landes, N., (2006). *The BSCS 5E Instructional Model: Origins, Effectives and Applications*. Executive Summary, BSCS, Colorado Springs, CO.2.

Cakır, N. K. (2017). Effect of 5E Learning Model on Academic Achievement, Attitude and Science Process Skills: Meta-analysis Study Mugla, Turkey. *Journal of Education and Training Studies.* 5(11): 157 ISSN 2324-8068. URL: Retreived from http://www.jets.redfame.com.

Chua Y.P (2014). Effects of Gender Thinking Style on Students Creative Thinking Ability. Artick in Procedia Social and Behavioural Sciences Feb 2014 (Mashal of Facist)

Çimer, A. (2012). What makes biology learning difficult and effective: Students' views. Trabzon-Turkey. Educational Research and Reviews 7(3): 61-71.

Cornelius, M. (2012). The 5E Learning Cycle and Students Understanding of the nature of Science. M.Sc ed Thesis of Science Education Montana State University, Bozeman Montana. 1-18.

Cronin, L.L. (1989). Creativity in the Science classroom. Why it is as essential as a Microscope. The Sciene Teacher, 56, (2) 35-36.

Dahiru, S. (2013). The Effects of using Gagne's Learning Hierarchy in Chemistry students Academic Performance and Anxiety level in Balancing Chemical Equations in Secondary School in Katsina Metropolis. Unpublished Thesis Faculty of Education, Ahmadu Bello University, Zaria.

Daniel, H.P. (2005). A Whole New Mind Book.21-22. Retreived from http://www.academics.edu/3697211

Dambana, B.T. & Mari, J.S. (2013). Effect of Science-Technology-Society (STS) Instructional Strategy on Academic Performance in Selected Genetic Concepts among NCE Students in Federal College of Education Zaria. *Journal of Studies in Science and Mathematics Education*,3(1): 93-100.

Daworiye, P.S., Alagoa, K.J., Enaregha, E. & Eremasi, Y.B. (2015). Factors Affecting the Teaching and Learning of Biology in Kolokuma L.G.A. Bayelsa State, Nigeria. *International Journal of Current Research in Biosciences and plant Biology. ISSN: 2349-8080.* 2. (4): 151-156.

Denny, K ., and O'Suplivan V., (2007). The Economic Consequences of Being Left-unattended some sinister Results Journals of Human Resources (126) 353-374.

Dewey, J. (1994). Thinking Technology in Educational Technology, 34 (4): 34-37.

Dewey, J. (1938). Experience & Education. New York, NY: Kappa Delta Pi. http://.www.scholar.google.com.

Dorgu, T.E. (2016). Different Teaching Methods: A Panacea for Effective Curriculum Implementation in the classroom. *International Journal of Secondary Education. Special Issue:* Teaching Methods and Learning style in Education 3(6-1, 2015) 77-87.

Education Inspectorate Division, Zaria and Kaduna, 2015.

Epple, C. (1998).Coming to terms with Navajo " nadleehi" A Critique of JSTOR. https://www.jstor.org

Ergin, I. Kanli U & Unsal, Y. (2008). An Example for the Effect of the 5E Model on the Academic Success Attitude Levels of Students: 'Inclined Projectile Motion.Retrived from http://www.*Journal of Turkish Science Education* 5 (3): 26-32.

Etiubon, R.U. and Okopide, A.A. (2015). Utilizing Research Findings in Science Education Curriculum for Teachers' Creative skills STAN towards Effective Application of STEM Education Research, 291-298.

Eshetu A.A., (2015).Gender Disparity Analysis in Academic Achievement in Higher Education Preparatory Schools: Case of South Wollo Ethiopia. https://academicjournals.org/ERR.

Ezeaghasi, N.E. (2017). Efficacy of Evacs and Evolve Computer Simulation Models on Attitude, Retention and Performance in Evolution Concepts among NCE students in North West, Nigeria. An unpublished Ph.D Dissertation, Ahmadu Bello University, Zaria. 26-27.

Ezenduka, C. U., Achufusi, J.N. & Okoli, S.I. (2014). Enhancing Creativity in Senior Secondary School Biology Teaching through Generative Learning Model Approach. Paper 27 of Science Teacher Association of Nigeria Biology Panel Series 215-222. STAN Publication.

Farooq M.S., Chandry A.H., Shafiq M., Behane G. (2011). Factor Affecting Students Quality of Academic Performance: A Case of Secondary School Level J.Q. Technnology Mange 7(2) 1-14 from Gender Disparity Analysis in Academic Achievement at Higher Education Preparatory School Case of South Wolio, Ethiopia

Fazelian, P., Ebrahim, A. N. & Soraghi S. (2010). The effect of 5E Instruction design model on learning and retention of science for middle class students in procedia Nahavand 5:140-143.

Federal Minisrty of Education (FME) (2013). National Policy on Education. Lagos: NERDC Press.

Federal Republic of Nigeria(FRM) (2013). National Policy on Education 6th Edition. Yaba Lagos: NERDC Press. 17-29.

Finn, H., Maxwell, M. & Calver, M.C. (2002). Why does experimentation matter in teaching ecology? *Journal of Biolocal Education.* 36(4): Retrived from https://www.researchgate.

Frost, J. (1992). Play and Playscapes. Albany New York: Delmar Publisher lnc. Retreived from https://www.pgpedia.com

Garba, U.M. (2018). Master thesis effects at guided discovery strategy on creativity and performance in basic science concepts among junior secondary schools students in Bauchi Metropolis Nigeria. Unpublished MEDThesis, Department of Science Education, AhmaduBello University, Zaria. 47-63.

Goldhill, O. (2018). Both Biology and Society Influence Gender: NONBINARY BIOLOGY. Retrieved from http://www.nonbinarybiology.org.

Guilford, J.P. (1959). Traits of creativity in Creativity and its Cultivation. 142-161. Retrived from http://moderncreativity.weebly.com.

Gutierrez, O.M., Agudo, L.S.L & Garcia, M.A.R. (2018). Gender difference in adolescents' academic achievement SAGEjournal. Young 26(3), 250.Retrieved from https://journals.sagepab.comdio.rg/10.1/77/i103308817715163.

Gyuse, E.Y., Achor, E.E. &Chianson, M.M. (2014). How creative are Secondary School Student? STEM Education and Creativity. 55th Annual Conference.146-159.

Hackett, J.K and Everett, S.A. (2007). Teaching Science as investigation: Modeling Inquiry Through Learning Cycle Lesson. https://www.person.com/us/higher-education/program/moyer-Teaching-science-as-investigations-modeling-inquiry-Through-Learning-cycle-Lessons/PGM212252,html.

Huppent, J., Lomack S.M and Lararowets R. (2002). Computer Simulations in the high School: Students' Cognitive Stages, Science Process Skills and Academic Achievement in Microbiology August 2002. International Journal of Science Education 24 (8):803-821. Doi:10-1080/0950069010049150.

Hwang, Chen, Dung and Yang (2007). Multiple Representation Skills and Creativity Effects on Mathematical Problem Solving using a Multimedia Whiteboard System. Educational Technology and Society 10(2) 191-212. PDFreserach.net

Ibrahim, S.T. (2012). Effect of Teacher-Student verbal interaction on student's Academic Achievement in some Biology Concepts of Senior Secodary School Students in Sabon Gari Local Government Area, Zaria. *Journal of Studies in Science and Mathematics Education* 2(1) 24-35.

Ibrahim, S.T. (2013). Effect of high level of Teacher-Students verbal interaction on students Achievement in Biology: Implication for curriculum and new Science, Technology and Mathematics Teacher. Nigeria Education Forum. *A Journal of Institute of Education*,22(2): 81-89.

Ibrahim, S.T. (2014). Hands-on Learning for Enhancing Functional Skills Acquisition through Biology Education for Sustainable Development. A Paper Presented at Science Teachers Association of Nigeria Conference, Katsina State Chapter on; 3rd-7th March, 201school of Education Theatre Hall Federal Education Katsina.

Ibrahim, S.T. (2015). Impact of 5E learning cycles on Attitude, Retention and Performance in Genetics among PRE-NCE students with varied abilities in North-West zone, Nigeria. UnpublishedPh.D Dissertation, Department of Science Education, Ahmadu Bello University, Zaria. 106-118.

Igboegwu, E.N. (2012). Effects of Guided Discovery and Demonstration Teaching Methods on Achievement of Chemistry students of different levels of scientific literacy. *Journal of Research in Curriculum and Teaching*, (1c): 445-448.

Idris, I.O. (2012). Effect of concept mapping strategy on Mathematics Achievement and Attitude among students with varied Ability levels in senior Secondary schools in Zaria Education Zone. A postgraduate research seminar paper (EDSE 805) Department of Science and Mathematics Education. Faculty of Education, Ahmadu Bello University Zaria.

Ihejiamaizu, C. C., Ukor, D. D. & Neji, H. A. (2018). Utilization of 5Es' Constructivist approach for Enhancing the Teaching of difficult eptsinbiology. *Global Journal of EducationalResearch.*17,2018:55-60.ISSN1596-6224.Retreivedfrom http//:www.globaljournalseries.com.

Iny, A.& Luc de Brabandere (2013). *Thinking in New Boxes: a New Paradigm for Business Creativity.* Random House publication.

Isa, Y.B. (2012). Effect of a Constructivist Instructional Strategy on the Academic Achievement, Retention and Attitude of Physics among Secondary School Students of Different Ability Levels in Kano State, Nigeria. An unpublished Ph.D Dissertation, Ahmadu Bello University, Zaria. 33-55.

Isao M. & Emmanuel C. (2014). School Examinations Leakage: Case of Zimbabwe Schools Examination Council. *IOSR Journal of Humanities and Social Science* 19(4) 47-54.

Inventional Institute.com (2018). The Creativity in all students. Project-based learning for inspirating grade K-12.

Ismet, E. (2012). Constructivist Approach based 5E model usability Instructional Physics. Turkish Military Academy, Bakanliklar 06654 Ankara, Turkey. Lat. Am. J. Phys. Educ, 6 (1): 14-19Retrived from http://www.lajpe.org.

Ityokyaa F.M (2015) Biological Teachers Awareness and Utilization of Innovative Teaching Strategies in Secondary Schools in Benue State, Nigeria. A Seminar Paper Presented in the Department of Science Education, Federal University of Agriculture, Makurdi

James,V., Lederman, G.R., & Vagt-Traore, B. (2004). Enhancing creativity in the classroom. Retrivedfrom http://epltt.coe.uga.edu/Navigation menu.

Jegede, S.A. and Adedayo, J.O. (2013). Enriching Physics Education in Nigeria towards Enhancing a Sustainable Technological Development.*Greener Journal of Educational Research,*3(2): 80-83.

Jesulowo, J.F. (2015). Use of Expository Approach in teaching living things and their habitats among Senior Secondary School (SS1) Students. *STAN National Biology Panel Series.* Variability, Heredity, Adaptation & Evolution module , 172.

Jesulowo, J.F. (2018). Improving the Basic and Secondary Education as a Panacea for Global Security and Socio- Economic Development in Nigeria. Being a paper presented at the Faculty of Education Ahmadu Bello University Conference held on 25th-29th September 2018.

John, W.B. & James, V.K. (2011). Research in education, tenth edition: PHI learning private limited, New Delhi-110001.

Kauru, A.I., Shehu, M.I. and Ya'u B. (2016). Effects of 5Es Constructivist model on Polytechnics students' Retention and Academic Performance in Genetic concepts in Kaduna State, Nigeria. *Journal of Institute of Education.* Ahmadu Bello University, Zaria. 25 (1): 89-101.

Kaufman & Beghetto (2008). Exploring 'mini-c:' Creativity Across Cultures. Retrieved from http://www.ronaldbeghetto.com/publication

Kerlinger, F. N. (2000). Foundation of Behavioural Research: Research Design in Occupational Education, Oklahoma State University 9. 72.

Kibirige and Teffo (2014). Actual and Idea Assessment Practices in South African Natural Sciences Classrooms. *International Journal of Educational Sciences* 6(3) 509-519.

Kruager, C.A. (2010). A study of the use of computers in science teaching and learning in Sekoradi-metropolis in Ghana. *Journal of Studies in Science and Mathematics Education,* 1 (1).

Kuo, F.R. & Hwang G.J. (2014). A five Phase Learning Cycle Approach to Improving the Web-Based Problem-Solving Performance of Student. Educational Technology and Society 17(1), 169-184.

Kwan, L.P., Lam, E.Y.K., & Ofeefuna, J.O. (2011). New System Biology for Senior Secondary Schools. Africana First Publishers. Marshall Cavendish Education.

Lakpini, M.A. (2006). Effect of Conceptual Change Instructional Strategy on the Achivement, Retention and Attitude of Secondary School Biology Students with Varied Abilities, unpublished Ph.D Dissertation, Science Education , Faculty of Education, Ahmadu Bello University, Zaria.

Lakpini, M.A. (2012). Effect of conceptual changes Instructional Strategy on Biology Performance of low and average Secondary School Students in Giwa Educational Zone. *Journal of Studies in Science and Mathematics Education,* 2(1): 47-56.

Launch, P. (2006). *www.gtvoice.org.uk/sites/files/8enrichment.pdf*. Oxford Brookes University, Institute of Education.

Lawal, F.K. (2009). Effectiveness of Conceptual Change Strategies in Remediating Misconceptions in Genetics concept among Senior Secondary School Students in Kano State. An Unpublished Ph.D Dissertation Ahmadu Bello University, Zaria Nigeria.

Lawal, F.K. (2010). Relationship between qualify exams (Q.E) and National Examination Council NECO results in Biology in selected secondary schools in Kano metropolis. *Journal of Studies in Science and Mathematics Education,* 1 (1): 42-46.

Lawal, F.K. (2012). Performance of Two Groups of students Taught selected concepts in Biology using two different approaches. *Nigeria Educational Forum. Journal of the Institude of Education,* Ahmadu Bello University. 20 (1): 63.

Lawal, F.K.& Usman, S. (2018). Gender effect on academic performance and science process skills acquisition in Biology among secondary school students in Kaduna state Nigeria. Proceedings of Science Teachers Association of Nigeria. 150-159.

Lawson, A.E. (2001). Using the Learning Cycle to teach biology concepts and reasoning patterns. *Journal of Biological Education.* 35 (4): 165-169.

Lee, K & Jun, J. (2015). Developmental characteristics of Creative thinking Ability and Creative Personality of Elementary School children Korea. Advanced Science and Technology Letters 92 Education. 46-51. Retreived from http//:www.dx.d.org/10.14257/oct/.

Liewellyn, D. (2005). Teaching high School through inquiry: A case study approach. Thousand oaks: Corwin press.

Madden, M.E., Baxter, M., Beauchamp, H., Bouchard, K., Habermas, D., Huff, M., Ladd, B., Pearon, J.,& Plaque. G. (2013).Rethinking STEM Education: An Interdisciplinary STEAM Curriculum. Procedia Computer Sciencedirect 20 (3): 541-546. http://www.sciencedirect.com

Madden M, Savter M, Beauchamp H, Bouchard K, Habermas, D Huff M, Plague, G. (2013). Rerhin King STEM Education. AA Interdisciplinary STEAM Curriculum-Procedia Computer Science 20, 541-546.

Mahmud, A. (2017). Impact of three Problem Solving and Discovery strategy on Attitude, Retention and Performance in Genetics Concepts among Secondary School Students. An Unpublished Ph.D Dissertation Science Education, Faculty of Education Ahmadu Bello University, Zaria. 23-27.

Mashal H. Facist M., Hendler T., Jorng-Beloman, M (2007). Anfmr Investigation of the Neural Correlates Underlying the Processing of Novel Metaphoric Expressions Brain and Language; 100;115-126

Mark, B. (2012). Psychometric work Research Group. Manchester Business Schools.15-16.

Mari, J.S. (2002). The effect of Process Skills Instruction on formal Reasoning Ability among Senior Secondary School students in Kaduna State Ph.D Thesis. Department of Education Ahmadu Bello University Zaria.

Mari, J.S. (2007). Gender Related Differences in Achievement in Biology among Senior Secondary Schools Student, Zaria. *Journal of Studies in Education* 3(2) 111-122.

Maikano, S., Bichi, S.S. & Shaibu, A. (2015). Effects of Outdoor and Indoor Laboratory Experiences on Secondary School Students' Academic Achievement in Ecology, Kaduna State. *Journal of Educational Research and Development.* Publication of the Faculty of Education ABU, 9 (2): 27-32.

Mari, J.S., (2007). Gender Related Differences in Achievement in Biology Among Senior Secondary School Students' *ZariaJournal of Studies in Education* (ZJSE) 3 (2) 11-122

Margal S.K (2011) in Salisu (2014). in Part of Animated Media Teaching Strategy on Academic Achievement Relation and Interest Among Senior School Geography Students in veated Concept, Katsina State. A PhD Dissertation, Department of Science Education, Faculty of Education. ABU, Zaria Pp50-54

Moyer, R.HH., Hackett, J.K. & Everett, S.A. (2007). Teaching science as investigation: Modeling inquiry through learning cycle lessons. Electronic Journal of Science Education. Retrived http://www.journalscienceeducation.com.

Moore, D.W., Bhadeha, R.A. Billings, R.L., Fulwiler, C., Heiman K.M., Rood, K.M.J., and Gansler, D.A., (2009). Hemispheric Connectivity and the Visual-Spatical Divergent-thinkingComponent of Creativity. Brain and Cognition*Journal Homepage* www.elservier.com/locate/b&c1-6 70(2009), 267-277.

Mbanefo,M.C. & Olatunji, F. (2019).Towards Achieving National Goal for Basic Education in Nigeria through Effective Educational Policy Plan Implimentation.*Proceeding of Innovation in STEM Education.*STAN Conference.120-130.

Mcleod, S.A.(2014). Biological Theories of Gender. Simply Pschology.Retreived from http://wwww.simplepshcology,org./gender.mtml

Muoneme, J.O.H., Usman, I.A., & Olorukooba, S.B. (2015). Impact of Enriched-Lecture Method with Multimedia-Board on Academic Achievement of Secondary School Students in Evolution Concepts of Biology Niger State, Nigeria. *Journal of Educational Research and Development,* 9 (1): 110-111.

Munandar, O (2012). Pencapaian daya don Kreativitas anak berbakat. *Jakarta: PT Rineka Cipta*.

Mwanga E.C. & Sibanda, L. (2017). Teaching Biology Practical lesson in secondary school. Retrived http://www. Semanticschool 6(3).

National Policy on Education (2013). 6th Edition 1.

NECO, (2011). National Examination Council Examiner's report for Senior Secondary.

NECO, (2013-2018). National Examination Council, Kaduna. https://www.neconigeria.org

Njoku (2004). Enhancing Girls Requisition of Science Process Skills in Co-Educational Schools. An Expensive with Seux Grouping for Practical Chemistry. *Journal of Science Teacher's Association of Nigeria* 37(142) 69-75.

Norah, M.A. (2015). Effects of Cooperative Learning on Academic Performance of College Students in Saudi Arabia. An Unpublished M.Sc. (Ed) Dissertation, State University of New York, New York.

Northern, S. (2018). The 5E's of Inquiry-Based Learning. Knowledge Quest. Retrived from http://www.knowledgequest.aasl.org.

Nsofor, C.C & N.A. Ala (2013). Effects of Computer Aided Instructional Package on Biology Students' Achievement in Genetics Concepts in Katagum Education Zone, Bauchi. Proceedings of Multicultural African Conference. Faculty of Education Ahmadu Bello University Zaria, 159-169.

Nuri, B. & Hakan, S. (2016). The effect of 7E-Learning Cycle on learning in Science Teaching: Ameta-Analysis study. *European Journal of Educational Research.* 5(2 61-72. Retrived from http://www.eujer.com.

Nwagbo, C. & Aham, A. (2015). Research in STEM Education: Utilizing the 5Es' Constructivist instructional approach for effective classroom delivery of Genetics concepts. Towards effective application STEM education research. *proceedings, of STAN.* 56th Annual Conference166-172.

Nwanfor, M.C., Esemua O.M and Orefor J.A (2015). Secondary School Students Level of Awareness of the Need for Conservation of Natural Resources in Z.C. Njoku (Ed) Towards Effective Application of STEM Education Reserved STAN 56th Annual Conference 239-245.

Obeka, S.S. (2010). Effect of Inquiry and Demonstration Methods on Students Achievements and Retention in Some Environmental Education Concepts of Education. *Journal of Studies in Science and Mathematics Education,* 1 (1): 52-55.

Obeka, S.S. (2011). The role of objectives and measurement in educational research. Panacea of Science Education Research Ahmadu Bello University Press Limited Zaria. ISBN.978-125-846-2 178-185.

Odubumi, E.O. (2006). Science and Technology education in Nigeria: the euphoria, the frustration and the hopes. 21st Inaugural Lecture, Lagos State.

Okebukola, P. (2005). In Wasagu, M.A. (2019). Innovation in STEM Education: The missing Link in Nigeria. A Key note address at 60th Annual Conference Proceedings. STAN. 5-17.

Olajide, J.O., Lawal, T.E. & Umahaba, E.R. (2016). Impact of 5Es Learning model on academic Performance and gender among secondary school Chemistry students, Katsina Metropolis, Nigeria. *Journal of Institute of Education.* Ahmadu Bello University, Zaria.25 (1) 25-33.

Olaofe, I.A. (2013). Resources for Teachers in Effective Management of Learning in Large Classses. Pre-Conference Workshop.Proceedings of Multicultural African Conference. 10th-11th June, 2013. Faculty of Education Ahmadu Bello University, Zaria 9-23.

Olarewaju, R.R. (2012). Effects of Cooperative learning strategy with model on academic achievement and Retention of biology concepts among Pre-National Diploma students in Kaduna State Unpublished PhD dissertation of Ahmadu Bello University Zaria. 5-84.

Olatunji, F., Isa, U. & Olajide, J.O. (2017). Impact of Gallary walk Cooperative Learning on academic performance and self-Esteem among Basic Science students in Tarauni LGA Kano, Nigeria. Unpublished M.Ed Thesis Ahmadu Bello University Zaria. 22-27.

