

**EFFECT OF COMPUTER ASSISTED INSTRUCTION ON ACADEMIC
PERFORMANCE OF AGRICULTURAL SCIENCE STUDENTS IN COLLEGE
OF EDUCATION GIDAN-WAYA, KADUNA STATE NIGERIA**

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**DEPARTMENT OF VOCATIONAL AND TECHNICAL EDUCATION,
FACULTY OF EDUCATION,
AHMADU BELLO UNIVERSITY,
ZARIA NIGERIA**

NOVEMBER, 2017

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**A DISSERTATION SUBMITTED TO THE SCHOOL OF POSTGRADUATE
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FACULTY OF EDUCATION,
AHMADU BELLO UNIVERSITY,
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NOVEMBER, 2017

DECLARATION

I declare that the work in this dissertation titled effect of Computer Assisted Instruction on Academic Performance of Agricultural Science Students in College of Education Gidanwaya Kaduna state, Nigeria, has been carried out by me in the Department of Vocational and Technical Education. The information derived from the literature has been duly acknowledged in the text and a list of references provided. No part of this dissertation was previously presented for another degree or diploma at this or any other institution.

Yusuf AGWAM

SIGNATURE

DATE

CERTIFICATION

This Dissertation titled EFFECT OF COMPUTER ASSISTED INSTRUCTION ON THE ACADEMIC PERFORMANCE OF AGRICULTURAL SCIENCE STUDENTS IN COLLEGE OF EDUCATION, GIDAN-WAYA, KADUNA STATE, NIGERIA by Yusuf AGWAM meets the regulations governing the award of master of Science in Agricultural Education of Ahmadu Bello University, and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

I gladly dedicate this work to my Late father, Mr. John ZakkaAgwam, my wonderful mother, Mrs. Alice John ZakkaAgwam, my darling, beloved wife, PheobeJohnAgwam, and my lovely children-Joshua and Jonah.

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ABSTRACT

This study determined the effect of computer assisted instruction on the academic performance of agricultural Science students in Kaduna State College of Education Gidan-Waya, Kaduna State Nigeria. The study had four specific objectives. Four research questions stated and four research hypotheses were formulated and tested at 0.05 level of significance. The design adopted for the research was quasi pretest-post-test, experimental design. The population comprised of sixty one (61) students of NCE II 2015/2016 session who offered courses in agricultural education. The experimental groups were made up of 10 students exposed to computer assisted instruction Package (CAI) for seven weeks while the control was a group of 10 students who were taught using conventional lecture method for seven weeks. An instrument consisting of 20 objective questions and two essay questions agricultural science achievement test (ASAT) with reliability of 0.85 was administered during post-test. Data were analyzed using mean, standard deviation and t-test statistic. The findings of the study revealed there was significant difference in objective test of students taught with CAI than those in the control group. It also showed a significant difference between the academic performances of students taught using CAI and those in the control group. The study further showed that there was significant difference in the academic performance of students taught using CAI based on gender with mean scores for both experimental and control group were 41.60 and 48.00 in favour of female students. The researcher concluded that CAI produced better result than the conventional teaching methods. It is recommended that CAI should be used in teaching of agricultural science in colleges of education, and that teachers be provided with modern computers and software's necessary to teach agricultural science.

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LIST OF ABBREVIATIONS

ASAT:	Agricultural Science Achievement Test
CAL:	Computer Aided/Assisted Learning
CAT:	Computer Assisted Teaching
CBE:	Computer Based Education
CBI:	Computer Based Instruction
CCS:	computer conference system
CMI:	Computer Managed Instruction
CMSTA:	Computer Mediated System Teaching Approach
COE:	College Of Education
HMD:	Hyper Model Design
IBM:	International Business Machine Cooperation
ICAL:	Interactive Computer Assisted Learning
ICT:	Information and Communication Technology
ISD:	Instructional System Design
LGA:	Local Government Area
MAL:	Mathematics Achievement Level
NCCE:	National Commission for Colleges of Education
NCE:	Nigeria Certificate in Education
PHCN:	Power Holding Company of Nigeria
PPGD:	Process Poster Group Design
SAAT:	Students Academic Achievement Test
SITE:	Second Information Technology in Education
SSCE:	Senior School Certificate Examination

TOGS: Teacher Operational Grids Social Studies
UBEB: Universal Basic Education Board
WAEC: West African Examination Council

OPERATIONAL DEFINITION OF TERMS

Academic Performance:-This is the numeric score of the students which shows their ability of the students in agricultural science achievement test.

Computer Assisted Instruction:-this is an instructional technology design for a course that uses the computer to deliver instruction to learners both within and outside the classroom setting.