Olorukooba, S.B. & Lawal, F.K. (2010). Effects of Science-Technology-Society (STS) Approach and Lecture method on academic achievement and creativity, traits development of junior secondary school integrated science students. *Journal of Science and Mathematics Education,* 1 (1): 26-32.

Olorukooba, S.B., Lawal, F.K. & Jiya, A. (2012). Effects of teaching with Analogy on Academic achievement and Retention of Evolution concepts among male and female NCE Biology students. *Journal of Studies in Science and Mathematics 2 (1): 81-91.*

Oluwagbohunmi M.F (2014). Gender Issues in Classroom Interaction and Students Achivement in Social Studies. Int. J. Innovat. Res. Dev. (5)747-755.

Ong, E.T., Govindasay, A., Salleh, S.M., Tajudin, N.M., Rahman, N.A., & Borhan, M.T. (2018). 5E Inquiry Learning Model: Its effect on Science Achievement among Malaysian Year 5 Indian students. *International Journal of Academic Research in Business and Social Sciences.* 8(12): 348-360. ISSN:2222-6990 Retreived from http://www.researchgate,net/publication/329915553.

Orora, W., Keraro, F.N & Waclenga, S.W. (2014). Using Cooperative E-Learning Teaching Strategy to enhance students' Creativity in SecodarySchool Biology: A study of selected schools in Nakuru Colunly, Kenya. *International Journal of Education and Practice.* 2(6): 137-146. Retreived from http://.www.IJEP/retrieved13/4/2019.

Oscar Marcenaro-Gutteuorez Lu'z Alejarndrocope-Agado Miguel Angel Ropero-Garcia (2018). Gender Difference in Adolescents Academic Performance. http://doi.org/10.1177/1103308817715163.SAGEJournals

Paul S. (1939). The American Biology Teacher 16th 67-69. http://www.jstor.org/published by university of Califonia

Pedretti, E. (2005). Science Technology Society Education: Principles and practice in Aslop S., Bencze L., Pedretti E (eds), Analysing Exam play Science Teaching

theoretical lenses and a spectrum of possibility for practice. Open University press, Mc Grawhill Education.

Perry E. (2015). Developing Practical Work in Ghana. Ghana Science Resource Centres Teaching Biology practical.

Projectplus, (2017). The Problem and Prospects of Teaching Biology in Secondary Schools. A case study of Enugu South L.G.A. Retrived from http://www.google.com.

Piaget, J. (2005) in Isa, Y.B. (2012). Effects of a Constructivist Instructional Strategy on the academic achievement, Retention and attitude to physics among Senior Secondary Schools of different ability levels in Kano state Nigeria, 33-52.

Piaw, C.Y. (2013). Effects of gender and thinking style on students, creativity thinking ability in Kuala Lumpure, Malaysia. 5th World Conference on Educational Sciences. Science Direct. Retreived from http://.www.sciencedirect,com.

Picasso, P. (2017). Creativity Welness.Retreived from http://www.lifelabs.psychologias.co.uk.

Qaiser, S, Aslam, H.D, Sarwar, S, Lodhi, M.A. &Hussain, I. (2012) . Factors Responsible for Unsatisfactory Academic Performance of the Secondary School Students in the Rural Areas of Kohat Division, Khyber Pukhtunkhwa (Pakistan). *American Journal of Scientific Research*, 43, 46.

Qawasmeh, R.M & Syouf, A.A (2017). The Effect of Using Computerized 5E's Learning Cycle Model on Acquring Scientific Concept among fourth Graders. *American Journal of Educational Research* 5(5) 579-587. Receieved from http://www.scieducationalreserach.com

Questionnaire design and analysing the data using SPSS. 1-14.Retrived from http://.www.studentsshu.ac.uk

Ridgeway, V.G. (2004). One teacher journey. *Journal of Adolelence and Adult Litrace.* 47(5) 364-368.

Riechert, S. E. & Post, B. K. (2010). From Skeletal to Bridges and other STEM Enrichment Exercises for high school Biology. The America Biology Teacher, 72 (1): 20-22. Article, ABT. on PDF.

Runisah, Wiralodra & Herman, T.(2016). The Enhancement in Students' CreativityThinking Sills in Mathamatics through the 5E-Learning Cycle with Metacognitive to Techniques. *InternationalJournal of Education (4)7-347*.Retrived from*http://.www.students'creativethinkingskill.*

Rutto and Kptingel (2014). Challennges Facing Laboratory Practical Approach in Physics Instruction in Kenyu District Schools. International School of Achievement in Research and Technology 3(4) 650-675.

Sadi, O. &Cakiroglu, J. (2010). Effects of 5E learning cycle on students Human Circulatory System Achievement. *Journal of Applied Biological Sciences.* 4(3):retrieved from http://www.researchgatenet?publications

Sadi, O. & Cakiroglu J. (2014). Relations of cognitive and motivational variables with students Human Circulatory system Achievement. Educational Sicences theory and practice. Restrived from http://www.researchgate.net/publication.

Salisu, A. (2014). Impact of Animated-Media Teaching Strategy on Academic Achievement, Retention and Interest among Senior Secondary School Geography Students in Weather Concepts, Katsina State. A Ph.D Dissertation, Department of Science Education, Faculty of Education, Ahmadu Bello University Zaria, 50-54.

Sam, C.K. Owusu-, K. A. &Anthony-Krueger, C. (2018).Effectiveness of 3E, 5E and Conventional Approaches of Teaching on Students' Achievement in High School Biology. *American Journal of Educational Research*. 6(1): 76-82. Retrived from http://www.*americanjournalofeducationalresearch.com*.DOI: 10.12691/education-6-1-12.

Sambo, A.A. (2005). Research methods in Education. Stirling-horden publishers (Nig) Ltd. Nigeria, Lagos. Retrived fromhttp://*wwww.//Sciencecurriculum pdf*

Sambo, A.A. (2008). Statistical Principles for research in Education and Social science. Asekome Publishing Company Samaru Zaria, Nigeria.

Samba, R.M.O & Eriba, J. O., (2012). in Ihejiamaizu, C. C., Ukor, D. D. and Neji, H. A. (2018). Utilization of 5Es' Constructivist approach for Enhancing the Teaching of difficult eptsinbiology. *Global Journal of Educational Research* 17, 2018: 55-60. ISSN1596-224.Retreivedfrom http//:www.globaljournalseries.com

Sani S.V., Maruf, O.I (2012). Mathematical Creative Development Among Children. A Precursor for Counsellors and Mathematics Teachers. European Scientific Journal, 24 (8), 164-169/in How Creative are Secondary School Students in Nigeria by Gyuse E.Y., Achor E.E. Chenason M.M Paper 19 Procedures of 55th Annual Conference of STAN August 18-23, 2014 146-150 Pg 148.

Sen &Oskay (2017). The Effects of 5E Inquiry Learning Activities on Achievement and Attitude toward Chemistry.*Journal of Education and Learning* 6(1) ISSN 1927-5250 E-ISSN 1927-5269 URL: Retrivedfrom http://dx.doi.org/10.5539/jel.v6n1p.

Seyhan, H.G. (2015). The effects of Problem solving applications on the development of Science process skills, logical thinking skills and perception on problem solving ability in the science laboratory. Asia Pacific Forum on science Learning and Teaching, 16(2) Article 8

Shadeen N, Alam, T. Mushtag M & Bukhari, M A. (2015). Effect of Inquiry Base Learning on the Performance of students' at elementary level in Rawaipindi city. Anexperimental study. *Academic Research International* 6(2): 382-397.

Sunny, C. (2009) in Abdullahi, G.M. (2014). Science Technology Society Instructional Model and its impact on Academic achievement and Retention in ecology among Senior Secondary Biology students in Kaduna State. MEd proposal Defense 10.

Tete, D.B. & Mari, J.S. (2013). Effect of Science-Technology-Society (STS) Instructional strategy on Academic Performance in selected Genetic concepts among NCE students in Federal College of Education. *Journal of studies in Science Education and Mathematics Education,* 3 (1): 93-100.

Timothy, J. (2013). Trends in Academic Performance of Senior Secondary Biology Students in SSCE from 2006-2011 in Ikorodu Local Education Area of Lagos State. *Journal of Studies in Science and Mathematics Education.*3(1): 119-127.

Ukor, D. D. (2010). Achievement in integrated Science as a Predictor of success in senior Secondary School Science. *Journal of Research in curriculum and teaching,* 5(1): 402-403.

Umahaba, E.R. (2018). Impact of 5Es Learning Model on Academic Performance in Chemical Equations Concept among Secondary School Students, Katsina Metropolis, Nigeria. *International Journal of Educational Research and Information Science,* 5, (1): 10-14.

Umoke, J.C and Nurafor C.C. (2014). Effect of Institutional Simulation on Secondary School Students Achievement in Biology. *Journal of Education and Practice* ISSN 2222-1735(Paper) ISSN 2222-288X 5(19)

Uptmor, K. (2019). Teaching Ecology and Environmental Science concepts in Early Childhood. Retreived fromhttp://www.chapter17lesson8study.com.

Usman, I.A. (2010). The effects of indoor and outdoor laboratory instructional methods on academic achievement of Junior Secondary School Integrated Science Student's in Zaria Local Government Area of Kaduna State. *Journal of Studies in Science and Mathematics Education* 1(1) 67.

Uzoeche, B.C. (2007). Strategies for Developing Teacher's Competencies and Skills in Book Development for Sustainable Science, Tech and Maths Education in Nigeria 50thAnniversary Conference Proceedings of STAN P45.

Varah, S.R. (2012). Problem of youth restivenex through adaptive teaching entrepreneurship skills concepts of Senior Secondary School Biology education for sustainable national security in Nigeria. Post graduate seminar series Department of Science Education. Faculty of Education,1 (1): 38-43.

Vygotsky, L.S. (1962). Lev Vygotsky and Social Learning Theories. Thought and Language Cambridge MA MIT Press. Retrieved from http://www.jan.ucc.nau.edu.

Vygotsky, L.S. (1978). Vygotsky Theory on Constructivism. Retreived from http://www.teachnology.com.

Vance, K., Miller, K. & Hand, B. (1995). Two Constructivist Approaches to Teaching Ecology at the middle school level. The American Biology Teachers. 57(4):Retreived from http://.www.jstor.org/stte/4449978. 244-249.

Voyer, D., Voyer S.D., (2014). Gender Differences in Scholastic. Achievement: A Meta-Analysis Psycho Bull 140 (4) 1174-1204 doi.org/10.1033/a0036620. http://www.apa.org>release

WAEC, (2007-2010). West African Examination Council. Chief examiners' report.

West African Examination Council (WAEC), SSCE Results (2011 -2018).Report. Yaba, Lagos.

West African Extermination Council (WAEC), (2015).General Chief Examiners' Report on the stardard of the papers. Biology 2 Essay, 277-287.

West African Examination Council (WAEC), (2016). Report of the Inspectors. Kaduna State Ministry of Education.

Wakili, L.A. (2007). The Influence of Guided-discovery Approach on Creative traits of M.Ed. Thesis. Department of Education, Ahmadu Bello University, Zaria.

Wasagu, M.A. (2019). Innovation in STEM Education: The missing Link in Nigeria. A Key note address at 60th Annual Conference Proceedings. STAN. 5-17.

White, J. (2008). Playing and Learning outdoors Making Provision for High Quality Experience in the Outdoor Environment With Children New York, 88. https://www.amazon.co.uk Retreived from 18/02/2019 9:45am.

Webster, M. (2014). Spanish- English Dictionary. Merriam-Webster Incorporated. Retrived fromhttp://www.edu.gov.on.ca/eng/curriculum/element/science18currb.pdf. 27/1/2017, 2pm.

Yucel, E.O. &Ozkan, M. (2015). Determination of Secondary School Students' cognitive structure and misconception in ecological concepts through word association test. *Educational Research and Reviews academic Journals.* 10(5): 660-674. Retreived from https://www.*Educational Research and Reviews academic Journals.*

Yigit, C. (2012). The Effect of the 5E Model in Writting on Achievement and motivation Turkish Republic of Trakya University Iinstitution of Social Science Foreign Language Teaching Department Division of English Language Teaching a Master's Thesis.

Yusuf, M.O. & Afolabi, A.O. (2010). Effects of Computer Assessment Instruction on Secondary School Students Performance in Biology. *Turkish online Journal of Educational Technology,* 9 (1): 62.

Zalizan M.J., Kaadijah R.M., Hazadiah M.D., and Mairod R., (2003). Girls out Performed boys in most Subjects. The August 12.

Zimbabwe Passed Examiner' Report (2014). Retrived from https://.www.iosrjournals.org

Zubairu, Z. (2011). Evaluation of Biology Curriculum in Public Secondary Schools in Kaduna metropolis. Unpublished M.Ed Thesis. Ahmadu Bello University Zaria, 4.

LIST OF APPENDICES

Appendix I

CREATIVITY ASSESSMENT SCALE (CAS)
Pattern, may also want to measure certain dimensions of creativity in students (clients)

S/N: ……..……...

SEX: ……

STUDENT:…….

INSTRUCTIONS

Please use the ten point scale below to rate yourself on each of the following items. Rate items most descriptive of you high (in the increasing order of magnitude (6, 7, 8, 9). Rate items least descriptive of you low (in decreasing order of magnitude (4, 3, 2, 1, 0). Zero being your rating for an item that is totally unlike you. Those items you are not sure about, you rate 5.

(Totally unlike me) 1----------1 (very much like me)
0 1 2 3 4 5 6 7 8 9
You just circle the number that described magnitude of your personal description.

Example

I am dull at generating new ideas

0 1 (2) 3 4 5 6 7 8 9

(Totally unlike me) 1----------1 (very much like me)

My rating is 2 because it is very much unlike me

YOU CAN NOW START RATING YOURSELF ON THE ITEMS

YOU WILL TAKE JUST ABOUT 30 MINUTES TO COMPLETE THE WHOLE SCALE

Ideative flexibility scale

How accurate are the following descriptions for your person

1. Accept ambiguous situations	0 1 2 3 4 5 6 7 8 9
2. Attract by mysterious unclear events	0 1 2 3 4 5 6 7 8 9
3. Tend to break health conventions	0 1 2 3 4 5 6 7 8 9
4. Not hostile or aggressive on the whole	0 1 2 3 4 5 6 7 8 9
5. Look for new ways of doing things	0 1 2 3 4 5 6 7 8 9

6. Tend to overlook significant 0 1 2 3 4 5 6 7 8 9

7. Meticulously curious 0 1 2 3 4 5 6 7 8 9

8. Often a fault finder 0 1 2 3 4 5 6 7 8 9

9. Does not like constantly 0 1 2 3 4 5 6 7 8 9

10. Manifest odd patterns of behaviour at times 0 1 2 3 4 5 6 7 8 9

11. Sensitive to beautiful things 0 1 2 3 4 5 6 7 8 9

12. Willing to take risks 0 1 2 3 4 5 6 7 8 9

13. Like to propose new approaches to a problem 0 1 2 3 4 5 6 7 8 9

14. Neglect significant facts arising from a problem Situation 0 1 2 3 4 5 6 7 8 9

15. Never bored 0 1 2 3 4 5 6 7 8 9

16. Can perceive details 0 1 2 3 4 5 6 7 8 9

17. I Can easily adapt a thing for other use 0 1 2 3 4 5 6 7 8 9

18. I can adjust quite easily to novel situations 0 1 2 3 4 5 6 7 8 9

19. I can detect small shades of different Colour from a painting that looks one colour 0 1 2 3 4 5 6 7 8 9

20. It is easy for me to change my attention from One absorbing duty to another 0 1 2 3 4 5 6 7 8 9

21. If I meet a person once, I'll know him when next I meet him 0 1 2 3 4 5 6 7 8 9

Ideative originality scale

1. Criticize my mates 0 1 2 3 4 5 6 7 8 9

2. Attracted to difficult jobs 0 1 2 3 4 5 6 7 8 9

3. Ca\n pick out valuable things to me of many Seemingly equally attractive ones 0 1 2 3 4 5 6 7 8 9

4. like solitary life 0 1 2 3 4 5 6 7 8 9

5. Not popular with people 0 1 2 3 4 5 6 7 8 9

6. Non-conforming even to intimate 0 1 2 3 4 5 6 7 8 9

7. Like to tackle problems that others may avoid 0 1 2 3 4 5 6 7 8 9

8. Follow instructions very closely 0 1 2 3 4 5 6 7 8 9

9. Seek knowledge for its sake 0 1 2 3 4 5 6 7 8 9

10. Like to disagree at times 0 1 2 3 4 5 6 7 8 9

11. Like to question orders of superiors when it is

Not clear 0 1 2 3 4 5 6 7 8 9

12. Do not like business 0 1 2 3 4 5 6 7 8 9

13. Can be proud and self-satisfied at times 0 1 2 3 4 5 6 7 8 9

14. Differ with friends on opinions at times 0 1 2 3 4 5 6 7 8 9

15. Do not fear to make mistakes 0 1 2 3 4 5 6 7 8 9

16. Reserved, not open like others 0 1 2 3 4 5 6 7 8 9

17. Do not want to be controlled by any person 0 1 2 3 4 5 6 7 8 9

18. May be terribly native in style of life 0 1 2 3 4 5 6 7 8 9

19. Visionary and insightful 0 1 2 3 4 5 6 7 8 9

20. Seek recognition for contributions I make 0 1 2 3 4 5 6 7 8 9

21. Averagely intelligent at least 0 1 2 3 4 5 6 7 8 9

22. Like to do thing s the way I think right 0 1 2 3 4 5 6 7 8 9

23. I am resolute, I'LL change the order of things

In the present world 0 1 2 3 4 5 6 7 8 9

24. It monotonous to see even the most beautiful

Things without change for many years 0 1 2 3 4 5 6 7 8 9

25. Innovation and introduction of the unusual

makes one happy and healthy 0 1 2 3 4 5 6 7 8 9

Ideative fluency scale

1. Have easy-flowing ideas on certain problems that
   Bother me 0 1 2 3 4 5 6 7 8 9
2. Self-sufficient in idea generation 0 1 2 3 4 5 6 7 8 9
3. Versatile 0 1 2 3 4 5 6 7 8 9
4. Rich in terms of the variety of ideas running through
   My mind 0 1 2 3 4 5 6 7 8 9
5. I can ask a hundred questions on the use
   of palm tree 0 1 2 3 4 5 6 7 8 9

6. I can explain the possible consequences of an act fairly
   Accurately 0 1 2 3 4 5 6 7 8 9

7. I can describe a scene as accurately as possible
   within a limited given time0 1 2 3 4 5 6 7 8 9

8. If a pictorial scene is supplied, I can vividly supply many
   ideas describing the cause(s) 0 1 2 3 4 5 6 7 8 9

9. If a painting is supplied in a sequential order,
   I can generate many ideas about the sequence

   that will follow 0 1 2 3 4 5 6 7 8 9

10. I can give much information to explain

    a just-suppose question 0 1 2 3 4 5 6 7 8 9

11. If a diagram is incompletely drawn. I can

    quickly thing of many ways of improvement 0 1 2 3 4 5 6 7 8 9

12. I may be dry-up of ideas very often 0 1 2 3 4 5 6 7 8 9

13. I can easily draw an elephant from a big oval

    or circular drawing 0 1 2 3 4 5 6 7 8 9

14. I have to write poems 0 1 2 3 4 5 6 7 8 9

15. I like objective type examinations 0 1 2 3 4 5 6 7 8 9

16. I prefer to write essay examinations 0 1 2 3 4 5 6 7 8 9

17. Plenty of ideas come to me early in the morning

    When I am about to take breakfast 0 1 2 3 4 5 6 7 8 9

18. I keep a note book always in which I write

    the many ideas that come to me 0 1 2 3 4 5 6 7 8 9

19. I do not quickly see all the sides to an argument

    Because of idea shortage 0 1 2 3 4 5 6 7 8 9

20. At times when I am peacefully alone, myriads

    of ideas come to me on long standing problem0 1 2 3 4 5 6 7 8 9

21. At times when playing a game, I tend to

    remember many useful ideas to solve a problem

    bothering me 0 1 2 3 4 5 6 7 8 9

22. I find it difficult to start a discussion 0 1 2 3 4 5 6 7 8 9

23. When a discussion is started, my ideas start following like river 0 1 2 3 4 5 6 7 8 9

24. I tend to describe things with few words 0 1 2 3 4 5 6 7 8 9

25. When I start thinking about a problem, I wonder about the way my mind conjure myriads of ideas 0 1 2 3 4 5 6 7 8 9

26. It is interesting to put one's ideas on record 0 1 2 3 4 5 6 7 8 9

Creativity motivation scale

1. Have very deep interest in disorderly settings 0 1 2 3 4 5 6 7 8 9
2. Courageous 0 1 2 3 4 5 6 7 8 9
3. Have great determination 0 1 2 3 4 5 6 7 8 9
4. Desire high competence in my endeavours 0 1 2 3 4 5 6 7 8 9
5. Enthusiastic about all problems that come my way 0 1 2 3 4 5 6 7 8 9
6. Fail to let others know my new ideas 0 1 2 3 4 5 6 7 8 9
7. Keep unusually long hours on a problem 0 1 2 3 4 5 6 7 8 9
8. Industrious 0 1 2 3 4 5 6 7 8 9
9. Controlled by an inner force which does not care about what people say 0 1 2 3 4 5 6 7 8 9
10. Have abundant energy for work that interest me 0 1 2 3 4 5 6 7 8 9
11. Emotionally sensitive to new ideas 0 1 2 3 4 5 6 7 8 9
12. Highly persistent on difficult problems 0 1 2 3 4 5 6 7 8 9
13. Discouraged at times due to certain situations 0 1 2 3 4 5 6 7 8 9
14. Self-confident 0 1 2 3 4 5 6 7 8 9
15. Resolute 0 1 2 3 4 5 6 7 8 9
16. Humorous 0 1 2 3 4 5 6 7 8 9
17. Can quickly receive and register external stimuli 0 1 2 3 4 5 6 7 8 9

Appendix II

LESSON PLAN FOR EXPECRIMENTAL GROUP 5E-LEARNING MODEL

LESSON PLAN FOR EXPERIMENTAL GROUP

LESSON ONE

GROUP: GSS Muchia

NAME OF RESEARCHER: Janet Funke JESULOWO

WEEK: Week 1

LEVEL OF GROUP: SS2

GENDER: Male and Female

TOPIC: AIR AND NOISE POLLUTION

DURATION: Double Period (1hour 20minutes)

SUBJECT: Biology

DATE: 2018

NUMBER OF STUDENTS: 50

AVERAGE AGE: 16 years

TEACHING STRACTEGY: 5E-Learning Model.

REFERENCE MATERIALS:

(i) New Modern Biology for Senior Secondary school 2001.

(ii) College Biology by Idodo Umeh 2009 Edition

(iii) Senior Secondary School Biology Curriculum 2009 and 2015.

(iv) New System Biology for Senior Secondary Schools. 2011by Kwan, L.P.E.Y.K. and Ofoefuna, J.O.

(v) Past Question and Answer for Senior Secondary School Examination for SSCE, NECO and GCE 1988-2007, 2008-2016.

PREVIOUS KNOWLEDGE: Students have been around neighborhood and school to be able to define environmental hygiene and state nature of environmental hygiene.

INSTRUCTIONAL MATERIALS: Candle, Matches, Radio, insecticide (mobil) using pictures of human activities cycle on air polluted environment,Chalkboard and Calks, Students and Research assistance.

BEHAVIOUR OBJECTIVES: At the end of the lesson, the students should be able to:

(i) Define pollution of natural environment.

(ii) Differentiate between air source pollutants and noise source pollutants.

(iii) Mention two sources of air pollutants at home and school.

(iv) Tell what air pollutant are and identify things that contribute to air pollution in their community.

(v) Identify the most toxic and harmful pollutants that affect citizen of Nigeria.

(vi) Mention sources of noise pollution at home and around schools.

(vii) State two effects of insecticides and herbicides on man and plants.

(viii) Mention and explain two controls by the legislation on and noise pollution.

PRESENTATION: Teacher presents the lesson by introducing the the 5E-Learning Model for the experimental group:

PHASE: ENGAGEMENT PHASE: (i) Activity 1: 20minutes; The teacher would engage the students using Pre-test to know the level of their equivalence academic achievement of Ecology of Pollution, Concervation of Natural resource. Pests and diseases of plants and animals.

Procedure: (i) To distribute the Biology Achievement Test (BAT).

Students to answer the questions.

(ii) what is environmental hygine?

PHASE 2 EXLORATION PHASE:(ia) Activity 2: 15minutes; The teacher group the students intofive (5) groups of ten (10) students for activities to carry out and

be able to classify environmental pollutants, some pollutants were provided.

using pictures of human activities cycle on air polluted environment to discover the followings:

Procedure:

(ii) Group 1: The definition ofair pollution and illustrate sources of air pollution from the human activities.

(iii) compare man's natural environment.

(iv) Group 2: Students will identify things that contribute to air pollution in their community.

(v) Group 3:Students clarify environmental hygiene?

(vi) Group 4: Students to classify sources of sulfurdioxide, carbondioxide, carbomonoxide and partrculate matter.

(viii) Group 5:Discuss legislation rules on air and noise.

PHASE 3 EXPLANATION PHASE: Activity 3: 10minutes;The teacher explain some concept of the topic.

Procedure:

(i) Explain history of pollution in Nigeria and the World.

(ii) Explain point source polluants and non point source polluants.

(iii) Explain nature and meaning of air pollution showing some pictures of air polluted environment.

(iv) Explain meaning of air polluted environment.

(v) Expantiates on source of air pollutionand emphasis on biological pollutants.

(vi) Explain toxic and harmful atmospheric pollutant that affect Nigerian citizen.

(vii) Explain the health effects of noise pollution to man.

(viii) Expantiates legislation rules on air and noise.

PHASE 4: ELABORATION PHASE:Activity 4: 20minutes; The teacher exposes the students to progressive activities by extending their understanding and skill activities through accessing them:

Procedure:The group members to observe, perceive, identify and confirm effect of carbon monoxides, smoke, and environment as follows:

Group 1: to light candle, with matches.

(i) Group 2: Listen to music on radio at high volume.

(ii) Group 3: Visit their school workshop.

(iii) Classify your findings into air and noise pollution.

(i) Students to brainstorm on effects of air pollution to climate change.

(ii) Identify the most toxic and harmful pollutants that affect citizen.

(iii) To identify health problems that are caused by pollutant.

(iv) Compare and report their observation on noise air pollution.

(v) Write out two effects of air and noise pollution.

PHASE 5: EVALUATION PHASE:Activity 5: 10miuntes: Teacher asks the students the following questions and allow to write in their class note.

(i) Define pollution of natural environment.

(ii) State two sources of air pollutants at home and school.

(iii) Tell what air pollution are.

(iv) Identify the most toxic and harmful pollutants that affect citizens of Nigeria.

(v) Mention three effects of home air pollutants.

(vi) Identify sources of air pollution around the school.

(vii) Mention two sources of noise pollution at home and school.

(viii) State two effects of herbicides on plants and man.

(ix) Mention and explain two controls by the legislation on air and noise pollution.

ASSIGNMENT: 5minutes i) Study your community and identify causes of polluted stream or river and land.

LESSON PLAN FOR EXPERIMENTAL GROUP

LESSON TWO

GROUP:	GSS Muchia
NAME OF RESEARCHER:	Janet Funke JESULOWO
WEEK:	Week 2
LEVEL OF GROUP:	SS2
GENDER	Male and Female
TOPIC	WATER AND LAND POLLUTION
DURATION	Double Period (1hour 20mintes)
SUBJECT	Biology
DATE	2018
NUMBER OF STUDENTS	50
AVERAGE AGE	16 years
TEACHING STRATEGY	5E Learning Model.
REFERECE MATERIALS:	

(i) New Modern Biology for Senior Secondary school 2001.

(ii) College Biology by Idodo Umeh 2009 Edition

(iii) Senior Secondary School Biology Curriculum 2009 and 2015.

(iv) New System Biology for Senior Secondary Schools. 2011 by Kwan, L.P.E.Y.K. and Ofoefuna, J.O.

(v) Past Question and Answer for Senior Secondary School Examination for SSCE, NECO and GCE 1988-2007, 2008-2016.

PREVIOUS KNOWLEDGE: The students were already have the knowledge of Air and Noise pollution.

INSTRUCTIONAL MATERIALS: Jars/beakers, petridish, spatula, wash bottle, water, pond water with mosquitoe larvae, tadpole, water for drinking, mosquitoe larvae, tad poles. Crude, oil, detergents, insecticides. Polluted stream or river, polluted substances from home to school, chalkboard, chalk, students, research assistance.

BEHAVIOURAL OBJECTIVES: At the end of the lesson the students should be able to:

(i) Mention ways stream and land can be polluted.

(ii) State the effects of water and land pollution.

(iii) To mention two sources water and land pollution.

(iv) To make report of their observation on water pollution.

(v) To illustrate how water and soil pollution can be control by the community and government.

PRESENTATION: The teacher present the lesson to the experimental group with 5E-learning model as follows:

PHASE 1 ENGAGEMENT PHASE: Activity 1: 10minutes: The teacher act as a guide and facilitator to students.

Procedure:

(i) Use of quetions as entry behaviour to get students thinking for five minutes on air and noise pollution.

Questions:

(ii) Mention one source of air pollution.

(iii) What does effect of noise pollution mean?

(iv) What is the difference between air and noise pollution?

(iv) To mention one way water can be polluted.

Activity 2: 10 minutes

Observe theStudy your community and identify causes ofpolluted stream or river and land.

PHASE 2 EXPLORATION PHASE: Activity 3: 10 minutes:The teacher gives the students activities to carry out by each groupto determine:

(i) From students knowledge: Observe and differentiate the colour and the odour of different sewage.(home, school and industry)

(ii) Explain to others the different between processed water and body of natural water like lake, river and stream.

Activity 4: 5 minutes

(i) The students will continue to carry out experiment using pond water with mosquito larvae.

(ii) The students observe their immediate environment and explore to bring out the agricultural pollutant e.g school garden/land/soil.

Activity 5: 10minutes

(i) Students to use pictures to study formation and effects of Acid rain.

(ii) Students to use termites as an example of insects damaging soil state the control process apart from use of insecticides and herbicides.

(iii) The students to state the effects of polluted water.

PHASE 3 EXPLANATION PHASE:Activity 6: 10minutes;

Procedure:

The teacher explain to the students themajor concept of the topic:Explain water and land pollution.

Explain effects of water and land pollution.

Explain government control of water and land pollution.

PHASE 4 ELABORATION PHASE: Activity 7: 20minutes;The teacher allows the students to elaborate by

(i) Extending their understanding to other on dumping of refuse in water and an open areas.

(ii) Students to visitpolluted stream in their community.

(iii) to set up the apparatus using glass jars, mosquito larva, tadpoles, crude oil, detergents, insecticiides of the set upexperiment.

(iv) State the report of laboratory experiment.

(v) Observethe effects of pollutant on the organisms.

(vi) Observedstream polluted water.

PHASE 5 EVALUTION PHASE: 10minutes The teacher asks the students the following questions:

(i) Mention ways stream and land can be polluted.

(ii) State the effects of water and land pollution.

(iii) To mention two sources water and land pollution.

(iv) To make report on water pollution.

(v) To illustrate how water and soil pollution can be control by the community and government.

ASSIGNMENT: 5minutes Visit the school library to find out from biologyand geography textbooks different locations of conserved resources in Africa.

LESSON PLAN FOR EXPERIMENTAL GROUP

LESSON THREE

GROUP:	GSS Muchia
NAME OF RESEARCHER:	Janet Funke JESULOWO
WEEK:	Week 3
LEVEL OF GROUP:	SS2
GENDER:	Male and Female
TOPIC:	CONSERVATION OF NATURAL RESOURCES
DURATION	Double Period (1 hour 20minutes).
SUBJECT	Biology
DATE:	2018
NUMBER OF STUDENTS	50
AVERAGE AGE:	16 years
TEACHING STRATEGY:	5E-Learning of Construtivist Instructional Method.
REFERENCE MATERIALS	(i) New Modern Biology for Senior Secondary school 2001.
	(ii) College Biology by Idodo Umeh 2009 Edition
	(iii) Senior Secondary School Biology Curriculum2009 and 2015.
	(iv) New System Biology for Senior Secondary Schools. 2011 by Kwan, L.P.E.Y.K.and Ofoefuna, J.O.
	(iv) Past Question and Answer for Senior Secondary School Examination for SSCE, NECO and GCE 1988-2007, 2008-2015.
PREVIOUS KNOWLEDGE:	The students were taught pollution of water and land.
INSTRUCTIONAL MATRIALS:	Pictures on Laptop showing examples of Rivers, Lake,wildlife animals, Game reserved inNigeria. Laptop of recorded government laws. Chalkboard, chalk, students and research assistance.
BEHAVIOUR OBJECTIVES:	At the end of the topic the students should be able to:
	(i) Define Conservation of natural resources.
	(ii) Enumerrate reasons for protection of waters e.g rivers, streams, lakes
	(iii) Identify ways of ensuring conservation of wildlife from destrotion and extinction.
	(iv) Describe how agencies could be responsible for conservation.
	(v) State why conservation laws should be obey.

(vi) Mention two conservation laws on land and one of water.

(vii) Identify three possible solution to problems of water and wildlife conservation.

PRESENTATION: The teacher presents the lesson to the experimental group with 5E Model Learning as follows:

PHASE 1 ENGAGEMENT PHASE: Activity 1:20minutes; The teacher engages the students on the topic.

Procedure:

(i) Mention three pollutant of water.

(ii) Students explain harmful effects of polluted soil.

(iii) Students to group natural resources into renewable resources and non renewable.

PHASE 2 EXPLORATION PHASE: Activity 2: 15minutes

Procedure:

(i) The students to observe pictures of some wildlife animal's structures, colour, shape and location in Nigeria.

(ii) Explore pictures of some natural resources of water different locations in Nigeria.

PHASE3EXPLANATION PHASE: Activity 3: 10minutes; the teacher explains types of natural resources.

Procedure:

(i) Use some related pictures for Nigeria natural resources to explain problems of water and wildlife conservation.

(ii) Educate the students on how to have solutions to water and wildlife conservation problems.

(iii) Explain types of conservation of natural resourece.

(iv) Advocate for what has been done.

PHASE 4 ELABORATION PHASE: Activity 4: 20minutes: The teacher would allow the students toelaborate their understanding and skills through activities and knowledge access:

Procedure:

(i) The students will identifying and describe different ways of ensuring the sustainability of water and wildlife concervation of natural resources..

(ii) conservation ofwater and animals of natural resources in Nigeria.

PHASE 5 EVALUTION PHASE: Activity 5: 10minutes;

(i) Define Conservation of natural resources.

	(ii)	Enumerrate reasons for protection of waterss
	(iii)	Identify ways of ensuring conservation of wildlife fromdestruction and extinction.
	(iv)	Describe how agencies could be responsible for conservation.
	(v)	State why conservation laws should be obeyed.
	(vi)	Mention two conservation laws on land and one of water.
	(vii)	Identify three possible solution to problems of water and wildlife conservation.
Assignment: 5minutes	(i)	Students to browse and study water cycle and nitrogen cycle.

LESSON PLAN FOR EXPERIMENTAL GROUP

LESSON FOUR

GROUP:	GSS Muchia.
NAME OF RESEARCHER:	Janet Funke JESULOWO
WEEK:	Week 4
LEVEL OF GROUP:	SS2
GENDER:	Male and Female
TOPIC:	CONSERVATION OF NATURAL RESOURCES
DURATION	Double Period (1 hour 20 minutes)
SUBJECT	Biology
DATE: 2018	
NUMBER OF STUDENTS	50
AVERAGE AGE:	16 years
TEACHING STRATEGY:	5E Learning Model Instructional Method.
REFERENCE MATERIALS (i)	New Modern Biology for Senior Secondary school 2001.
(ii)	College Biology by Idodo Umeh 2009 Edition
(iii)	Senior Secondary School Biology Curriculum 2009 and 2015.
(iv)	New System Biology for Senior Secondary Schools. 2011 by Kwan, L.P.E.Y.K. and Ofoefuna, J.O.
(v)	Past Question and Answer for Senior Secondary School Examination for SSCE, NECO and GCE 1988-2007, 2008-2015.
PREVIOUS KNOWLEDGE:	The students were taught natural resources based on meaning of conservation of natural resources of water and animals, ways of conserving, benefits of water and animals resources.
INSTRUCTIONAL MATERIALS:	Chalk board, chalk and paper pictures of forest, land of different locations in Nigeria. Different mineral resources in Nigeria.
BEHAVIOURAL OBJECTIVE:	At the end of the lesson the students should be able to:
(i)	Define the followings: a) Forest, b) Land and c) Minerals natural resources.
(ii)	Discuss various ways of conservation of forest, land and minerals.
(iii)	Students will have an understanding of the problems of erosion and mention three ways to prevent it.

(iv) Explain ways of ensuring conservation of forest, land and minerals natural resources.

(v) Describe three ways to educate the public on the sustainability of conservation of forest and land of natural resources.

(vi) State two ways of creating forest reserves.

(vii) Mention two benefits of forest and land resources.

PRESENTATION: The teacher present the lesson to the experimental group with 5E Model Learning instructional Method as follows:

PHASE 1 ENGAGEMENT PHASE: Activity 1: The teacher starts the lesson by asking the following questions:

(i) State two benefits of water reserve.

(ii) Mention two benefits of wildlife reserve.

(iii) The teacher will engage the students by grouping them to view the pictures of forest and Land.

(iv) To view pictures of minerals at different locations on Ipad.

PHASE 2 EXPLORATION PHASE: Activity 2: 15minutes

Procedure:

Students explore through

(i) Observation, imagination and evaluation of different pictures of Nigeria forest reserves.

(ii) Observation, imagination and evaluate different pictures of Land reserved in Nigeria.

(iii) To differentiate different minerals of different locations in Nigeria.

PHASE 3 EXPLANATION PHASE: Activity 3: 10minutes; The teacher explains to students to understanding

Procedure

(i) The observation base on concepts and the process for new skills.

(ii) To show film ot documentaryon oil spillage, gas flaring

(iii) The benefits of forest, Land and mineral resources.

(iv) Pass round documentary law of conservation.

PHASE 4 ELABORATE PHASE:Activity 4: (i) the teacher expose the students to elaborate by extending their understanding and skills through activities and knowledgeProcedure;

(i) will be access by drawing a typical forest reserve in Nigeria.

(ii) Discuss and highlight land reserved in Nigeria.

(v) Students to discuss land erosion and how to prevent reserved land.

(vi) Discuss planting of trees to conserve soil and replace used ones.

(vii) How to enrich and maintain soil fertility.

(viii) To study and draw living organisms that rich the soil. How to maintained the soil e.g. nitrogen fixing bacteria.

(ix) How planting of trees can conserve home and school lands.

(x) Describe mineral resources in Nigeria

PHASE 5 EVALUAITON PHASE: Activity 5: 5minutes: The teacher evaluates the lesson by asking the students questions based on the topic learned:

(i) Define conservation of the followings:

(i) Forest, (b) Land and (c) Minerals of natural resource.

(ii) Discuss various ways of conservation of forest and land could be achieve.

(iii) Explain two ways of ensuring conservation of land as anatural resource.

(iv) Describe three ways of educates the public on the sustainability of conservation of forest and land resources.

(v) State two ways of creation forest reserves.

(vi) List two benefits of forest, land and minerals resources.

Post Test 10minutes (i) Students to answer the Biology Achievement Test.

LESSON PLAN FOR EXPERIMENTAL GROUP

LESSON FIVE

GROUP:	GSS Muchai
NAME OF RESEARCHER:	Janet Funke JESULOWO
WEEK:	Week 5
LEVEL OF GROUP:	SS2
GENDER:	Male and Female
TOPIC:	PESTS OF CROPS
DURATION	Double Periods (1 hour 20 minutes)
SUBJECT	Biology
DATE: 2018	
NUMBER OF STUDENTS	50
AVERAGE AGE:	16 years
TEACHING STRATEGY:	5E Learning Model Instructional Method.

REFERENCE MATERIALS

(i) New Modern Biology for Senior Secondary school 2001.

(ii) College Biology by Idodo Umeh 2009 Edition

(iii) Senior Secondary School Biology Curriculum 2009 and 2015.

(iv) New System Biology for Senior Secondary and Ofoefuna, J.O.

(v) Past Question and Answer for Senior Secondary School Examination for SSCE, NECO and GCE 1988-2007,2008- 2015.

INSTRUCTIONAL MATERIALS: Chalkboard, chalk, pests, grasshopper, termites, bird, rat, school garden.

BEHAVIOURAL OBJECTIVES: At the end of the lesson the students should be able to:

(i) Define pest of crops.

(ii) Students to understand and identify different kinds of plants and animals pest of crops.

(iii) Classify the pests.

(iv) State the functional values of pest.

(v) Mention two economic importance of pest.

(vi) Explain the life cycle of lice and grasshopper.

(vii) Mention one cure using local herbs to control rats.

(viii) Mention four controls of pests crop.

PREVIOUS KNOWLEDGE: The students were taught conservation of forest land and minerals of natural resources.

PRESENTATION: The teacher present the lesson to experimental group with 5E Model Learning instructional Method as follows:

PHASE 1 ENGAGEMENT PHASE: Activity 1: 20minutes; The teacher will engage the students to:

(i) Mention four ways of conservation of soil or land.

(ii) Mention two legislative laws thatmaintainsforest reserve.

Procedure:

(iii) tourch, observe and identify different pests of crops provided.

(iv) Name and classify the pests of crops you are provided.

PHASE 2 EXPLORATION PHASE: Students are to: Activity 2: 15minutes

Procedure:

(i) Visit the school garden to study:

by observing and identify the infected leaves, fruits, stem and roots of plants pest by fungi, virus and bacterial.

(ii) Students are to: Observe, Touch, Feel, the pest of cropsprovided grasshopper, termites, lice weevils.

(iii) Classify, draw and label well the provided pests:

(iv) Study the structural parts of animal pests, e.g. Birds and Rat.

PHAS3 EXPLANATIONPHASE: Activity 3: 10minutes: The teacher explain what the concept of the topic.

Procedure;

(i) To relate what the students understood from homes e.g. birds and rat.

(ii) Using the school garden pest identified base on concepts.

(iii) The process for new skill for clarity.

PHASE 4 ELABORATION PHASE:Activity 4: The teacher will give students opportunity to elaborate the extent of their understanding and sills through activity and knowledge:

(i) By drawing and label to show different mouth part grasshopper.

(ii) Discuss and state the functional value of termite (protein content of pest)

(iii) To discuss and identify chemical, physical and biological control of birds and rat.

PHASE5 EVALUATION PHASE: 10minutes: The teacher asks the students the following questions:

(i) Define pest of crops.

(ii) Identify two plants and one animal's pests of crops.

(iii) Classify the pest of the crop identified into plants and animals pests.

(iv) Explain the life cycle of the a named pest.

(v) Mention four types of control of the pest identify per group.

ASSIGNMENT: 5minutes; Students to visit the school library to find out what are the diseases of animal and plants.

LESSON PLAN FOR EXPERIMENTAL GROUP
LESSON SIX

GROUP: GSS Muchai.

NAME OF RESEARCHER: Janet Funke JESULOWO

WEEK: Week 6

LEVEL OF GROUP: SS2

GENDER: Male and Female

TOPIC: DISEASES OF CROPS

DURATION Double Period (1 hour 20 minutes)

SUBJECT Biology

DATE: 2018

NUMBER OF STUDENTS 50

AVERAGE AGE: 16 years

TEACHING STRATEGY: 5E Learning Model Instructional Method.

REFERENCE MATERIALS(i) New Modern Biology for Senior Secondary school 2001.

(ii) College Biology by Idodo Umeh 2009 Edition

(iii) Senior Secondary School Biology Curriculum 2009 and 2015.

(iv) New System Biology for Senior Secondary Schools. And Ofoefuna, J.O.

(iv) Past Question and Answer for Senior Secondary School Examination for SSCE, NECO and GCE 1988-2007, 2008-2015.