Conventional teaching method: - these are the traditionally known methods used in teaching and learning process. E.g. Lecture and other methods.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Today's technology driven economy has impacted all aspects of society, including the work places (Cord, 2009). This and other development have placed education under great scrutiny, with calls for educational reform from multiple directions. Instructional technology including computers has the potentials to help improve the educative process (Anglin, 2005). The Agricultural education instructional process has been challenged for preferred future teaching and learning. To keep pace with the agricultural industry, agricultural education in our tertiary institutions need new ways to deliver instructions which entirely rest on the shoulders of those saddled with the task of producing the man power in the area of teaching and learning of agricultural science.

The philosophy of the Nigeria Certificate In Education (NCE) (Agricultural education programme) is tied with the National philosophy on agriculture for self reliance based on provision of teachers endowed with balance approach between principles and practice of Agriculture for academic and vocational ends, (NCCE, 2012) agriculture education is a double major subject which is offered on its own and not in combination with any subject. With the following instructional objectives.

1. To provide graduate with the right attitude and knowledge/professional competency in vocational agriculture.
2. To produce teachers who will be capable of motivating student to acquire interest and attitude for agriculture.

3. To develop in the student teacher the appropriate communication skills for effective transmission of agricultural information and skills to a student.
4. To equip the student teacher with adequate knowledge and ability to establish and manage a model school farm effectively.
5. To provide sound background to enhance further academic and professional progression of student teacher (NCCE, 2012).

Computer assisted instruction (CAI) is an interactive instructional method that used computer to present materials, and direct the user to additional material which meets the students need. It can also be used to describe internet based instruction through the use of web page, web bulletin boards, video and real audio, graphics and hard application. CAI is an interactive instructional material and monitor. Its instruction uses a combination of text, graphics, sound and video in the learning process. Computer can be used to teach all subject including agricultural science subjects. The use of computer in the process of teaching and learning has become widespread in education with the development of micro-computers. The fundamental use of computer in teaching and learning as a supplement to the conventional method produced higher achievement by the learners than using the conventional method alone.

CAI was utilized as an educational medium which delivers instructional activities in late 1950s. Achuonye, (2011) states that programming the computer to administer the kind of exercises traditionally given by a teacher on black board, textbook or worksheet is a technology that has been changing rapidly over the past twenty years. CAI is still utilized in drills and practice, tutorial, games, and simulation these are commonly used CAI applications for educational purpose.

Academic achievement is the outcome of educational programme. It is the extent to which a student has achieved his educational goals, it is what students achieved in the studies and how they cope with or accomplish different learning experiences given to them by their teachers (Osuwa, 2002). Academic achievement is commonly measured by examination or continuous assessment (CA) although there is no general agreement on how it is best tested or which aspects are most important, a number of factors have affected the academic performance of students during learning process, this includes individual difference, learning environment, children background among others. (Tukur, 2012)

1.2 Statement of the Problem

Teaching is indeed a complex activity and that of agricultural science seems to be more complex than people may think, because, this teaching and learning of agricultural science does not only start and end in the classroom. Erroneously, people believe that it takes only a good degree in agricultural education to adequately teach the subject at any level. It is worthy to note that effective teaching results when there is a fusion of sound academic knowledge and profound knowledge of the pedagogical principle (Oladeji, Oyeshola & Ikwuakam, 2009). The lack of effective teaching is reported to be the reason for cases of poor students' academic performance in national examination (Masanawa, 2015). Students' performances have continued to fluctuate in schools continuously. WAEC (2015) further revealed that less than 40% of Nigerian students passed at credit levels in agricultural science in the 2014 Senior School Certificate Examination (SSCE).

This has become a source of concern for all stakeholders in Education such as parents, teachers, school administrators and government. In Nigeria today specifically no teacher that teaches agricultural science at any level of education can proudly attest that all is well in the teaching of the subject (Oladeji, et. al. 2009). The situation is attributed to avoidable challenges that range from lack of interest in the subject by the students due to insufficient language of expression and or poor language background (Bakies, 2010). On the other hand, there is an array of teaching methods in agricultural science. These include (discussion, field-trip, demonstration, lecture methods among others) often employed by effective and efficient teachers to bring about desired change in the behavior of students. It is however reported that the declining state of students performance in the examination has continue to prevail. To correct this lapse and adequately improvestudents performance, CAI was introduced into the Nigerian educational system (Momoh-olle, 2013). It is revealing that inadequacy of data on its effect on students' academic performance has continue to plaque. Also lacking in literature is the effect of the CAI strategy on the academic performance of students across gender line particularly in the Kaduna state (Rufai, 2005). It is against this scenario that this study was conducted.