INTRUCTIONAL MATERIALS: Potato, Tomato blight.

BEHAVIOURAL OBJECTIVES: At the end of the topic the students should be able to:

(i) Define diseases.

(ii) List types of diseases.

(iii) To identify potato and tomato blight.

(iv) Classify the diseases of man.

(v) Mention two technological instruments to detect diseases.

(vi) Describe use of technology to remove acid water from soil to make it fit for use.

(vii) Mention two controls of the diseases.

PREVIOUS KNOWLEDGE: The students were taught pest of the crops.

PRESENTATION: The teacher presents the lesson to the experimental group with 5E Learning model as follows:

PHASE1 ENGAGEMENT PHASE: Activity 1: 20minutes; The teacher start the lesson by asking some questions:

(i) Mention five pests plants you know.

(ii) Mention two control measures to pests of crops.

(iii) Students engage to find out by from the school garden diseases of crops.

(iv) Students to observe and identify the diseases infected parts on leaves, fruits, stems and roots

(v) Students generates definition and effects of diseases on plants

PHASE 2 EXPLORATION PHASE: Activity 2; 15minutes

Procedures Students to explore by

(i) Observing,

(ii) Touch,

(iii) Feelpotato and tomatoes blight

(iv) Identify and classify the pathogen causing diseases using life cycle.

PHASE 3 EXPLANATION PHASE: Activity 3: 10minutes; The teacher explains the major concept of the topic for students to have more understanding for clarity.

(i) Description of disease.

(ii) Detection of disease.

(iii) Viral disease of crops

PHASE 4ELABORATION PHASE: Activity 4: 20minutes; The students elaborate to:

(i) Students will discuss how vector transfers diseases from organisms to organisms.

(ii) Describe to show pathogen that causes two diseases of crops

(iii) Explain the economical medical tips of fungi disease of crops.

(iv) Use of local treatment of disease using local herbs.

PHASE 5 EVALUATION PHASE: Activity 5: 5minutes; The will ask the students to:

(i) Define diseases.

(ii) List types of diseases of plants and animals.

(iii) Identify potato and tomato blight.

(iv) Classify the diseases of man.

(v) Mention two technological instruments to detect diseases.

(vi) Describe use of technology to remove acid water from soil to make it fit for use.

(vii) Mention two controls of the diseases.

Post Post Test : The students answer the Biology Achievement Test.

JESULOWO, Janet Funke.

Appendix III

LESSON PLAN FOR CONTROL GROUP
LESSON ONE

GROUP: GSS Gyellesu

NAME OF RESEARCHER: Janet Funke JESULOWO

WEEK: Week 1

LEVEL OF GROUP: SS2

GENDER Male and Female

TOPIC: POLLUTION (air and noise)

DURATION: Double Period (1hour 20minutes)

SUBJECT: Biology

DATE: 2018

NUMBER OF STUDENTS: 50

AVERAGE AGE: 16 years

TEACHING STRATEGY:Lecture Method

REFERENCE MATERIALS:

(i) New Modern Biology for Senior Secondary School2001.

(ii) College Biology by Idodo Umeh 2009 Edition

(iii) Senior Secondary School Biology Curriculum 2009 and Campus portal, 2015.

(iv) New System Biology. 2011

(iv) Past Question and Answer for Senior Secondary School Examination for SSCE, NECO and GCE 1988-2007, 2008-2015.

PREVIOUS KNOWLEDGE: Students have been around neighborhood and taught at school to be able to define environmental hygiene and state nature of environmental hygiene.

INSTRUCTIONAL MATERIALS: Pre-test, chalk board, chalk, pictures of factories, students, research assistance, industrial estate.

BEHAVIOUR OBJECTIVE: At the end of the lesson, the students should be able to:

(i) Define pollution.

(ii) Mention air pollutants and name two sources of air pollution.

(iii) Mention three harmful effects of air pollutants.

(iv) List three sources of noise pollution.

(v) Mention two effects of noise pollution.

(vi) Explain one control by the legislation on air pollution.

(vii) Explain one control by the legislation of noise pollution.

Introduction: The teacher will introduce the lesson by asking the students questions based on their previous knowledge.

Step A:(i) Pre-test the students to know the level of their equivalence academic achievement of Biology.

(ii) What is environmental hygiene?

Presentation:The teacher will present the lesson as follows:

Step B: (i) The teacher will define and explain the definition of pollution.

(ii) The teacher will explain the types of pollution.

Step C: (i) The teacher will explain sources of air and noise pollution.

(ii) The teacher and students activity is to visit industrial estate to study air polluted environment.

Step D: (i) Noise polluted environment showing factories that releases Carbonmonoxide, Sulphurdioxide, oxide of Nitrogen, Smoke, Smog dust and particles released from the factories to the environment.

Step E: (i) The teacher will emphasizes and states the effects of noise pollution from the industrial environment.

(ii) The teacher will explain the legislation control of air pollution.

(iii) The teacher will explain the legislation control on noise pollution.

Step F: The teacher will summaries the topic.

EVALUATION: Teacher asks the students the following questions:

(i) Define pollution.
(ii) Mention air pollutant and two sources of air pollution.
(iii) Mention three effect of air pollution.
(iv) Mention two effects of noise pollution.
(v) Explain one control of the legislation on air.
(vi) Explain one control of the legislation on noise pollution.

Assignment: Write a comprehensive report of your visitation to industry in the context of air, noise and sewage system as a source of pollution in the environment.

LESSON TWO

GROUP:GSSGyellesu
NAME OF RESEARCHER:Janet Funke JESULOWO
WEEK: Week 2
LEVEL OF GROUP:SS2
GENDERMale and Female
TOPIC: POLLUTION (water and land)
DURATION: Double Period (One hour 20 minutes)
SUBJECT: Biology
DATE: 2018
NUMBER IN CLASS 50
AVERAGE AGE: 16 years
TEACHING STRATEGY: Lecture Method
PREVIOUS KNOWLEDGE: The students were taught air and noise pollution.
INSTRUCTIONAL MATERIAL: Jars,petridish, spatula, wash bottle, water for drinking, mosquito larvae, tadpoles. Crude oil, detergents, artificial fertilizers, herbicides. Dead animal, dead plants, chalk board, classroom.
BEHAVIOURAL OBJECTIVES: At the end of the lesson the students should be able to:

(i) Mention two ways pollution of water could occur.
(ii) Mention two ways pollution of land could occur.
(iii) State three effects of water pollution.
(iv) State two effects of land pollution.
(v) State three effects of organic matter as sources of pollution.
(vi) Name domestic and industrial wastes that pollute land and water.
(vii) To mention one legislature's law of water pollution.
(viii) To mention one legislature's law of land pollution.

Introduction: The teacher will introduce the lesson asking the following questions based on previous konwledge:

(i) Define pollution.
(ii) Mention types of pollution.
(iii) Mention one sources and one effect of air pollution.
(iv) Mention two effect of noise pollution to man.

Presentation:The teachers will present the lesson as follows:

Step A: (i) The teacher will setting up jars containing drinking water, label A and B in a baker.

(ii) In each jar place mosquitoes larvae and tadpoles in jar A and in B.

(iii) Add few drops of pollutants of crude oil.

(iv) Add detergent to the B set up.

Step B: The teacher will allow the students to observe and write out their observation.

Step C: (i) The teacher will explain sources of water pollution.

(ii) The teacher will explain the effects of water pollution.

Step D: (i) The teacher illustrates and will explain the legislature laws on water pollution.

(ii)The teacher illustrates and will explain the legislature laws on land pollution

.(iii) The teacher will use insecticides to explain the effects on terrestrial organisms.

(iv) The teacher will explain the effects of artificial fertilizers and herbicides on terrestrial and aquatic organisms.

Step E: (i) The teacher will explain the effects artificial fertilizers on living organisms.

(ii) Teacher will mention the effects of dead plants and animals on soil.

(iii) The teacher will explain sources of land pollution.

(v) The teacher bring out the effects of land (Soil) pollution by decaying matter.

Step F:The teacher would summaries the topic:

EVALUATION: The teacher asks the students the following questions:

(i) Mention two ways pollution of water could occur.

(ii) Mention two ways pollution of land could occur.

(iii) State three effects of water pollution.

(iv) State two effects of land pollution.

(v) State three effects of organic matter as sources of pollution.

(vi) Name domestic and industrial wastes that pollute land and water.

(vii) Students to mention one legislature's law of water pollution.

(viii) Students to mention one legislature's law of land pollution.

LESSON THREE

GROUP:GSS Gyellesu

NAME OF RESEARCHER: Janet Funke JESULOWO

WEEK: Week 3

LEVEL OF GROUP: SS2

GENDER: Male and Female

TOPIC: CONSERVATION OF NATURAL RESOURCES

DURATION: Double Period (One hour 20 minutes)

SUBJECT: BIOLOGY

DATE: 2018

NUMBER OF STUDENTS: 50

AVERAGE AGE: 16 years

TEACHING STRATEGY: Lecture Method

PREVIOUS KNOWLEDGE: The students were taught water and land Pollution.

INSTRUCTIONAL MATRIALS:Chalk board, chalk and recorded laws on laptop as teaching aids.

BEHAVIOUR OBJECTIVES: At the end of the topic the students should be able to:

(i) Define conservation of natural resources.

(ii) Enumerate reasons for protection of lands.

(iii) Identify ways of ensuring conservation of wildlife from destruction and extinction.

(iv) Describe how agencies could be responsible for conservation.

(v) State why various conservation laws should be obey.

(vi) Mention two conservation laws on land and one conservation education of water.

(vii) Identify three possible solution to problems of conservation.

Introduction:The teacher will introduce the lesson by asking the following questions based on their previous knowledge:

(i) Mention three pollutants of water.

(ii) Explain harmful effects of polluted soil.

(iii) Describle the industrial estate visited.

Presentation:The teacher will present the lesson as follows:

Step A: (i) To explain thedefinition andmeaning of conservation of natural resources.

(ii) The teacher will explain types of conservation of natural resources.

Step B:(i) The teacher will explain problems of conservation.

(ii) The teacher will state and explain the possiblesolution for conservation problems.

Step C: (i) The teacher will identify and explain problems of conservation to the economy and social development.

(ii) The teacher will explains how prevention of plants and game animals helps the word conservation.

(iii) The teacher would explainof animals from game reserved.

(iv) The teacher would explain the regulation on planned harvestingand the use of minerals.

Step D: (i) The teacher will explian how prevention of forest encroachment is difficult and what should be the way forward.

(ii) The students will browse through the document on conservation of forest in Nigeria.

Step E: (i) The teacher summaries the topic by playing a recorded laws for the students to learn.

Step F: The teacher would summaries the topic:

EVALUATION: The teacher will ask the students the following questions:

(i) Define conservation of natural resources.

(ii) Enumerate reasons for protection of lands.

(iii) Identify ways of ensuring conservation of wild life from destruction and extinction.

(iv) Describe how agencies could be responsible for conservation.

(v) State why various conservation laws should be obey.

(vi) Mention two conservation laws on land and one conservation education of water.

(vii) Identify three possible solution to problems of conservation.

LESSON FOUR

GROUP: **GSS** Gyellesu.

NAME OF RESEARCHER: Janet and Funke JESULOWO

WEEK: Week 4

LEVEL OF GROUP: SS2

GENDER: Male and Female

TOPIC: CONSERVATION OF NATURAL RESOURCES

DURATION: Double Period (One hour 20 minutes)

SUBJECT: BIOLOGY

DATE: 2018

NUMBER OF STUDENTS: 50

AVERAGE AGE: 16 years

TEACHING STRATEGY: Lecture Method

PREVIOUS KNOWLEDGE: The students were taught what conservation of natural resources means and ways of ensuring it.

INSTRUCTIONAL MATRIALS: The conservation law document, Recorded gas flaring, Chalk board, chalk, pictures of water body like rivers, forest, wildlife.

BEHAVIOURAL OBJECTIVE: At the end of the lesson the students should be able to:

(i) list two conditions for erection of park and reserved.

(ii) State two conservation laws from the law book benefit of Conservation.

(iii) List types of conservation.

(iv) Illustrate needs to conserve petroleum and natural gas.

(v) Mention two methods of conservation.

(vi) Mention two benefits of each conservation of natural resources.

(vii) Mention two conservation laws and one conservation education on forest and minerals.

Introduction: The teacher will introduce the lesson by asking students the following questions:

(i) What is conservation of natural resources?

(ii) Mention four ways conservation of resources could occur.

Presentation: The teacher present the lesson as follows:

Step A: (i) The teacher will define and explain the benefits of conservation.

(ii) Teacher identify ways of ensuring conservation of wild life from destruction and extinction.

Step B: (i) Teacher will describe how agencies could be responsible for conservation.

(ii) State why various conservation laws should be obey.

Step C: (i) The teacher will explain types of conservation benefits.

(i) The teacher will explain prevention of desert encroachment.

(ii) The teacher will explain reasons for the protection of planned harvesting plants.

(iii) The teacher will explain reasons for the protection of wild animals.

Step D: (i) The teacher will explain reasons for regulating the useof minerals.

(ii) The teacher will explain the problems and difficulties of conservation with the students.

(iii) The teacher will pass round among the students the conservation law documents.

Step E: (i) The teacher will explain possible solutions to problems and difficulties on conservation of natural resources.

(ii) The teacher will explain how the benefits are useful toman and his environment.

Step F: The teacher will summarize by briefly going through the main points of the lesson by showing documentary on gas flaring and oil spillage.

EVALUATION: The teacher will ask the students the following questions:

(i) list two conditions for erection of park and reserved.

(ii) State two conservation laws from the law book benefit of Conservation.

(iii) List types of conservation.

(iv) Illustrate needs to conserve petroleum and natural gas.

(v) Mention two methods of conservation.

(vi) Mention two benefits of each conservation of natural resources.

(vii) Mention two conservation laws and one conservation education on forest and minerals.

Post Test Assesment: Students are to answer the Biology Assessment Test.

LESSON FIVE

GROUP: GSS Gyellesu.

NAME OF RESEARCHER: Janet Funke JESULOWO

WEEK: Week 5

LEVEL OF GROUP: SS2

GENDER:Male and Female

TOPIC: PESTS OF CROPS

DURATION: Double Period (One hour 20 minutes)

SUBJECT: BIOLOGY

DATE: 2018

NUMBER OF STUDENTS:50

AVERAGE AGE: 16 years

TEACHING STRATEGY: Lecture Method

PREVIOUS KNOWLEDGE: The students were taught wild life, forest, minerals and benefits of conservation resources.

INSTRUCTIONAL MATRIALS:Pests e.g grasshopper, termites, locust, birds, rodents (rat) Chalkboard and chalk.

BEHAVIOURAL OBJECTIVES:At the end of the lesson the students should be able to:

(i) Describe the life cycle of three pests crops.

(ii) Describe one crop desease.

(iii) Identify two pests of certain two crops you know.

(iv) Describe of a termite and rat.

(v) Mention two termites and rodents control.

(vi) Describe the life cycle of locust.

(vii) Classify pests.

(viii) List three control measures of grasshopper.

Introduction:The teacher introduces the topic by asking the students the following questions based on previous knowledge:

(i) Name two benefits of soil conservation as natural resources.

(ii) Mention one benefits of forest conservation.

Presentation: The teacher present the lesson as follow

Step A:(i) The teacher will explain and generate definition of pest.

(ii) The teacher will throw more light on pests of crops.

(iii) The teacher will explain the classification of pests.

Step B:(i) The teacher differentiates and state the differences between pestsprovided.

(ii) Teacher will highlight effects of pests on crops.

StepC:(i) Teacher willdescribe how the pest can be control.

(ii) The teacher will points out pests of crops.

Step D: (i) The teacher will explains the pests of crops and state the examples.(ii) Also define pests and write on chalkboard.

Step E: (i) The teacher explains the life cycles of selected pests.

(ii) The teacher expatiates on the effects of pests of crops.

(iii) The teacher will explain various parts of pests using the grasshopper, termites, locust,birds and rodent as examples.

Step F: The teacher will summaries the topic.

EVALUATION:The teacher asks the following questions:

(ii) Describe the life cycle of three pests crops.

(iii) Describe one crop desease.

(iv) Identify two pests of certain two crops you know.

(v) Describe of a termite and rat.

(vi) Mention two termites and rodents control.

(vii) Describe the life cycle of locust.

(viii) Classify pests.

(ix) List three control measures of grasshopper.

LESSON SIX

GROUP: GSS Gyellesu.

NAME OF RESEARCHER:Janet Funke JESULOWO

WEEK: Week 6

LEVEL OF GROUP: **S**S2

GENDER:Male and Female

TOPIC: DISEASES OF CROPS.

DURATION: Double Period (One hour 20 minutes)

SUBJECT: BIOLOGY

DATE: 2018

NUMBER OF STUDENTS: 50

AVERAGE AGE: 16 years

TEACHING STRATEGY: Lecture Method

PREVIOUS KNOWLEDGE: The students were taught pests of crops and their control.

INSTRUCTIONAL MATRIALS:Infected parts of tomato leaves, fruits and stem, infectedpart of potato, chalk board, chalk and laboratory.

BEHAVIOURAL OBJECTIVES:At the end of the topic the students should be able to:

(i) Generate definition of diseases.
(ii) State four types of diseases.
(iii) List three causes of crop diseases.
(iv) Explain one mode of transmission of leaf spot.
(v) List two mode of fungi disease of blight.
(vi) State two effects of diseases on livestock.
(vii) Mention three diseases prevention.

Introduction: The teacher will ask the students the followings questions based on their previous knowledge:
(i) Define pest.

(ii) Draw the life cycle of locust.

Step A: (i) The teacher will define diseases and explain with examples some diseases of crops.

(ii) The teacher will explain the mode of transmission.

(iii) The teacher will explain the vectors of diseases.

(iv) Teacher to explain on effects of diseases on crops.

Step B: (i) The teacher will use table showing the relationship of crop diseases, their agents and method of control.

Step C: (i) The teacher will **e**xplain some specific diseases of plant

(ii) The identify and explain diseases prevention of fungi and bacterial.

(iii) The teacher explain the control of diseases.

Step D: (i) The teacher explain differences between fungi, viral, andbacterial diseases of crops.

Step E: The teacher will summaries the topic.

EVALUATION: The teacher evaluates the lesson by asking the students the following questions:

(i) Define diseases.

(ii) State four types of diseases.

(iii) List three causes of crop diseases.

(iv) Explain one mode of transmission of leaf spot.

(v) List two mode of fungi disease of blight.

(vi) State two effects of diseases on livestock.

(vii) Mention three diseases prevention.

Post Post Test Assessment: The students are to answer the Biology Achievement Test.

JESULOWO, Janet Funke

Appendix IV:

Output, Performance, Retention and Creativity

Notes output

Notes

Output Created		19-APR-2019 00:27:04
Comments		
Input	Data	C:\Users\Ojo\Documents\JESULOWAO DATA1.sav
	Active Dataset	DataSet2
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	160
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.
	Cases Used	Statistics for each analysis are based on the cases with no missing or out-of-range data for any variable in the analysis.
Syntax		T-TEST GROUPS=GROUPS(1 2) /MISSING=ANALYSIS /VARIABLES=Mean_Scores /CRITERIA=CI(.95).
Resources	Processor Time	00:00:00.02
	Elapsed Time	00:00:00.02

i. Hypotheses Testing

ii. T-Test 2 sample t test

[DataSet2] C:\Users\Ojo\Documents\JESULOWAO DATA1.sav

Group Statistics

	GROUPS	N	Mean	Std. Deviation	Std. Error Mean
Mean_Scores	Control	41	11.8625	2.03491	.32175
	EXPERIMENTAL	50	13.5500	1.93417	.30582

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means					
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference
									Lower
Mean_Scores	Equal variances assumed	.115	.735	-3.802	89	.000	-1.68750	.44390	-2.57124
	Equal variances not assumed			-3.802	77.800	.000	-1.68750	.44390	-2.57127

```
DATASET ACTIVATE DataSet1.
USE ALL.
COMPUTE filter_$=(groups=2).
VARIABLE LABELS filter_$ 'groups=2 (FILTER)'.
VALUE LABELS filter_$ 0 'Not Selected' 1 'Selected'.
FORMATS filter_$ (f1.0).
FILTER BY filter_$.
EXECUTE.
NPAR TESTS
  /WILCOXON=pretest WITH posttest (PAIRED)
  /MISSING ANALYSIS.
```

NPar Tests

Wilcoxon Signed Ranks Test

Ranks

		N	Mean Rank	Sum of Ranks
After – Before	Negative Ranks	0[a]	.00	.00
	Positive Ranks	45[b]	23.00	1035.00
	Ties	5[c]		
	Total	50		

a. After < Before
b. After > Before
c. After = Before

Test Statistics[a]

	After – Before
Z	-6.462[b]
Asymp. Sig. (2-tailed)	.000

a. Wilcoxon Signed Ranks Test
b. Based on negative ranks.

```
NEW FILE.
DATASET NAME DataSet3 WINDOW=FRONT.
NPAR TESTS
  /M-W= interest BY tests(1 2)
  /MISSING ANALYSIS.
```

NPar Tests

Mann-Whitney Test

Ranks

	tests	N	Mean Rank	Sum of Ranks
interest	before	50	45.66	2283.00
	After	50	55.34	2767.00
	Total	100		

Test Statistics[a]

	Interest
Mann-Whitney U	1008.000
Wilcoxon W	2283.000
Z	-1.669
Asymp. Sig. (2-tailed)	.095

a. Grouping Variable: tests

```
DATASET ACTIVATE DataSet2.
T-TEST GROUPS=GROUPS(1 2)
  /MISSING=ANALYSIS
  /VARIABLES=RETENTION
  /CRITERIA=CI(.95).
```

Hypo 3

2 sample T-Test

Group Statistics

	GROUPS	N	Mean	Std. Deviation	Std. Error Mean
RETENTION	Control	41	11.53	4.076	.644
	EXPERIMENTAL	50	13.88	5.906	.934

samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means					
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Diff.	Std. Error Diff.	95% Confidence Interval of the Difference
									Lower
RETENTION	Equal variances assumed	.847	.360	-2.071	89	.042	-2.350	1.135	-4.609
	Equal variances not assumed			-2.071	69.282	.042	-2.350	1.135	-4.613

```
UNIANOVA Mean_Scores BY GROUPS SEX
  /METHOD=SSTYPE(3)
  /INTERCEPT=INCLUDE
  /POSTHOC=GROUPS(SCHEFFE)
  /EMMEANS=TABLES(OVERALL)
  /PRINT=DESCRIPTIVE
  /CRITERIA=ALPHA(.05)
 /DESIGN=GROUPS SEX GROUPS*SEX.
```

Hypo 4

2-way Analysis of variance

Descriptive Statistics

Dependent Variable: Mean_Scores

GROUPS	SEX	Mean	Std. Deviation	N
Control	Male	10.5000	2.87563	14
	Female	10.2593	3.79871	27
	Total	10.3415	3.47570	41
Experimental	Male	13.0400	3.63410	25
	Female	12.5200	3.52515	25
	Total	12.7800	3.55304	50
Total	Male	12.1282	3.56282	39

2-way Analysis of variance

Tests of Between-Subjects Effects

Dependent Variable: Mean_Scores

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	57.214[a]	3	19.071	4.719	.004
Intercept	12903.841	1	12903.841	3193.052	.000
GROUPS	56.610	1	56.610	14.008	.000
SEX	.130	1	.130	.032	.858
GROUPS * SEX	.130	1	.130	.032	.858
Error	307.133	76	4.041		
Total	13280.250	80			
Corrected Total	364.347	79			

a. R Squared = .157 (Adjusted R Squared = .124)

Estimated Marginal Means

Grand Mean

Dependent Variable: Mean_Scores

Mean	Std. Error	95% Confidence Interval	
		Lower Bound	Upper Bound
12.708	.225	12.260	13.156

```
DATASET ACTIVATE DataSet1.
NPAR TESTS
  /M-W= CREATIVITYS BY groups(1 2)
  /MISSING ANALYSIS.
```

Hypo 5

NPar Tests

Mann-Whitney Test

Ranks

	sex	N	Mean Rank	Sum of Ranks
CREATIVITYS	Male	25	31.26	781.50
	Female	25	30.00	775.00
	Total	50		

Test Statistics[a]

	CREATIVITYS
Mann-Whitney U	1.500
Wilcoxon W	3.500
Z	2.796
Asymp. Sig. (2-tailed)	.085

a. Grouping Variable: sex

Oneway

Descriptives

Pretest

	N	Mean	Std. Deviation	Std. Error
Tudun Jukun	50	8.4400	5.07961	.71837
DAKACE	34	9.8235	2.62240	.44974
Gyelesu	50	9.4000	3.23249	.45714
Muchia	50	11.4800	3.47140	.49093
GCC Zaria	50	10.6200	3.37391	.47714
Kofa bayana	49	11.6122	3.79043	.54149
Total	283	10.2473	3.86872	.22997

ANOVA

Pretest

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	379.532	5	75.906	5.474	.000
Within Groups	3841.154	277	13.867		
Total	4220.686	282			

Post Hoc Tests

Multiple Comparisons

Dependent Variable: pretest

Scheffe

(I) school	(J) school	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Tudun Jukun	Dakace	-1.38353	.82776	.732	-4.1578	1.3908
	Gyelesu	-.96000	.74477	.893	-3.4561	1.5361
	Muchia	-3.04000*	.74477	.006	-5.5361	-.5439
	GCC Zaria	-2.18000	.74477	.132	-4.6761	.3161
	Kofa bayana	-3.17224*	.74856	.004	-5.6811	-.6634
Dakace	Tudun Jukun	1.38353	.82776	.732	-1.3908	4.1578
	Gyelesu	.42353	.82776	.998	-2.3508	3.1978
	Muchia	-1.65647	.82776	.550	-4.4308	1.1178
	GCC Zaria	-.79647	.82776	.968	-3.5708	1.9778
	Kofa bayana	-1.78872	.83118	.464	-4.5745	.9970
Gyelesu	Tudun Jukun	.96000	.74477	.893	-1.5361	3.4561
	Dakace	-.42353	.82776	.998	-3.1978	2.3508
	Muchia	-2.08000	.74477	.172	-4.5761	.4161
	GCC Zaria	-1.22000	.74477	.748	-3.7161	1.2761
	Kofa bayana	-2.21224	.74856	.124	-4.7211	.2966
Muchia	Tudun Jukun	3.04000*	.74477	.006	.5439	5.5361
	Dakace	1.65647	.82776	.550	-1.1178	4.4308
	Gyelesu	2.08000	.74477	.172	-.4161	4.5761
	GCC Zaria	.86000	.74477	.931	-1.6361	3.3561
	Kofa bayana	-.13224	.74856	1.000	-2.6411	2.3766
GCC Zaria	Tudun Jukun	2.18000	.74477	.132	-.3161	4.6761
	Dakace	.79647	.82776	.968	-1.9778	3.5708
	Gyelesu	1.22000	.74477	.748	-1.2761	3.7161
	Muchia	-.86000	.74477	.931	-3.3561	1.6361
	Kofa bayana	-.99224	.74856	.881	-3.5011	1.5166
Kofa bayana	Tudun Jukun	3.17224*	.74856	.004	.6634	5.6811
	Dakace	1.78872	.83118	.464	-.9970	4.5745
	Gyelesu	2.21224	.74856	.124	-.2966	4.7211
	Muchia	.13224	.74856	1.000	-2.3766	2.6411
	GCC Zaria	.99224	.74856	.881	-1.5166	3.5011

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

Homogeneous Subsets

Pretest

Scheffe

School	N	Subset for alpha = 0.05	
		1	2
Tudun Jukun	50	8.4400	
Gyelesu	50	9.4000	9.4000
DAKACE	34	9.8235	9.8235
GCC Zaria	50	10.6200	10.6200
Muchia	50		11.4800
Kofa bayana	49		11.6122
Sig.		.165	.152

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 46.218.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

```
DATASET ACTIVATE DataSet3.

SAVE OUTFILE='C:\Users\Ojo\Documents\jesulowo creativity modified.sav'
  /COMPRESSED.
FREQUENCIES VARIABLES=v1 v2 v3 v4 v5 v6 v7 v8 v9 v10 v11 v12 v13 v14 v15 v16
v17 v18 v19 v20 v21
  /ORDER=ANALYSIS.
```

Frequencies

Ideative Flexibility scale

Frequency Table

Accept ambiguos situations

		Frequency	Percent	Valid Percent	Cumulative Percent
alid	unlike me	12	24.0	24.0	24.0
	not sure	6	12.0	12.0	36.0
	very much like me	32	64.0	64.0	100.0
	Total	50	100.0	100.0	

Attracted by mysterious unclear events

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	24	48.0	48.0	48.0
	not sure	4	8.0	8.0	56.0
	very much like me	22	44.0	44.0	100.0
	Total	50	100.0	100.0	

Tend to break health conventions

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	18	36.0	36.0	36.0
	not sure	6	12.0	12.0	48.0
	very much like me	26	52.0	52.0	100.0
	Total	50	100.0	100.0	

Not hostile or aggressive on the whole

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	21	42.0	42.0	42.0
	not sure	14	28.0	28.0	70.0
	very much like me	15	30.0	30.0	100.0
	Total	50	100.0	100.0	

Look for new ways of doing things

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	18	36.0	36.0	36.0
	not sure	7	14.0	14.0	50.0
	very much like me	25	50.0	50.0	100.0
	Total	50	100.0	100.0	

Tend to overlook significant implications of an idea

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	13	26.0	26.0	26.0
	not sure	7	14.0	14.0	40.0
	very much like me	30	60.0	60.0	100.0
	Total	50	100.0	100.0	

Meticulously curious

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	31	62.0	62.0	62.0
	not sure	8	16.0	16.0	78.0
	very much like me	11	22.0	22.0	100.0
	Total	50	100.0	100.0	

Often a fault finder

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	23	46.0	46.0	46.0
	not sure	6	12.0	12.0	58.0
	very much like me	21	42.0	42.0	100.0
	Total	50	100.0	100.0	

Does not like constantly

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	27	54.0	54.0	54.0
	not sure	8	16.0	16.0	70.0
	very much like me	15	30.0	30.0	100.0
	Total	50	100.0	100.0	

Manifest odd patterns of behaviour at times

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	22	44.0	44.0	44.0
	not sure	7	14.0	14.0	58.0
	very much like me	21	42.0	42.0	100.0
	Total	50	100.0	100.0	

Sensitive to beautiful things

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	13	26.0	26.0	26.0
	not sure	12	24.0	24.0	50.0
	very much like me	25	50.0	50.0	100.0
	Total	50	100.0	100.0	

Willing to take risks

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	17	34.0	34.0	34.0
	not sure	9	18.0	18.0	52.0
	very much like me	24	48.0	48.0	100.0
	Total	50	100.0	100.0	

Like to propose new approaches to a problem

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	23	46.0	46.0	46.0
	not sure	5	10.0	10.0	56.0
	very much like me	22	44.0	44.0	100.0
	Total	50	100.0	100.0	

Neglect significant facts arising from a problem situation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	22	44.0	44.0	44.0
	not sure	5	10.0	10.0	54.0
	very much like me	23	46.0	46.0	100.0
	Total	50	100.0	100.0	

Never bored

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	26	52.0	52.0	52.0
	not sure	9	18.0	18.0	70.0
	very much like me	15	30.0	30.0	100.0
	Total	50	100.0	100.0	

Can perceive details

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	16	32.0	32.0	32.0
	not sure	12	24.0	24.0	56.0
	very much like me	22	44.0	44.0	100.0
	Total	50	100.0	100.0	

I can easily adapt a thing for other use

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	26	52.0	52.0	52.0
	not sure	5	10.0	10.0	62.0
	very much like me	19	38.0	38.0	100.0
	Total	50	100.0	100.0	

I can adjust quite easily to novel situations

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	24	48.0	48.0	48.0
	very much like me	26	52.0	52.0	100.0
	Total	50	100.0	100.0	

I can detect small shades of different colour from a painting that looks one colour

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	20	40.0	40.0	40.0
	not sure	9	18.0	18.0	58.0
	very much like me	21	42.0	42.0	100.0
	Total	50	100.0	100.0	

It is easy for me to change my attention from one absorbing duty to another

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	19	38.0	38.0	38.0
	not sure	4	8.0	8.0	46.0
	very much like me	27	54.0	54.0	100.0
	Total	50	100.0	100.0	

If I meet a person once, I'll know him when next I meet him

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	19	38.0	38.0	38.0
	not sure	13	26.0	26.0	64.0
	very much like me	18	36.0	36.0	100.0
	Total	50	100.0	100.0	

```
FREQUENCIES VARIABLES=v22 v23 v24 v25 v26 v27 v28 v29 v30 v31 v32 v33 v34
v35 v36 v37 v38 v39 v40 v41 v42 v43 v44 v45 v46
  /ORDER=ANALYSIS.
```

Ideative Originality scale

Frequency Table

Criticize my mates

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	23	46.0	46.0	46.0
	not sure	4	8.0	8.0	54.0
	very much like me	23	46.0	46.0	100.0
	Total	50	100.0	100.0	

Attracted to difficult jobs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	20	40.0	40.0	40.0
	not sure	7	14.0	14.0	54.0
	very much like me	23	46.0	46.0	100.0
	Total	50	100.0	100.0	

Can pick out things valuable to me out of many seemingly equally attractive ones

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	25	50.0	50.0	50.0
	not sure	9	18.0	18.0	68.0
	very much like me	16	32.0	32.0	100.0
	Total	50	100.0	100.0	

Like solitary life

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	23	46.0	46.0	46.0
	not sure	6	12.0	12.0	58.0
	very much like me	21	42.0	42.0	100.0
	Total	50	100.0	100.0	

Not Popular with people

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	23	46.0	46.0	46.0
	not sure	6	12.0	12.0	58.0
	very much like me	21	42.0	42.0	100.0
	Total	50	100.0	100.0	

Non-conforming even to intimate friends

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	26	52.0	52.0	52.0
	not sure	5	10.0	10.0	62.0
	very much like me	19	38.0	38.0	100.0
	Total	50	100.0	100.0	

Like to tackle problems that others may avoid

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	21	42.0	42.0	42.0
	not sure	5	10.0	10.0	52.0
	very much like me	24	48.0	48.0	100.0
	Total	50	100.0	100.0	

Follow instructions very closely

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	14	28.0	28.0	28.0
	not sure	10	20.0	20.0	48.0
	very much like me	26	52.0	52.0	100.0
	Total	50	100.0	100.0	

Seek knowledge for its sake

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	22	44.0	44.0	44.0
	not sure	5	10.0	10.0	54.0
	very much like me	23	46.0	46.0	100.0
	Total	50	100.0	100.0	

Like to disagree at times

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	22	44.0	44.0	44.0
	not sure	4	8.0	8.0	52.0
	very much like me	24	48.0	48.0	100.0
	Total	50	100.0	100.0	

Like to question orders of superiors when it is clear

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	12	24.0	24.0	24.0
	not sure	5	10.0	10.0	34.0
	very much like me	33	66.0	66.0	100.0
	Total	50	100.0	100.0	

Do not like business

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	24	48.0	48.0	48.0
	not sure	7	14.0	14.0	62.0
	very much like me	19	38.0	38.0	100.0
	Total	50	100.0	100.0	

Can be proud and self-satisfied at times

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	22	44.0	44.0	44.0
	not sure	7	14.0	14.0	58.0
	very much like me	21	42.0	42.0	100.0
	Total	50	100.0	100.0	

Differ with friends on opinions at times

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	17	34.0	34.0	34.0
	not sure	7	14.0	14.0	48.0
	very much like me	26	52.0	52.0	100.0
	Total	50	100.0	100.0	

Do not fear to make mistakes

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	18	36.0	36.0	36.0
	not sure	9	18.0	18.0	54.0
	very much like me	23	46.0	46.0	100.0
	Total	50	100.0	100.0	

Reserved, not open like others

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	22	44.0	44.0	44.0
	not sure	5	10.0	10.0	54.0
	very much like me	23	46.0	46.0	100.0
	Total	50	100.0	100.0	

Do not want to be controlled by any person

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	12	24.0	24.0	24.0
	not sure	5	10.0	10.0	34.0
	very much like me	33	66.0	66.0	100.0
	Total	50	100.0	100.0	

May be terribly native in style of life

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	21	42.0	42.0	42.0
	not sure	5	10.0	10.0	52.0
	very much like me	24	48.0	48.0	100.0
	Total	50	100.0	100.0	

Visionary and insightful

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	28	56.0	56.0	56.0
	not sure	1	2.0	2.0	58.0
	very much like me	21	42.0	42.0	100.0
	Total	50	100.0	100.0	

Seek recognition for contributions I make

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	25	50.0	50.0	50.0
	not sure	6	12.0	12.0	62.0
	very much like me	19	38.0	38.0	100.0
	Total	50	100.0	100.0	

Averagely intelligent at least

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	22	44.0	44.0	44.0
	not sure	5	10.0	10.0	54.0
	very much like me	23	46.0	46.0	100.0
	Total	50	100.0	100.0	

Like to do things the way I think right

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	18	36.0	36.0	36.0
	not sure	10	20.0	20.0	56.0
	very much like me	22	44.0	44.0	100.0
	Total	50	100.0	100.0	

I am resolute, I'll change the order of things in the present world

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	23	46.0	46.0	46.0
	not sure	7	14.0	14.0	60.0
	very much like me	20	40.0	40.0	100.0
	Total	50	100.0	100.0	

It is monotonous to see even the most beautiful things without change for many years

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	14	28.0	28.0	28.0
	not sure	12	24.0	24.0	52.0
	very much like me	24	48.0	48.0	100.0
	Total	50	100.0	100.0	

Innovation and introduction of the unusual makes one happy and healthy

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	18	36.0	36.0	36.0
	not sure	9	18.0	18.0	54.0
	very much like me	23	46.0	46.0	100.0
	Total	50	100.0	100.0	

FREQUENCIES VARIABLES=v47 v48 v49 v50 v51 v52 v53 v54 v55 v56 v57 v58 v59 v60 v61 v62 v63 v64 v65 v66 v67 v68 v69 v70 v71 v72
/ORDER=ANALYSIS.

Ideative Fluency scale

Frequency Table

Have easy-flowing ideas on certain problems that bother me

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	28	56.0	56.0	56.0
	not sure	7	14.0	14.0	70.0
	very much like me	15	30.0	30.0	100.0
	Total	50	100.0	100.0	

Self-sufficient in idea generation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	26	52.0	52.0	52.0
	not sure	2	4.0	4.0	56.0
	very much like me	22	44.0	44.0	100.0
	Total	50	100.0	100.0	

Versatile

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	28	56.0	56.0	56.0
	not sure	12	24.0	24.0	80.0
	very much like me	10	20.0	20.0	100.0
	Total	50	100.0	100.0	

Rich in terms of the variety of ideas running through my mind

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	21	42.0	42.0	42.0
	not sure	3	6.0	6.0	48.0
	very much like me	26	52.0	52.0	100.0
	Total	50	100.0	100.0	

I can ask a hundred questions on the use of palm tree

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	18	36.0	36.0	36.0
	not sure	9	18.0	18.0	54.0
	very much like me	23	46.0	46.0	100.0
	Total	50	100.0	100.0	

I can explain the possible consequence of an act fairly accurately

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	20	40.0	40.0	40.0
	not sure	11	22.0	22.0	62.0
	very much like me	19	38.0	38.0	100.0
	Total	50	100.0	100.0	

I can describe a scene as accurately as possible within a limited given time

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	18	36.0	36.0	36.0
	not sure	9	18.0	18.0	54.0
	very much like me	23	46.0	46.0	100.0
	Total	50	100.0	100.0	

If a pictorial scene is supplied, I can vividly supply many ideas describing the cause(s)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	21	42.0	42.0	42.0
	not sure	8	16.0	16.0	58.0
	very much like me	21	42.0	42.0	100.0
	Total	50	100.0	100.0	

If a painting is supplied in a sequential order, I can generate many ideas about the sequence that will follow

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	24	48.0	48.0	48.0
	not sure	6	12.0	12.0	60.0
	very much like me	20	40.0	40.0	100.0
	Total	50	100.0	100.0	

I can give much information to explain a just-suppose question

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	33	66.0	66.0	66.0
	not sure	5	10.0	10.0	76.0
	very much like me	12	24.0	24.0	100.0
	Total	50	100.0	100.0	

If a diagram is incompletely drawn, I can quickly think of many ways of improvement

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	19	38.0	38.0	38.0
	not sure	10	20.0	20.0	58.0
	very much like me	21	42.0	42.0	100.0
	Total	50	100.0	100.0	

I can be dried-up of ideas very often

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	20	40.0	40.0	40.0
	not sure	6	12.0	12.0	52.0
	very much like me	24	48.0	48.0	100.0
	Total	50	100.0	100.0	

I can easily draw an elephant from a big oval or circular drawing

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	24	48.0	48.0	48.0
	not sure	3	6.0	6.0	54.0
	very much like me	23	46.0	46.0	100.0
	Total	50	100.0	100.0	

I have to write poems

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	25	50.0	50.0	50.0
	not sure	5	10.0	10.0	60.0
	very much like me	20	40.0	40.0	100.0
	Total	50	100.0	100.0	

I like objective type examinations

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	20	40.0	40.0	40.0
	not sure	7	14.0	14.0	54.0
	very much like me	23	46.0	46.0	100.0
	Total	50	100.0	100.0	

I prefer to write easy examinations

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	16	32.0	32.0	32.0
	not sure	9	18.0	18.0	50.0
	very much like me	25	50.0	50.0	100.0
	Total	50	100.0	100.0	

Plenty of ideas come to me early in the morning when I am about to take breakfast

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	26	52.0	52.0	52.0
	not sure	3	6.0	6.0	58.0
	very much like me	21	42.0	42.0	100.0
	Total	50	100.0	100.0	

I keep a note book always in which I write the ideas that came to me

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	22	44.0	44.0	44.0
	not sure	5	10.0	10.0	54.0
	very much like me	23	46.0	46.0	100.0
	Total	50	100.0	100.0	

I do not quickly see all the sides to an argument because of idea shortage

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	19	38.0	38.0	38.0
	not sure	12	24.0	24.0	62.0
	very much like me	19	38.0	38.0	100.0
	Total	50	100.0	100.0	

At times when I am peacefully alone, myriads of ideas come to me on a long-standing problem

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	17	34.0	34.0	34.0
	not sure	7	14.0	14.0	48.0
	very much like me	26	52.0	52.0	100.0
	Total	50	100.0	100.0	

At times when playing a game, I tend to remember many useful ideas to solve a problem bothering me

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	17	34.0	34.0	34.0
	not sure	8	16.0	16.0	50.0
	very much like me	25	50.0	50.0	100.0
	Total	50	100.0	100.0	

I find it difficult to start a discussion

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	25	50.0	50.0	50.0
	not sure	7	14.0	14.0	64.0
	very much like me	18	36.0	36.0	100.0
	Total	50	100.0	100.0	

When a discussion is started, my ideas start flowing like river

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	29	58.0	58.0	58.0
	not sure	4	8.0	8.0	66.0
	very much like me	17	34.0	34.0	100.0
	Total	50	100.0	100.0	

I tend to describe things with few words

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	28	56.0	56.0	56.0
	not sure	3	6.0	6.0	62.0
	very much like me	19	38.0	38.0	100.0
	Total	50	100.0	100.0	

When I start thinking about a problem, I wonder about the way my mind conjure myriads of ideas

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	23	46.0	46.0	46.0
	not sure	9	18.0	18.0	64.0
	very much like me	18	36.0	36.0	100.0
	Total	50	100.0	100.0	

It is interesting to put one's ideas on records

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	19	38.0	38.0	38.0
	not sure	8	16.0	16.0	54.0
	very much like me	23	46.0	46.0	100.0
	Total	50	100.0	100.0	