1.3 Objective of the Study

The general objective of the study was to find out the effect of the use of CAI in teaching agricultural science students in Kaduna State College of education Gidan-way. With the following as specific objectives:

1. Determine the effect of using computer assisted instruction (CAI) on academic performance of agricultural science students in objective test in Kaduna State College of Education, Gidan-waya.
2. Determine the effect of using computer assisted instruction (CAI) on academic performance of agricultural science students in essay test in Kaduna State College of Education, Gidan-waya.
3. Compare the difference in objective and essay test performance of students taught agricultural science using computer assisted instruction (CAI) in Kaduna State College of Education, Gidan-way.
4. Determine the difference between performance of male and female students taught agricultural science using computer assisted instruction (CAI) in Kaduna State College of Education, Gidan-waya.

1.4 Research Questions

The following research questions were formulated by the researcher to be answered.

1. What is the effect of using computer assisted instruction (CAI) on students' academic performance in agricultural science in objective test in Kaduna state college of education Gidan-waya.
2. What is the effect of using computer assisted instruction (CAI) on students' academic performance in agricultural science in essay test in Kaduna state College of Education Gidan-Waya.

3. What is the difference in both objective and essay test in academic performance of agricultural science students taught using computer assisted instruction in Kaduna State College of Education Gidan-Waya.
4. What is the effect of using computer assisted instruction (CAI) on academic performance of male and female agricultural science students in Kaduna State College of Education Gidan-Waya.

1.5 Null Hypotheses

The following null hypotheses were formulated and tested in the study

1. There is no significant difference between the academic performance of agricultural science student taught using computer assisted Instruction(CAI)and those taught using conventional teaching method in objective test.
2. There is no significant difference between the academic performance of agricultural science students taught using computer assisted instruction (CAI) and those taught using conventional teaching methodin essay test.
3. There is no significant difference between the academic performance of agricultural science students taught using computer assisted instruction (CAI)and those taught using conventional teaching methodon objective and essay test.
4. There is no significant difference between gender inacademic performance of agricultural science students taught using computer assisted instruction (CAI) and those taught using conventional teaching method.

1.6 Significance of the Study

The outcome of this study will benefit learners, teachers, educators, curriculum planners, and the general public.

Learners:- The study findings will help expose students to recent method of learning considering the recent technological dispensation and motivate them towards learning new concepts and zeal for easy adoption to new and innovative techniques.

Teachers:- a lot of time could be spared for doing other important things while the computer does most of the teaching and the teacher only co-ordinates or controls the class

Educators:- Educators could reshape their world of technological advancement seeing the usefulness of CAI in teaching and learning situation, thereby spurring them into engaging in this recent technological innovation by improving themselves in the use of ICT tools like computer not only as information tools for research alone, but also in discharging their academic duties such as teaching, administration of examination and marking student scripts.

Curriculum planners:- will see the positive outcome as enough evidence to direct their attention toward solid recommendations and enforcement of computer usage in teaching and learning process.

General public:- they will appreciate the importance of computer in the teaching and learning process and consequently assist schools by donating computers and supporting schools financially for better service delivery to the citizenry.

1.7 Basic Assumptions of the Study

In this study the following assumptions were made.

1. CAI helps to enhance students academic performance in agricultural science in Kaduna state college of education Gidan-Waya
2. CAI may not enhance academic performance of agricultural science students in Kaduna state college of education Gidan-way based on gender.

1.8 Delimitation of the Study

This research study was delimited to NCE II students of Agricultural Education Department Kaduna state College of Education Gidan-Waya. The study was also delimited to the use of CAI in teaching AGE 222(Soil fertility). To establish its effect on academic performance of Agricultural science students of college education Gidan-Waya.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.0 Introduction

This chapter deals with the review of related literature under the following subheadings:-

- 2.1 Theoretical Framework
- 2.2 Historical development of computer assisted instruction
- 2.3 Computer assisted instruction in education
- 2.4 Types of computer assisted instruction used in teaching
 - 2.4.1 Models of Computer Assisted Instruction
- 2.5 Characteristics of computer assisted instruction
- 2.6 Benefit of Computer Assisted Instruction
- 2.7 Student academic performance
- 2.8 Gender and Use of Computer Assisted Instruction
- 2.9 Empirical studies
- 2.10 Summary of reviewed literature