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FREQUENCIES VARIABLES=v73 v74 v75 v76 v77 v78 v79 v80 v81 v82 v83 v84 v85
v86 v87 v88 v89
  /ORDER=ANALYSIS.
```

Creativity Motivation scale

Have very deep interest in disorderly settings

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	22	44.0	44.0	44.0
	not sure	8	16.0	16.0	60.0
	very much like me	20	40.0	40.0	100.0
	Total	50	100.0	100.0	

Courageous

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	22	44.0	44.0	44.0
	not sure	5	10.0	10.0	54.0
	very much like me	23	46.0	46.0	100.0
	Total	50	100.0	100.0	

Have great determination

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	21	42.0	42.0	42.0
	not sure	8	16.0	16.0	58.0
	very much like me	21	42.0	42.0	100.0
	Total	50	100.0	100.0	

Desire high competence in my endeavours

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	23	46.0	46.0	46.0
	not sure	9	18.0	18.0	64.0
	very much like me	18	36.0	36.0	100.0
	Total	50	100.0	100.0	

Enthusiastic about all problems that come my way

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	29	58.0	58.0	58.0
	not sure	12	24.0	24.0	82.0
	very much like me	9	18.0	18.0	100.0
	Total	50	100.0	100.0	

Fail to let others know my new ideas

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	24	48.0	48.0	48.0
	not sure	7	14.0	14.0	62.0
	very much like me	19	38.0	38.0	100.0
	Total	50	100.0	100.0	

Keep unusually long hours on a problem

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	22	44.0	44.0	44.0
	not sure	3	6.0	6.0	50.0
	very much like me	25	50.0	50.0	100.0
	Total	50	100.0	100.0	

Industrious

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	17	34.0	34.0	34.0
	not sure	7	14.0	14.0	48.0
	very much like me	26	52.0	52.0	100.0
	Total	50	100.0	100.0	

Controlled by an inner force which does not care about what people say

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	22	44.0	44.0	44.0
	not sure	4	8.0	8.0	52.0
	very much like me	24	48.0	48.0	100.0
	Total	50	100.0	100.0	

Have abundant energy for work that interest me

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	22	44.0	44.0	44.0
	not sure	8	16.0	16.0	60.0
	very much like me	20	40.0	40.0	100.0
	Total	50	100.0	100.0	

Emotionally sensitive to new ideas

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	27	54.0	54.0	54.0
	not sure	6	12.0	12.0	66.0
	very much like me	17	34.0	34.0	100.0
	Total	50	100.0	100.0	

Highly persistent on difficult problems

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	19	38.0	38.0	38.0
	not sure	10	20.0	20.0	58.0
	very much like me	21	42.0	42.0	100.0
	Total	50	100.0	100.0	

Discouraged at times due to certain situations

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	28	56.0	56.0	56.0
	not sure	6	12.0	12.0	68.0
	very much like me	16	32.0	32.0	100.0
	Total	50	100.0	100.0	

Self-confident

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	19	38.0	38.0	38.0
	not sure	9	18.0	18.0	56.0
	very much like me	22	44.0	44.0	100.0
	Total	50	100.0	100.0	

Resolute

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	20	40.0	40.0	40.0
	not sure	8	16.0	16.0	56.0
	very much like me	22	44.0	44.0	100.0
	Total	50	100.0	100.0	

Humorous

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	18	36.0	36.0	36.0
	not sure	9	18.0	18.0	54.0
	very much like me	23	46.0	46.0	100.0
	Total	50	100.0	100.0	

Can quickly receive and register external stimuli

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unlike me	14	28.0	28.0	28.0
	not sure	9	18.0	18.0	46.0
	very much like me	27	54.0	54.0	100.0
	Total	50	100.0	100.0	

```
FREQUENCIES VARIABLES=groups sex GROUPINGS
  /ORDER=ANALYSIS.
```

Frequencies

Frequency Table

Groups

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	exp	50	100.0	100.0	100.0

Sex

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	25	50.0	50.0	50.0
	Female	25	50.0	50.0	100.0
	Total	50	100.0	100.0	

GROUPINGS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male Experimental	25	50.0	50.0	50.0
	Female Experimental	25	50.0	50.0	100.0
	Total	50	100.0	100.0	

Ideative Flexibility scale

s/no	Items	Response categories			Mean
		Very much like me	Not sure	Unlike me	
1	Accept ambiguous situations	32	6	12	2.4
2	Attracted by mysterious unclear events	22	4	24	1.96
3	Tend to break health conventions	26	6	18	2.16
4	Not hostile or aggressive on the whole	15	14	21	1.88
5	Look for new ways of doing things	25	7	18	2.14
6	Tend to overlook significant implications of an idea	30	7	13	2.34
7	Meticulously curious	11	8	31	1.6
8	Often a fault finder	21	6	23	1.96
9	Does not like constantly	15	8	27	1.76
10	Manifest odd patterns of behaviour at times	21	7	22	1.98
11	Sensitive to beautiful things	25	12	13	2.24
12	Willing to take risks	24	9	17	2.14
13	Like to propose new approaches to a problem	22	5	23	1.98
14	Neglect significant facts arising from a problem situation	23	5	22	2.02
15	Never bored	15	9	20	1.66
16	Can perceive details	22	12	16	2.12
17	I can easily adapt a thing for other use	19	5	26	1.86
18	I can adjust quite easily to novel situations	26	0	24	2.04
19	I can detect small shades of different colour from a painting that looks one colour	21	9	20	2.02
20	It is easy for me to change my attention from one absorbing duty to another	27	4	19	2.16
21	If I meet a person once, I'll know him when next I meet him	18	13	19	1.98
	Cumulative mean				***2.019***

Standard/decision mean = 2.00

Ideative originality scale

s/no	Items	Response categories			Mean
		Very much like me	Not sure	Unlike me	
1	Criticize my mates	23	4	23	2
2	Attracted to difficult jobs	23	7	20	2.06
3	Can pick out things valuable to me out of many seemingly equally attractive ones	16	9	25	1.82
4	Like solitary life	21	6	23	1.96
5	Not Popular with people	21	6	23	1.96
6	Non-conforming even to intimate friends	19	5	26	1.86
7	Like to tackle problems that others may avoid	11	7	32	1.58
8	Follow instructions very closely	22	8	20	2.04
9	Seek knowledge for its sake	16	9	25	1.82
10	Like to disagree at times	20	10	20	2
11	Like to question orders of superiors when it is clear	24	11	15	2.18
12	Do not like business	23	13	14	2.18
13	Can be proud and self-satisfied at times	20	6	24	1.92
14	Differ with friends on opinions at times	21	6	23	1.96
15	Do not fear to make mistakes	17	11	22	1.9
16	Reserved, not open like others	20	10	20	2
17	Do not want to be controlled by any person	20	8	22	1.96
18	May be terribly native in style of life	26	2	22	2.08
19	Visionary and insightful	20	8	22	1.96
20	Seek recognition for contributions I make	27	4	19	2.16
21	Averagely intelligent at least	18	14	18	2
22	Like to do things the way I think right	22	5	23	1.98
23	I am resolute, I'll change the order of things in the present world	21	8	21	2
24	It is monotonous to see even the most beautiful things without change for many years	17	10	23	1.88
25	Innovation and introduction of the unusual makes one happy and healthy	19	9	22	1.94
	Cumulative mean				***1.968***

Standard/decision mean = 2.00

Ideative Fluency scale

s/no	Items	Response categories			Mean
		Very much like me	Not sure	Unlike me	
1	Have easy-flowing ideas on certain problems that bother me	23	6	21	2.04
2	Self-sufficient in idea generation	25	10	15	2.2
3	Versatile	19	10	21	1.96
4	Rich in terms of the variety of ideas running through my mind	23	7	20	2.06
5	I can ask a hundred questions on the use of palm tree	23	8	19	2.08
6	I can explain the possible consequence of an act fairly accurately	20	8	22	1.96
7	I can describe a scene as accurately as possible within a limited given time	11	9	30	1.62
8	If a pictorial scene is supplied, I can vividly supply many ideas describing the cause(s)	23	12	15	2.16
9	If a painting is supplied in a sequential order, I can generate many ideas about the sequence that will follow	19	12	19	2
10	I can give much information to explain a just-suppose question	21	11	18	2.06
11	If a diagram is incompletely drawn, I can quickly think of many ways of improvement	24	13	13	2.22
12	I can be dried-up of ideas very often	25	13	12	2.26
13	I can easily draw an elephant from a big oval or circular drawing	21	9	20	2.02
14	I have to write poems	23	13	14	2.18
15	I like objective type examinations	17	12	21	1.92
16	I prefer to write easy examinations	20	10	20	2
17	Plenty of ideas come to me early in the morning when I am about to take breakfast	20	13	17	2.06
18	I keep a note book always in which I write the ideas that came to me	26	3	21	2.1
19	I do not quickly see all the sides to an argument because of idea shortage	20	9	21	1.98
20	At times when I am peacefully alone, myriads of ideas come to me on a long-standing problem	27	6	17	2.2
21	At times when playing a game, I tend to remember many useful ideas to solve a problem bothering me	18	16	16	2.04
22	I find it difficult to start a discussion	22	7	21	2.02
23	When a discussion is started, my ideas start flowing like river	21	10	19	2.04
24	I tend to describe things with few words	17	13	20	1.94
25	When I start thinking about a problem, I	19	20	11	2.16

	wonder about the way my mind conjure myriads of ideas				
26	It is interesting to put one's ideas on records	24	12	14	2.2
					2.056

Standard/decision mean = 2.00

Creativity motivation scale

s/no	Items	Response categories			Mean
		Very much like me	Not sure	Unlike me	
1	Have very deep interest in disorderly settings	28	7	15	2.26
2	Courageous	27	10	13	2.28
3	Have great determination	24	8	18	2.12
4	Desire high competence in my endeavours	25	9	16	2.18
5	Enthusiastic about all problems that come my way	25	7	18	2.14
6	Fail to let others know my new ideas	21	9	20	2.02
7	Keep unusually long hours on a problem	26	10	14	2.24
8	Industrious	22	13	15	2.14
9	Controlled by an inner force which does not care about what people say	20	11	19	2.02
10	Have abundant energy for work that interest me	22	14	14	2.16
11	Emotionally sensitive to new ideas	24	13	13	2.22
12	Highly persistent on difficult problems	23	14	13	2.2
13	Discouraged at times due to certain situations	22	11	17	2.1
14	Self-confident	24	14	12	2.24
15	Resolute	21	14	15	2.12
16	Humorous	19	15	16	2.06
17	Can quickly receive and register external stimuli	22	13	15	2.14
	Cumulative mean				2.155

Standard/decision mean = 2.00

APPENDIX V:

CREATIVITY ASSESSMENT SCALE OUTPUT

Ideative Flexibility Scale

Reliability

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	20	100.0
	Excluded[a]	0	.0
	Total	20	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.665	.672	21

Item Statistics

	Mean	Std. Deviation	N
Accept ambiguous situations	1.55	.826	20
Attracted by mysterious unclear events	1.60	.821	20
Tend to break health conventions	1.55	.759	20
Not hostile or aggressive on the whole	1.80	1.005	20
Look for new ways of doing things	2.40	.821	20
Tend to overlook significant implications of an idea	1.80	.894	20
Meticulously curious	1.95	.945	20
Often a fault finder	1.80	.951	20
Does not like constantly	1.45	.826	20
Manifest odd patterns of behaviour at times	1.95	.999	20
Sensitive to beautiful things	1.90	.912	20
Willing to take risks	1.75	.910	20
Like to propose new approaches to a problem	2.00	.973	20
Neglect significant facts arising from a problem situation	1.65	.875	20
Never bored	1.80	.951	20
Can perceive details	2.05	.887	20
I can easily adapt a thing for other use	1.90	.912	20
I can adjust quite easily to novel situations	2.40	.883	20
I can detect small shades of different colour from a painting that looks one colour	1.65	.875	20
It is easy for me to change my attention from one absorbing duty to another	2.05	.945	20
If I meet a person once, I'll know him when next I meet him	1.90	.912	20

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	1.852	1.450	2.400	.950	1.655	.062	21

Ideative Originality Scale
Reliability

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	20	100.0
	Excluded[a]	0	.0
	Total	20	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.705	.705	25

Item Statistics

	Mean	Std. Deviation	N
Criticize my mates	2.10	.968	20
Attracted to difficult jobs	2.00	.973	20
Can pick out things valuable to me out of many seemingly equally attractive ones	1.80	.951	20
Like solitary life	1.70	.923	20
Not Popular with people	1.90	1.021	20
Non-conforming even to intimate friends	1.60	.821	20
Like to tackle problems that others may avoid	1.85	.933	20
Follow instructions very closely	1.70	.865	20
Seek knowledge for its sake	1.90	.912	20
Like to disagree at times	2.00	.973	20
Like to question orders of superiors when it is clear	1.90	.968	20
Do not like business	1.70	.923	20
Can be proud and self-satisfied at times	1.95	.945	20
Differ with friends on opinions at times	2.15	.933	20
Do not fear to make mistakes	1.90	.968	20
Reserved, not open like others	1.95	.945	20
Do not want to be controlled by any person	2.10	.968	20
May be terribly native in style of life	2.05	.999	20
Visionary and insightful	2.05	.887	20
Seek recognition for contributions I make	2.10	.912	20
Averagely intelligent at least	1.95	.999	20
Like to do things the way I think right	1.90	.968	20
I am resolute, I'll change the order of things in the present world	1.35	.745	20
It is monotonous to see even the most beautiful things without change for many years	2.10	.912	20
Innovation and introduction of the unusual makes one happy and healthy	1.85	.933	20

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	1.902	1.350	2.150	.800	1.593	.034	25

Ideative Fluency Scale

Reliability

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	20	100.0
	Excluded[a]	0	.0
	Total	20	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.782	25

Item Statistics

	Mean	Std. Deviation	N
Have easy-flowing ideas on certain problems that bother me	2.20	.834	20
Self-sufficient in idea generation	1.80	.951	20
Versatile	1.75	.851	20
Rich in terms of the variety of ideas running through my mind	1.80	.894	20
I can ask a hundred questions on the use of palm tree	1.90	.968	20
I can explain the possible consequence of an act fairly accurately	1.65	.813	20
I can describe a scene as accurately as possible within a limited given time	2.05	.945	20
If a pictorial scene is supplied, I can vividly supply many ideas describing the cause(s)	1.70	.801	20
If a painting is supplied in a sequential order, I can generate many ideas about the sequence that will follow	1.95	.999	20
I can give much information to explain a just-suppose question	1.95	.945	20
If a diagram is incompletely drawn, I can quickly think of many ways of improvement	1.80	.894	20
I can be dried-up of ideas very often	1.95	.999	20
I can easily draw an elephant from a big oval or circular drawing	1.95	.826	20
I have to write poems	2.15	.933	20
I like objective type examinations	1.95	.945	20
I prefer to write easy examinations	2.55	.759	20
Plenty of ideas come to me early in the morning when I am about to take breakfast	2.15	.875	20
I keep a note book always in which I write the ideas that came to me	1.60	.883	20
I do not quickly see all the sides to an argument because of idea shortage	1.95	.945	20
At times when I am peacefully alone, myriads of ideas come to me on a long-standing problem	1.85	.988	20
At times when playing a game, I tend to remember many useful ideas to solve a problem bothering me	1.85	.875	20
I find it difficult to start a discussion	2.15	.933	20
When a discussion is started, my ideas start flowing like river	2.15	.933	20
I tend to describe things with few words	1.85	.988	20
When I start thinking about a problem, I wonder about the way my mind conjure myriads of ideas	1.80	.951	20

```
RELIABILITY
  /VARIABLES=v73 v74 v75 v76 v77 v78 v79 v80 v81 v82 v83 v84 v85 v86 v87 v88 v89
  /SCALE('ALL VARIABLES') ALL
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```
/MODEL=ALPHA
/STATISTICS=DESCRIPTIVE
/SUMMARY=MEANS.
```

Creativity Motivation scale

Reliability

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	20	100.0
	Excluded[a]	0	.0
	Total	20	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.762	.768	17

Item Statistics

	Mean	Std. Deviation	N
Have very deep interest in disorderly settings	1.85	.933	20
Courageous	1.65	.933	20
Have great determination	2.10	.968	20
Desire high competence in my endeavours	2.25	.910	20
Enthusiastic about all problems that come my way	2.40	.883	20
Fail to let others know my new ideas	2.25	.851	20
Keep unusually long hours on a problem	1.85	.933	20
Industrious	2.15	.988	20
Controlled by an inner force which does not care about what people say	1.95	.826	20
Have abundant energy for work that interest me	2.00	.858	20
Emotionally sensitive to new ideas	2.20	.894	20
Highly persistent on difficult problems	1.75	.910	20
Discouraged at times due to certain situations	1.70	.923	20
Self-confident	1.65	.875	20
Resolute	1.60	.883	20
Humorous	1.90	.912	20
Can quickly receive and register external stimuli	1.85	.933	20

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	1.947	1.600	2.400	.800	1.500	.059	17

All the variables of creativity combined

Reliability

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	20	100.0
	Excluded[a]	0	.0
	Total	20	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.848	.849	89

Item Statistics

	Mean	Std. Deviation	N
Accept ambiguous situations	1.55	.826	20
Attracted by mysterious unclear events	1.60	.821	20
Tend to break health conventions	1.55	.759	20
Not hostile or aggressive on the whole	1.80	1.005	20
Look for new ways of doing things	2.40	.821	20
Tend to overlook significant implications of an idea	1.80	.894	20
Meticulously curious	1.95	.945	20
Often a fault finder	1.80	.951	20
Does not like constantly	1.45	.826	20
Manifest odd patterns of behaviour at times	1.95	.999	20
Sensitive to beautiful things	1.90	.912	20
Willing to take risks	1.75	.910	20
Like to propose new approaches to a problem	2.00	.973	20
Neglect significant facts arising from a problem situation	1.65	.875	20
Never bored	1.80	.951	20
Can perceive details	2.05	.887	20
I can easily adapt a thing for other use	1.90	.912	20
I can adjust quite easily to novel situations	2.40	.883	20

I can detect small shades of different colour from a painting that looks one colour	1.65	.875	20
It is easy for me to change my attention from one absorbing duty to another	2.05	.945	20
If I meet a person once, I'll know him when next I meet him	1.90	.912	20
Criticize my mates	2.10	.968	20
Attracted to difficult jobs	2.00	.973	20
Can pick out things valuable to me out of many seemingly equally attractive ones	1.80	.951	20
Like solitary life	1.70	.923	20
Not Popular with people	1.90	1.021	20
Non-conforming even to intimate friends	1.60	.821	20
Like to tackle problems that others may avoid	1.85	.933	20
Follow instructions very closely	1.70	.865	20
Seek knowledge for its sake	1.90	.912	20
Like to disagree at times	2.00	.973	20
Like to question orders of superiors when it is clear	1.90	.968	20
Do not like business	1.70	.923	20
Can be proud and self-satisfied at times	1.95	.945	20
Differ with friends on opinions at times	2.15	.933	20
Do not fear to make mistakes	1.90	.968	20
Reserved, not open like others	1.95	.945	20
Do not want to be controlled by any person	2.10	.968	20
May be terribly native in style of life	2.05	.999	20
Visionary and insightful	2.05	.887	20
Seek recognition for contributions I make	2.10	.912	20
Averagely intelligent at least	1.95	.999	20
Like to do things the way I think right	1.90	.968	20
I am resolute, I'll change the order of things in the present world	1.35	.745	20
It is monotonous to see even the most beautiful things without change for many years	2.10	.912	20
Innovation and introduction of the unusual makes one happy and healthy	1.85	.933	20
Have easy-flowing ideas on certain problems that bother me	2.20	.834	20
Self-sufficient in idea generation	1.80	.951	20
Versatile	1.75	.851	20
Rich in terms of the variety of ideas running through my mind	1.80	.894	20
I can ask a hundred questions on the use of palm tree	1.90	.968	20
I can explain the possible consequence of an act fairly accurately	1.65	.813	20
I can describe a scene as accurately as possible within a limited given time	2.05	.945	20

If a pictorial scene is supplied, I can vividly supply many ideas describing the cause(s)	1.70	.801	20
If a painting is supplied in a sequential order, I can generate many ideas about the sequence that will follow	1.95	.999	20
I can give much information to explain a just-suppose question	1.95	.945	20
If a diagram is incompletely drawn, I can quickly think of many ways of improvement	1.80	.894	20
I can be dried-up of ideas very often	1.95	.999	20
I can easily draw an elephant from a big oval or circular drawing	1.95	.826	20
I have to write poems	2.15	.933	20
I like objective type examinations	1.95	.945	20
I prefer to write easy examinations	2.55	.759	20
Plenty of ideas come to me early in the morning when I am about to take breakfast	2.15	.875	20
I keep a note book always in which I write the ideas that came to me	1.60	.883	20
I do not quickly see all the sides to an argument because of idea shortage	1.95	.945	20
At times when I am peacefully alone, myriads of ideas come to me on a long-standing problem	1.85	.988	20
At times when playing a game, I tend to remember many useful ideas to solve a problem bothering me	1.85	.875	20
I find it difficult to start a discussion	2.15	.933	20
When a discussion is started, my ideas start flowing like river	2.15	.933	20
I tend to describe things with few words	1.85	.988	20
When I start thinking about a problem, I wonder about the way my mind conjure myriads of ideas	1.80	.951	20
It is interesting to put one's ideas on records	1.75	.967	20
Have very deep interest in disorderly settings	1.85	.933	20
Courageous	1.65	.933	20
Have great determination	2.10	.968	20
Desire high competence in my endeavours	2.25	.910	20
Enthusiastic about all problems that come my way	2.40	.883	20
Fail to let others know my new ideas	2.25	.851	20
Keep unusually long hours on a problem	1.85	.933	20
Industrious	2.15	.988	20
Controlled by an inner force which does not care about what people say	1.95	.826	20
Have abundant energy for work that interest me	2.00	.858	20
Emotionally sensitive to new ideas	2.20	.894	20
Highly persistent on difficult problems	1.75	.910	20

Discouraged at times due to certain situations	1.70	.923	20
Self-confident	1.65	.875	20
Resolute	1.60	.883	20
Humorous	1.90	.912	20
Can quickly receive and register external stimuli	1.85	.933	20

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	1.907	1.350	2.550	1.200	1.889	.047	89

Pre-test and post-test reliability using PPMC

Appendix B: Raw scores of the two sets of tests for determining the coefficient of reliability of the test instrument

S/NO	X	Y	X^2	Y^2	XY
1	11	11	121	121	121
2	10	13	100	169	130
3	13	14	169	196	182
4	14	14	196	196	196
5	10	12	100	144	120
6	15	17	225	289	255
7	15	14	225	196	210
8	13	13	169	169	169
9	13	14	169	196	182
10	12	11	144	121	132
11	13	13	169	169	169
12	13	14	169	196	182
13	14	14	196	196	196
14	10	12	100	144	120
15	16	16	256	256	256
16	14	14	196	196	196
17	12	12	144	144	144
18	14	13	196	169	182
19	11	10	121	100	110
20	12	11	144	121	132
N=27	**∑X**=255	**∑Y**=3+3	**∑X2**=3309	**∑Y2**=3488	**∑XY =3384**

Note: x and y are first and second tests scores for performance

(Statistics for finding reliability)

Pearson Product Moment Correlation computed for the Reliability index for the instrument used in the pilot study of the research.

The formula for Pearson Product Moment Correlation is given below:

$$R = \frac{N(\sum xy) - (x)\sum Y}{((N(X^2) - (NY^2)-(Y)^2)}$$

N=Number of respondents

X is test scores at pre test

Y is test scores at post test

$\sum x$ is scores at pretest is summed

$\sum y$ is scores at Post test is summed

$\sum x^2$ is scores at pre test is squared and summed

$\sum Y^2$ is scores at post test is squared and summed

$(\sum x)^2$ is scores at pre test is summed and squared

$(\sum Y)^2$ is scores at post test is summed and squared

Where:

$\sum$**X**=255 $\sum$**Y**=262 $\sum$**X2**=3309 $\sum$**Y2**=3488 $\sum$**XY=3384**

N=20

Pearson Product Moment Correlation formula is:

$$r = \frac{N(\sum xy) - \sum (x)\sum Y}{((N(\sum X^2) - (N*\sum Y^2)-(\sum Y)^2}$$

$$= \frac{20*3309 - 255*262}{20*(3309)^2 - 20*3488-(262)^2}$$

=.754

r=.71

Performance and Retention Data

Sample data

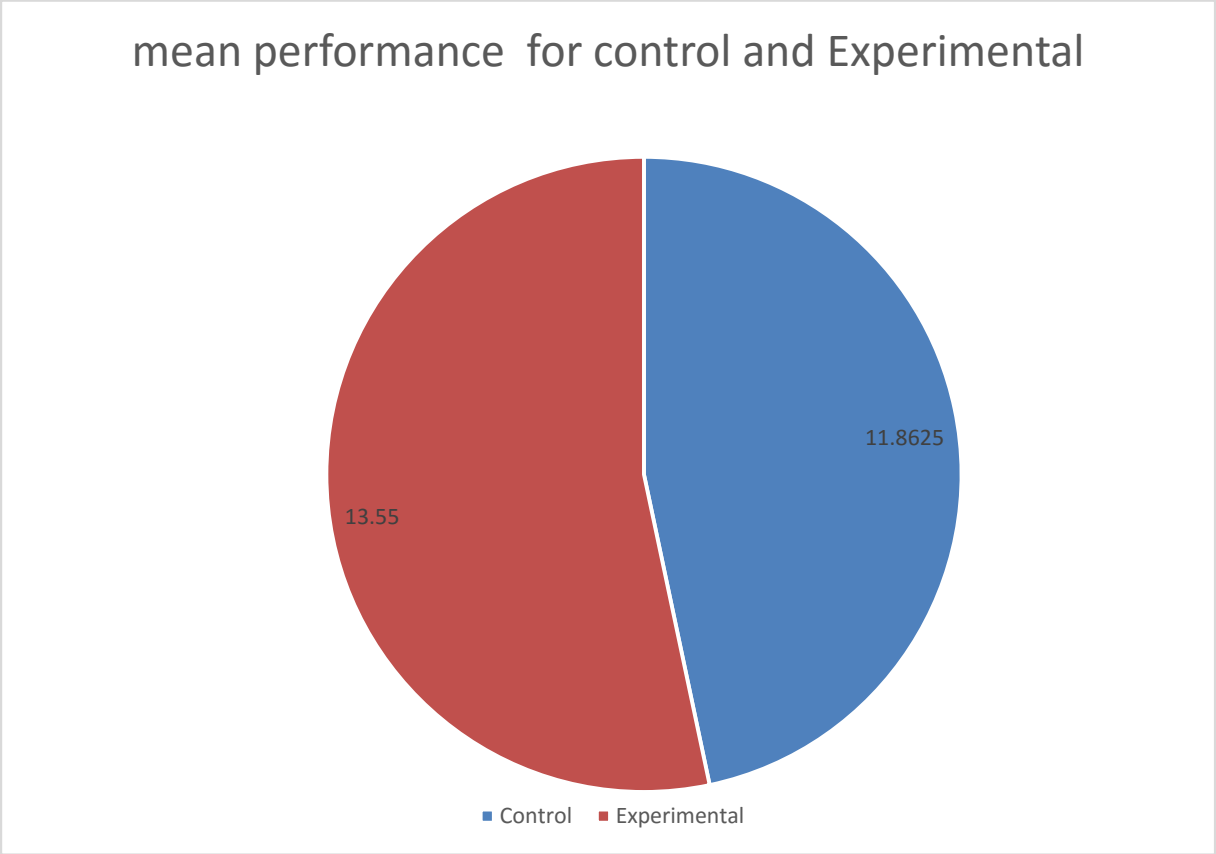
Pretest, Post test and Retention Data for the two schools

S/no	Groups	Pretest	Posttest	Retention
1	Control	10	10	14
2	Control	9	14	15
3	Control	8	24	27
4	Control	13	14	17
5	Control	9	13	20
6	Control	7	16	19
7	Control	17	13	16
8	Control	10	7	10
9	Control	7	14	17
10	Control	10	17	19
11	Control	8	7	10
12	Control	14	14	18
13	Control	10	8	11
14	Control	9	17	20
15	Control	12	15	18
16	Control	8	9	12
17	Control	11	15	17
18	Control	10	12	15
19	Control	10	10	13
20	Control	18	8	12
21	Control	10	14	17
22	Control	10	15	19
23	Control	5	17	20
24	Control	9	13	16
25	Control	14	13	16
26	Control	13	7	10
27	Control	10	9	12
28	Control	13	16	19
29	Control	7	18	21
30	Control	11	13	16
31	Control	10	16	20
32	Control	12	12	15
33	Control	12	12	15
34	Control	9	11	16
35	Control	16	16	19
36	Control	9	16	19
37	Control	11	10	13
38	Control	9	12	17

39	Control	12	10	13
40	Control	13	17	20
41	Experiment	17	16	19
42	Experiment	18	12	15
43	Experiment	19	11	20
44	Experiment	11	13	16
45	Experiment	11	19	22
46	Experiment	13	16	19
47	Experiment	10	16	19
48	Experiment	10	16	21
49	Experiment	11	14	17
50	Experiment	13	16	19
51	Experiment	9	15	18
52	Experiment	10	16	19
53	Experiment	13	16	19
54	Experiment	15	16	19
55	Experiment	19	12	15
56	Experiment	7	17	20
57	Experiment	13	13	16
58	Experiment	11	13	16
59	Experiment	13	14	17
60	Experiment	15	12	15
61	Experiment	9	11	14
62	Experiment	5	12	15
63	Experiment	12	13	16
64	Experiment	10	13	16
65	Experiment	15	18	21
66	Experiment	8	14	17
67	Experiment	8	14	17
68	Experiment	9	17	20
69	Experiment	13	13	16
70	Experiment	11	20	23
71	Experiment	13	14	17
72	Experiment	15	16	19
73	Experiment	19	16	18
74	Experiment	16	16	16
75	Experiment	13	15	20
76	Experiment	12	16	17
77	Experiment	10	14	17
78	Experiment	20	13	16
79	Experiment	11	14	19
80	Experiment	11	14	17

APPENDIX VI

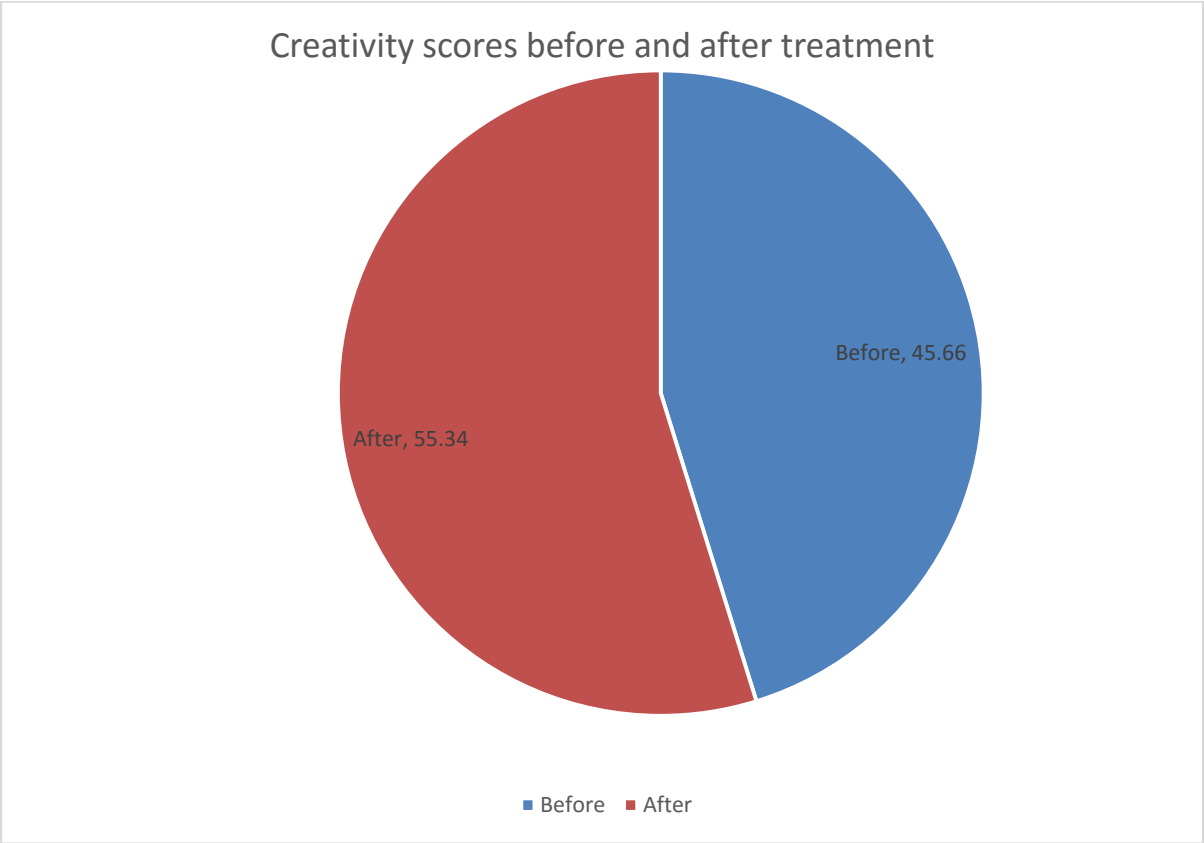
HYPOTHESES FIGURES



Keys: Blue colour-Control

Red color-Experimental

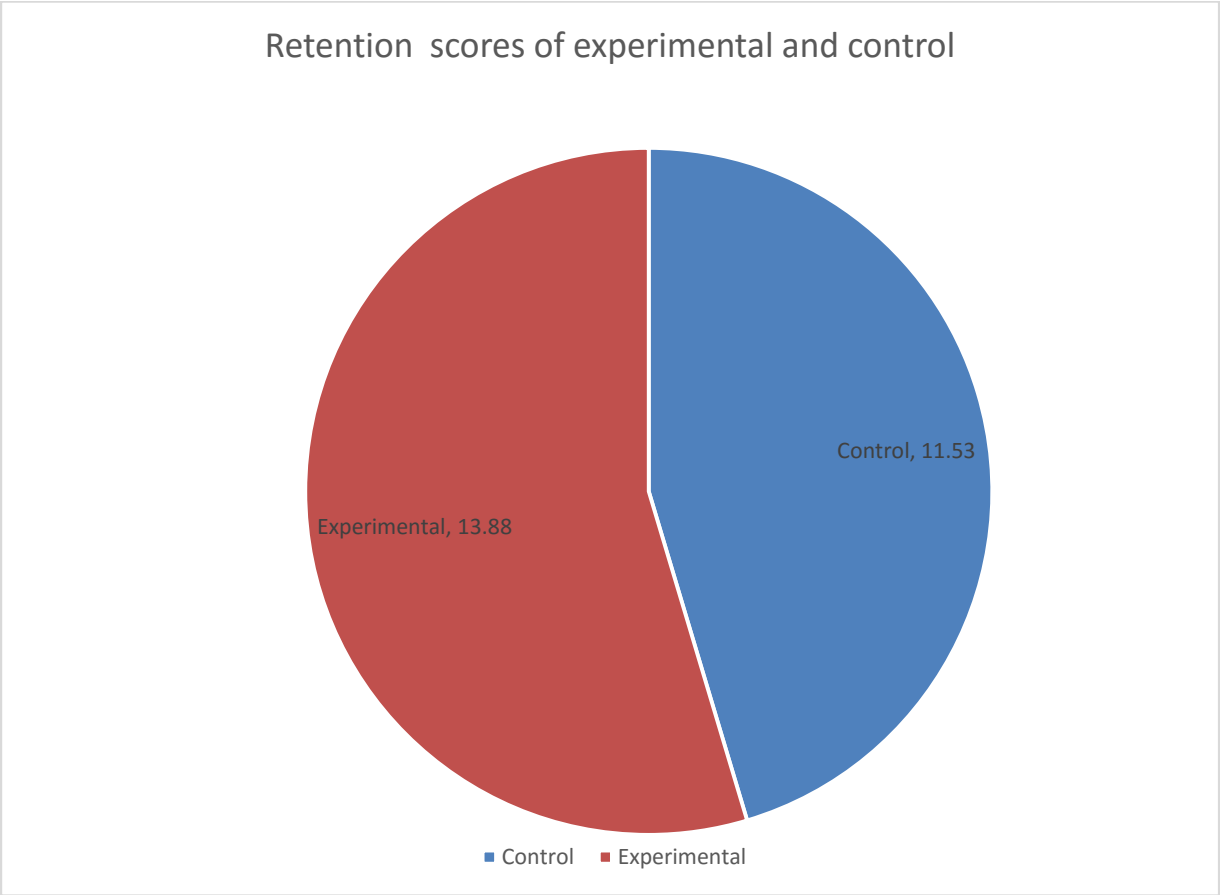
Figure 4.1: Pie chart showing 2-Sample t-test Performance Experimental and ControlGroup.



Keys: Blue colour-Control group

Red colour-Experimental group

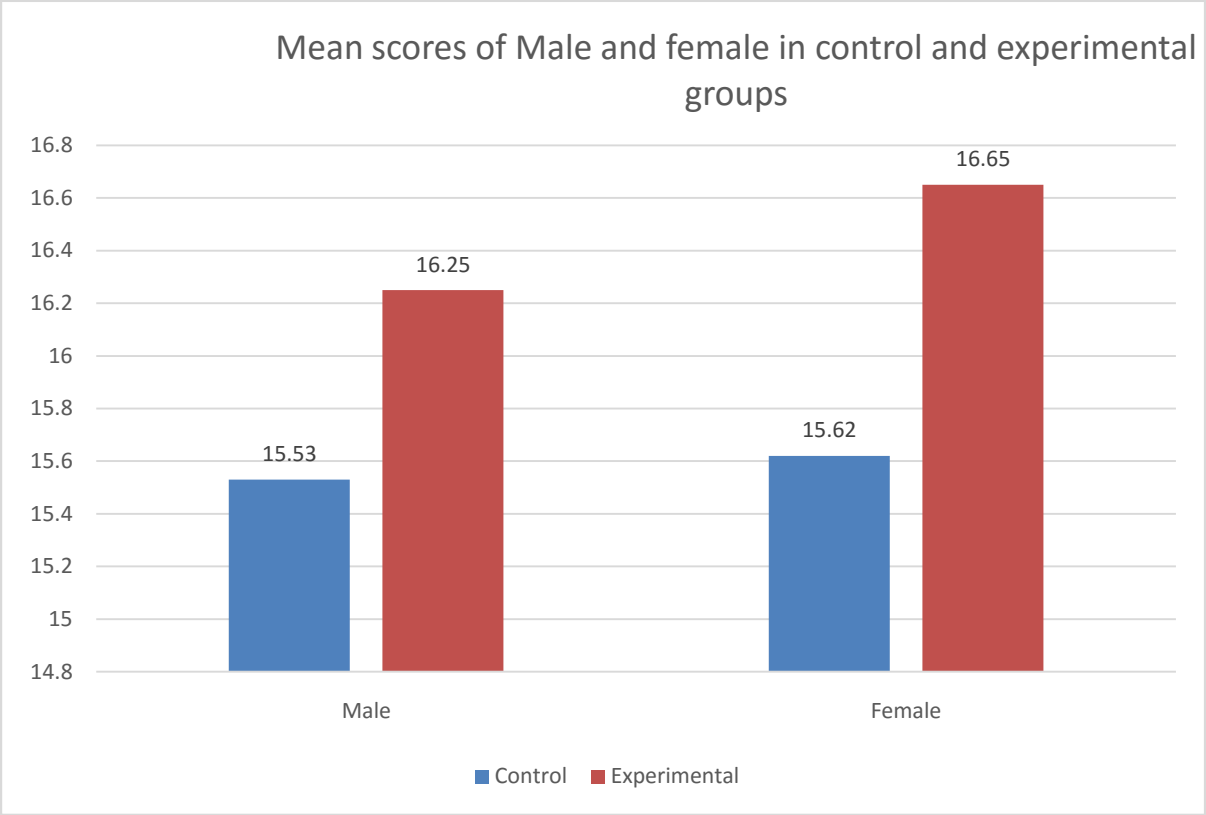
Figure 4.2:Pie-Chart showing the Wilcoxon test on difference in creativity trait between Experimental and Control Group.



Keys: Blue colour-Control group

Red colour-Experimental group

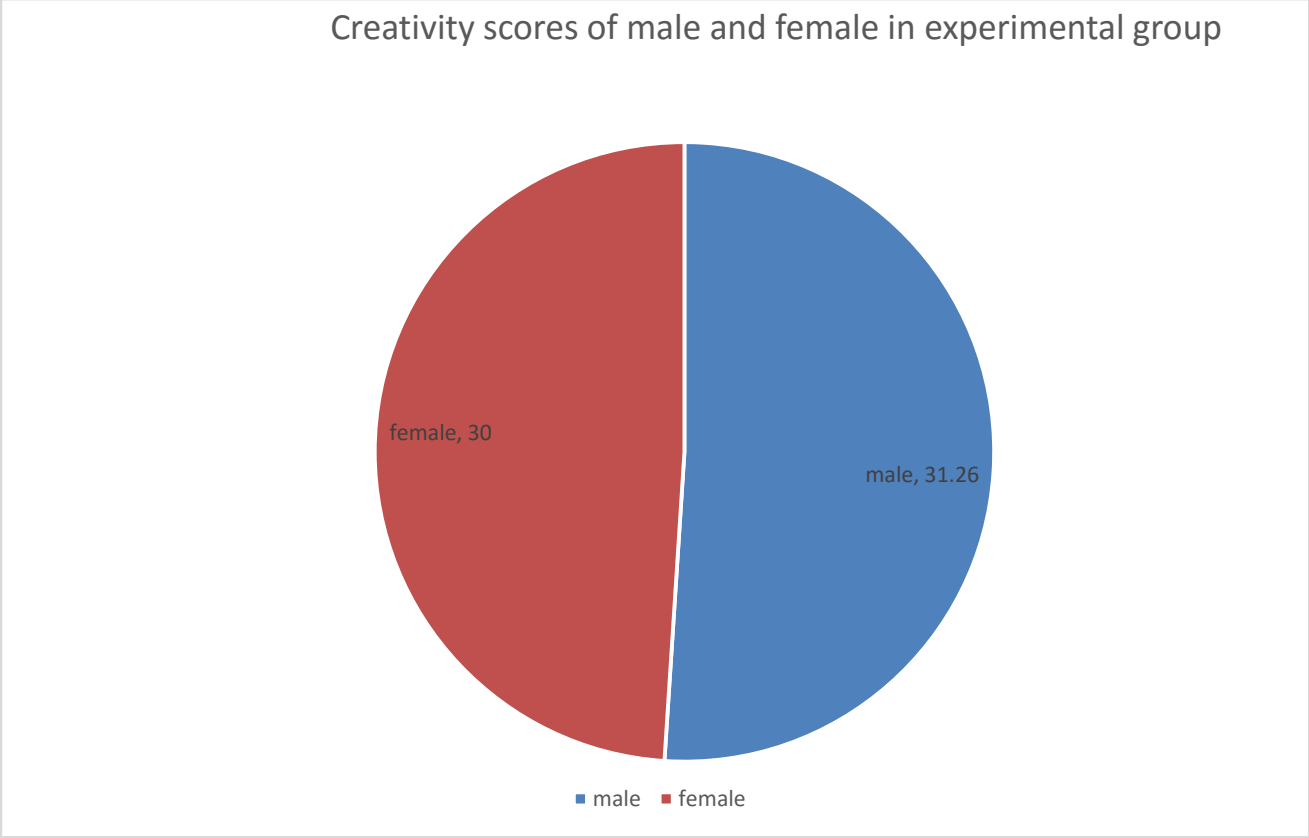
Figure 4.3:Pie chartRetention for control and Experimental



Keys: Blue - male

Red - female

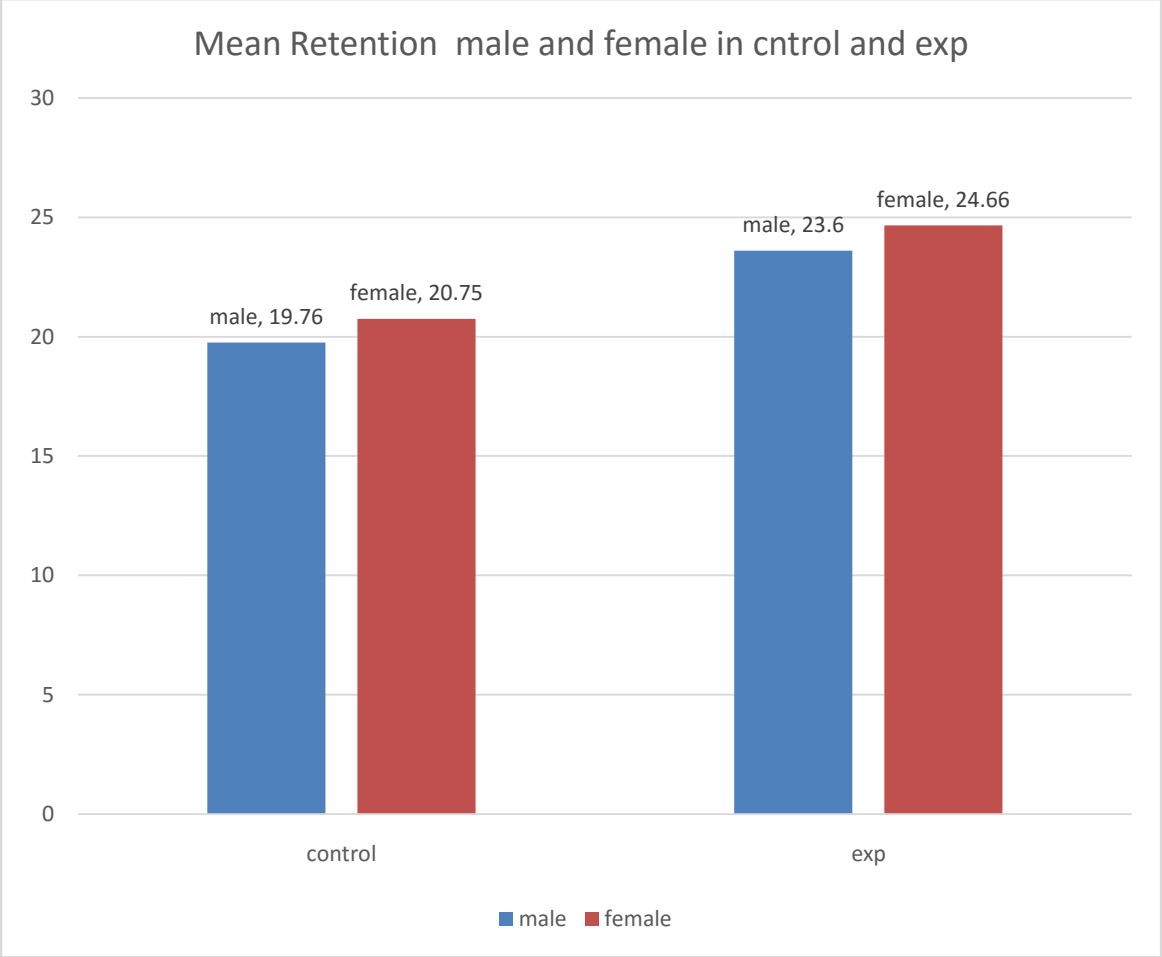
Figure 4.4: Graph of Bar Chart showing Mean Performance Male and Female in Control and Experimental group.



Keys: Blue colour-Control group

Red colour-Experimental group

Figure 4.5: Pie chart showing Mean Creativity trait Male and Female in Cntrol and Experimental groups



Keys: Blue colour-Control group

Red colour-Experimental group

Figure 4.6:Graph of Bar chart showing Mean Retention Male and Female in Cntrol and Experimental group.

APPENDIX VII

ITEMS OF BIOLOGY ACHEIVEMENT TEST

	YEARS/SSCE, WAEC, GCE, NECO	YEARS/JAMB	BIOLOGY FOR SENIOR SEC. SCH.Q&A BY SHINGYU 1997 page 87-91	NEW SYSTEM BIOLOGY TEXT BOOK
Items	Q1. SSCE June 1988, Pg. 3; Q41	Q13.1988 Pg.23 Q46	BAT QUESTIONS. Q5. Pg.90 Q694	BAT QUESTIONS. No Q40. Pg. 286 Q3. Chapter 21
	Q2. SSCE 1991 Pg. 16. Q45	Q14.1989 Pg. 24 Q43	Q6. Pg. 91 Q 701	
	Q3. WASSCE 2003; Pg. 93. Q49	Q15. 1990Q47 Pg. 26	Q7. Pg. 90 Q700	
	Q4. WASSC 2005: Pg. 105 Q 45	Q16 Pg.28 Q48	Q8. Pg. 90 Q 695	
	Q21. SSCE 1988; Pg.3 Q42.	Q17. Pg.70 Q40	Q9. Pg. 90 Q 696	
	Q22. SSCE 1988-2016 Pg.3; Q43	Q18. 1986 Pg. 19, Q49	Q10. Pg. 90 Q697	
	Q23. SSCE 1990. Pg. 12 Q49	Q19. 1993 Pg.32 Q43	Q11.Pg. 90 Q698	
	Q24. SSCE 1990 Pg.12 Q50	Q20. Pg. 62. Q47	Q12. Pg. 90 Q699	
	Q25. WASSCE June 2002. Pg. 85 Q47		Q34. Pg. 86 Q667	
	Q26. WASSCE 2005. Pg. 105 Q46.		Q35. Pg. 87 Q669	
	Q27. WASSCE 2000 June. Pg. 72 Q54&105 Q47	2013	Q36. Pg. 88 Q 680	
	Q28. WASSCE 2008. Pg. 123 Q43		Q39.Pg. 85 Q657	
	Q29. WASSCE 2008. Pg.123 Q44			
	Q30. WAEC Online Q3353			
	Q31. SSCE June 1995.Pg.32 Q49			
	Q32. SSCE 1993. Pg. 24 Q45			
	Q33. SSCE 1993. Pg.24 Q46			
	Q37. SSCE 1995. Pg. 32 Q46			
	Q38. SSCE. 19 Pg. 22 Q43.			

Source: Field Study II, 2019

APPENDIX VIII

Pre-Test

Table 3.2: Testing for uniformity of means using the six schools pretest test scores. Pre-test results.

Descriptive

Pretest

Schools	N	Mean	Std. Deviation	Std. Error
Tudun Jukun	50	8.4400	5.07961	.71837
Dakace	34	9.8235	2.62240	.44974
Gyelesu	50	9.4000	3.23249	.45714
Muchia	50	11.4800	3.47140	.49093
GCC Zaria	50	10.6200	3.37391	.47714
Kofa kuyabana	49	11.6122	3.79043	.54149
Total	283	10.2473	3.86872	.22997

Table 3.3:**Testing for uniformity of Analysis of variance using the six schools pretest test scores.**

Pretest

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	379.532	5	75.906	5.474	.000
Within Groups	3841.154	277	13.867		
Total	4220.686	282			

Table 3.4 Table using Post Hoc Tests Multiple Comparisons

Homogeneous Subsets

Pretest

Scheffe

School	N	Subset for alpha = 0.05	
		1	2
Tudun Jukun	50	8.4400	
Kofa bayana	50	9.4000	
Dakace	34	9.8235	
GCC Zaria	50	10.6200	
Muchia	50		11.4800
Gyelesu	49		11.6122
Sig.		.165	.152

AppendixIX

BIOLOGY ASSESSMENT TEST
SENIOR SECONDARY SCHOOL

SS II

INSTRUCTION: YOU ARE PROVIDED WITH QUESTION 1-40 SELECT THE CORRECT OPTION FROM A-D, AND SHADE ON YOUR ANSWER SHEET THE CORRECT OPTION.

OBJECTIVE QUESTIONS **TIME: 40 minutes**

1. A constituent of the exhaust gases of motor vehicles which causes serious air pollution is:
   a. Water vapour
   b. Carbon dioxide
   c. Carbon monoxide
   d. Oxygen
2. Which of the following may not contribute to environmental pollution?
   a. A solar energy radiation
   b. Industrial waste
   c. Waste disposal
   d. Smoke
3. Improper sewage disposal could be dangerous for the following reasons except:
   a. The smell of carelessly disposed sewage water is most undesirable.
   b. The spread of gastro-intestinal diseases are enhanced.
   c. Resultant outbreak of water-borne diseases.
   d. There would be little space for disposal of wastes
4. Algal bloom depletes oxygen contents of bodies of water polluted by
   a. Industrial effluents
   b. Thermal plant discharge
   c. Raw sewage disposal
   d. Crude oil spillage
5. Pollution may occur under the following conditions except when
   a. Industrial wastes are recycled.
   b. Factories are sited in residential areas

c. Nuclear bombs are tested in the sea

d. Unwanted material are thrown into the rivers

6. Which of the following would not pollute the air

a. Fertilizer

b. Aerosol pesticides

c. Automobile exhaust fumes

d. Industrial fumes

7. Pouring oil on the surface of stagnant water is a control measure for the spread of malaria because oil

a. Destroy source of food for the larvae of mosquitos.

b. Destroys the eggs of the malaria parasites

c. Blocks the breeding tubes of mosquitos to larva and pupae

d. Makes water unsuitable for the breeding of the malarial parasites.

Use the following list to answer question 8-11

i. Contour ploughing	ii Crop rotation
iii. Factory waste	iv. Pest control
v. Drainage of swamps	vi. Closed season

Which of the above is most closely related to each of the following effects?

8. Cause of stream pollution

a. II b. III c. IV d. V

9. Restoration of crop destruction

a. I b. II c. III d. IV

10. Prevention of crop destruction

a. I b. II c III d. IV

11. Prevention of the formation of gullies

a. I b. II c III d. IV

12. Which of the following methods is not suitable for the disposal of household refuse.

a. Dumping it in fast flowing streams

b. Burying it in uncultivated lands.

c. Putting it into an incinerator

d. Putting it into compost pits

13. Which of the following causes pollution?

a. Consumption of canned drinks

b. The addition of fertilizer to farmland

c. Respiration of living organism

d. Burning of refuse

14. Which of the ways of controlling bilharzias can result in pollution?

a. Cleaning water weeds on which the snails feed.

b. Treating infected people with drugs

c. Preventing contamination of water by infected urine and feaces

d. Applying chemical to kill the snails.

15. Which of the following constitutes pollution?

a. Dropping from birds

b. Loud disco music

c. A pack of cigarette

d. Refuse in an incinerator

16. Sources of pollution are"

a. Industrial chimneys, burning fossil oils and river dams

b. Sulphur dioxide, acid rain and pesticides

c. Sulphurmines, vehicle exhausts and aerosols.

d. Sewage, smoke and oil vehicles

17. A pollutant that is biodegradable is

a. Crude oil b. Heavy metalc. Cellophaned. Sewage

18. The following are methods of soil conservation except

a. Contour terracing b. Strip cropping

c. Contour ploughing d. Mixed grazing

19. Soil fertility can be conserved and renewed by

a. Yearly monocropping

b. Crop rotation and cover crops.

c. Bush burning to remove unwanted debris

d. Avoiding artificial manures

20. Which of the following animals is most adapted for water conservation

a. Earth worms b. Mammals

c. Flatworms d. Insects

21. Which of the following steps would not be taken to protect or conserve fishing grounds from over exploitation.

a. Use of net with all sizes of mesh

b. Use of nets with a particular mesh size
c. Ban on harvesting of some species
d. Regulating the size of ships allowed into fishing grounds.

22. Which of the following is not part of the objectives of conservation of natural resources?
    a. To eliminate wild animals in order to enable other plants and animals survive.
    b. To use our resources on sustained yield basis.
    c. To guard against indiscriminate killing of plants and animals.
    d. To guard against the extinction and exhaustion of natural resources.
23. The conservation of natural resources can be achieved by the following except
    a. Creation of national parks
    b. Formation of conservation societies and agencies
    c. Establishment of game reserves
    d. Deregulated harvesting
24. Water rises most rapidly in
    a. Sandy soil b. Clayey soil
    c. Sandy–loam soil d. Loamy soil
25. Wildlife conservation is enhanced by
    a. Enacting laws to encourage poaching
    b. Discouraging elimination of endangered species
    c. Encouraging creation of satellite hunting unit
    d. Suppressing the activities of wildlife conservation agencies.
26. Conservation of wild life is necessary mainly because
    a. Wild species cannot resist diseases better than their domesticated species.
    b. Many predators wild animals help in control of pests.
    c. Many people derive pleasure from observing wild animals.
    d. It helps to prevent extinction of species
27. Which of the following is not a means of conservation?
    a. Controlling of excessive deforestation
    b. Preventing of poaching
    c. Replacing harvested mature feeds with seedlings

d. Burning of vegetation before cropping

28. To avoid over fishing in a lake, the following measures may be helpful except

a. Limited Fishing periods b. Regulating the size of nets

c. Fishing throughout the year d. Fish breeding exercise

29. Conservation may be promoted by

a. Encouraging tree planting b. Systematic deforestation

c. Overgrazing of pastures d. Unabated bush burning

30. Which of the following practices does not contribute to the preservation and improvement of the environment?

a. Pollution reduction b. Material recycling

c. Reafforestation d. Overgrazing

31. Which of the natural resources is most readily available to all living organism?

a. Water b. Oil c. Food d. Air

32. The following agencies are responsible for conservation in Nigeria except

a. Forestry Departments

b. Nigerian Conservation Society

c. Game Reserve Authority

d. Nigerian Red Cross Society

33. The largest game reserve in Nigeria is the

a. Kainji Game Reserve in Niger State

b. Zamfara Forest Reserve in Sokoto State

c. Yankari Game Reserve in Bauchi State

d. Borgu Game Reserve in Niger State

34. Which of the following crops increases the nitrogen content of the soil?

a. Maize b. Potato

c. Cassava d. Beans

35. A sample of soil was heated at $92^{o}C$ in a steam oven for two days after which a decrease in weight was noted. Which of the following account for this decrease? A loss of:

a. Water and air

b. Microorganism, air and rock particles.

c. Water, clay and air

d. Water, humus and micro-organism

36. Soil that contains an average proportion of all soil components with good humus content is described as:

a. Loam b. Clay

c. Sand d. Silt

37. Prevention of erosion could be best be carried out by

a. Crop rotation and mulching

b. Contouring of slopping ground and afforestation.

c. Grazing, terracing and shifting cultivation

d. Strip cropping and poaching.

38. The role of dead organism matter in the soil is to

a. Make the soil black

b. Increase the mineral salt content

c. Provide food for all living organisms

d. Increase the acidity of the soil

e. Soil acidity calcium carbonate

f. Calcium carbonate

g. Magnesium

h. Copper carbonate

39. Which of the following is not a conservable natural resources?

a. Water b. Sunlight c. Forest d. Soil

40. Which of the following best describe the biological control of pests of crops.

a. Use of pesticide to kill pests and vectors.

b. Eliminate pests using traps.

c. Using of crop rotation to break life cycle of pests.

d. Introduce natural predators to control population of pests.

Appendix XI

BIOLOGY ASSESSMENT TEST MARKING SCHEME
SENIOR SECONDARY SCHOOL

SS II
ANSWERS FOR THE OBJECTIVES

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

REFERENCES

1. Senior School Certificate Examination Past Question and Answers for WASSCE, SSCE, NECO and GCE Biology (1988-2009) Theory, Objectives and Practicals.

2. Senior School Certificate Examination Past Question and Answers for SSCE, GCE and NECO BiologyTheory and Objectives with Practicals (1988-2016)

3. Shingyu, O. (1997). Ecology, Pollution, Conservation of Natural Resource. Biology for Senior Secondary School Revision Questions. Zamani College Kaduna. 87-91

4. JAMB Biology (1978-2013) Past questions and answers UME Exam, Success guide.

5. Kwan, L.P.E.Y.K. and Ofoefuna, J.O. (2011). New System Biology New System Biology for Senior Secondary Schools.

Appendix XII

SENIOR SECONDARY SCHOOL (SSS II)
BIOLOGY ASSESSMENT TEST (PERFORMANCE/RETENTION)

ANSWER SHEET 2018

S/N:_____

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

Appendix XIII

LETTER TO VALIDATORS OF THE INSTRUMENTS
DEPARTMENT OF SCIENCE EDUCATION
FACULTY OF EDUCATION
AHMADU BELLO UNIVERSITY, ZARIA

16th December, 2017

Dear Sir/Ma,

VALIDATION OF INSTRUMENTS

I am a Ph.D student in the above mentioned Department working on "Effect of 5E Learning Model on on Creativity,Performance and Retention among Senior Secondary Schools in Zaria, Kaduna State. Nigria" I have two instruments for use in the research and they are as follows:

(i) Biology Achievement Test (BAT)
(ii) Creativity Assessment Scale (CAS)

Sir/Ma kindly validates the instruments applicable to you as is related to your field.

Yours faithfully,

JESULOWO, Janet Funke
PHD/EDUC/7393/09-10

Appendix XIV: Letter of Introduction.

DEPARTMENT OF SCIENCE EDUCATION

AHMADU BELLO UNIVERSITY ZARIA

Vice Chancellor: **Professor Ibrahim Garba** B.Sc, M.Sc(ABU) Ph.D DIC (London), FNMGS
Head of Department: **Professor Sani Sale Bichi** NCE, B.Ed, M.Ed, Ph.D(ABU), AKC. Lond

Your Ref:
Our Ref: DSE/R/I/Vol.1

Date: 26th June, 2018

~~THE HEAD~~ The Director
Zaria Zonal Office
Education Zone.

Dear Sir/Madam,

PG INTRODUCTORY LETTER TO ACCESS RESEARCH DATA

This is to introduce the bearer, JESULOWO, Janet Funke with registration number PHD/EDUC/7393/09-10, is one of our PHD SCIENCE EDUCATION (BIOLOGY) students who is working on the topic: EFFECT OF 5E LEARNING MODEL ON CREATI PERFORMANCE AND RETENTION AMONG SENIOR SECONDARY SCHOOL II IN ZARIA METROPOLIS, KADUNA STATE NIGERIA

Please accord her every necessary assistance to enable her get access to da for her study.

A
HOD PRS.
Research std for your
further action pls.
27/6
18

Yours faithfully,

H.O.D
SCIENCE EDUCATION
A.B.U. Zaria

Professor S.S. Bichi
Head, Science Education Department

Ministry Of Education Science
and Technology

Zonal Office Headquarters,

Zaria

Date 27 - 06 - 2018

The Principal / Proprietor,

Gss Gyellesu

Zaria

LETTER OF INTRODUCTION

JESULOWO, Janet Funke

The bearer is a Phd student of Science Edu in the department of / from Science Education Faculty of Educ. A.B.U Zaria and wish to conduct a research in the following areas:-

1. Effect of 5E-Learning model on creativity, Perfo
2. and Retention among Senior Secondary School II
3. Zaria metropolis Kaduna State Nigeria.
4. _____
5. _____

I am directed to request you to allow him/ her the use of your facilities accordingly please.

27/6/2018

Fatima D Ismail
H.O.D, P.R.S
For: - Director

Ministry Of Education Science
and Technology

Zonal Office Headquarters,

Zaria

Date 27-06-2018

The Principal / Proprietor,

Miss Muchia
(Snr.)
Esq.

LETTER OF INTRODUCTION

JESULOWO, Janet Funke

The bearer is a Phd Student of Science Edu in the department of / from - Science Education, Faculty of Education A.B.U Zaria and wish to conduct a research in the following areas:-

1. Effect of 5E-Learning model on Creativity,
2. Performance and Retention among Senior
3. Secondary School II in Zaria Metropolis
4. Kaduna State, Nigeria.
5.

I am directed to request you to allow him/ her the use of your facilities accordingly please.

27/6

Fatima D Ismail
H.O.D, P.R.S
For: - Director

Appendix XV

LIST OF PLATES

Plate 1: Showing the researcher and the students.

Plate 2: Showing Experimental Group Exploring stage.

Plate 3: Showing Explaination by a student

Plate 4: Showing Students in Experimental Group of Elaborate stage

Plate 5: Showing Students Performance and Retention Test control group.

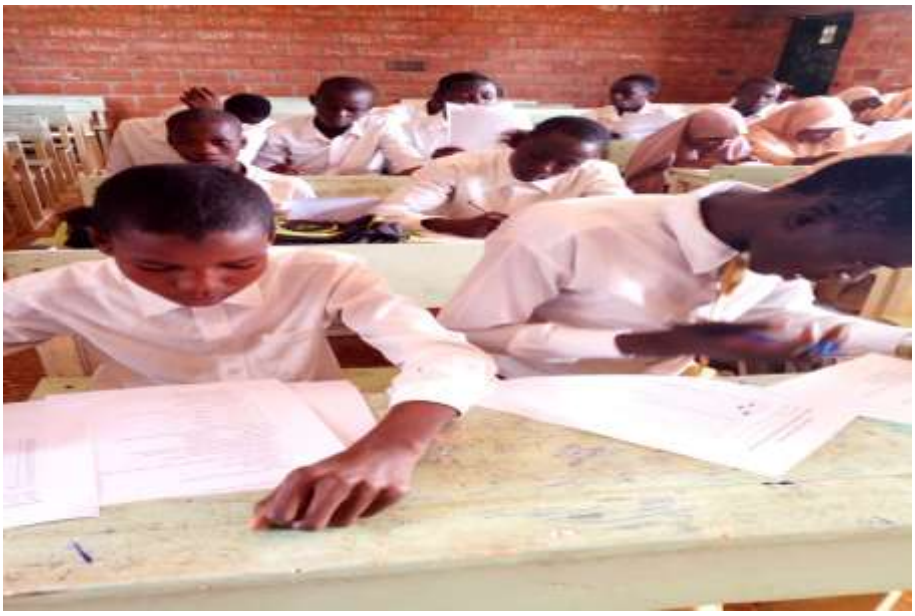


Plate 6: Showing Students Performance and Retention Test

Plate 7: Showing Specimens

Plate 8: Showing Specimen display for students work.

Plate 9: Showing Specimen display for students work.

Plate 10: Showing Researcher Evalution Stage and data collection.