2.1 Theoretical Framework

The theoretical basis of this study is derived from the operant conditioning by Skinner as described by Renshowand Taylor (2010). Operant conditioning is a type of conditioning in which a learner achieves some outcome by producing an action which is called the operant. If the operant is followed by something pleasant, the outcome is positively enforced but if it is followed by the removal, (something unpleasant) the

outcome is negatively reinforced. This theory was influential during the heydays of the audio-lingual method which lost favour in 1960s. It was revived after the introduction of the use of computer into education. Skinner's enforcement theory is central to computerized learning especially drills, practice and tutorial learning. Students' behaviour is being permitted to proceed to the next frame when they get the right answer. This indicates that Skinner illustrated how to develop and programme learning sequences to be used directly to designed modules. CAI is supported mostly by the behaviorist views of learning, which is basically based on the principles of practice and enforcement. Here, when learning is effective, the learner moves onto the next task having been able to deal with the old task. Here, learning is seen as a step by step process and when any new concept is learned, there is fulfillment in the learners mind and readiness to learn more. These views helped and guided this study in the use and application of CAI to teach agricultural science topics with a view to understanding students learning outcome.

2.2 Historical Development of Computer Assisted Instruction

The national policy on computer education in Nigeria which was launched in 1988, according to Audu and Agbo (2008) encouraged the use of computer to facilitate learning in Nigerian educational institutions. Nwaji (2006) noted that computer is among the new generation of educational technologies in developing countries like Nigeria.

According to Audu and Agbo (2008) CAI was first coined by Patric Soppesan, which started in what was viewed as a collaboration between educators at Stanford University in California and International Business Machines Cooperation (IBM) in the mid 1950s and early 1960s. Yusuf and Afolabi (2005) introduced it into the teaching of selected elementary schools. Initially CAI programmes were a linear presentation

of information with drill and practice sessions. These early CAI systems were limited by computers that were available at that time. In Nigeria early CAI system was initiated by the University of Ilorin in the early 1960s and developed to control data cooperation for higher learning and the use of had computers for assisting instructions. Three Years later, virtually all schools in most countries were equipped with teaching computers. In Nigeria virtually every educational institution have keyed into to the vision of providing computers for use in teaching and learning. This is further buttressed by a statement made in the draft policy of the national information communication technology (ICT, 2012). Which mention that government will provide computers in public places such as schools, public libraries among others for educational purposes.

2.3 Computer Assisted Instruction in Education

There are many ways the computer is used in education. The one directly related to instruction are known as CAI, computer based training (CBT) interactive computer assisted learning (ICAL), or computer conference system (CCS), (Whoji 2012). The most commonly used label for computer used in instruction at the present time is computer assisted instruction (CAI). Other labels according to Whoji (2012), includes computer managed instruction (CMI), computer assisted learning (CAL), and computer supported learning aid (CSL). Computer based education (CBE), is the general term and it is often used to refer to any computerized system of education. According to Aggarwal, (2009) CBE has no fixed hardware, software or courseware system. It is merely seen as a term used to describe an educational environment that is characterized by the use of computerized technology to aid the learning process.

The term computer assisted instruction (CAI) and computer assisted learning (CAL) have often been used synonymously. But as noted by Calton(2006) CAI is a terminology used in the United States of America while CAL is used in United Kingdom and elsewhere. Both terms and also computer assisted teaching CAT will be viewed as synonymous terms. Computer assisted instruction (CAI) makes use of computer directly as a medium of instruction and an information delivery system. This means an instruction design whereby computer systems deliver instruction directly to learners by allowing them to interact with designed lessons that have been programmed into the system. Calton(2006) defines computer assisted instruction as a teaching process involving the computer in the presentation of instructional materials in an interactive mode to provide and control the individualized learning environment for each individual student. This interactive modes are usually sub-divided into drills and practice, tutorial, simulation and gaming and problem solving.

This definition by Calton, (2006)clearly shows that CAI has focus on individualization of instruction. Computer assisted instruction is usually designed and presented in a way that the attention of the learner is generated right from the onset of the learning process.The attention is sustained and maintained through appropriate programming and the stimulus response chain of activities (Aggarwal, 2009). CAI assumes direct instructional role and hence divorces the learner from the instructor through deliberate programming which entails providing either new information or avenues for drills and practice of skill previously acquired through the teacher in person or the computer teacher.

2.4 Types of Computer Assisted Instruction used in teaching

Hussain, (2010) defines three levels of computers assisted instruction as drills and practice, tutorial and dialogue.

Drill and Practice: This is the simplest and lowest level. It assumes that a concept, skill or procedure has previously been taught to the learner. This level is to perfect and reinforce previously learned concept, skills, rules and procedures in this level the learner is led. Through a series of examples so as to increase dexterity and fluency in using the skill learners work through computer - drill in mathematics, science, foreign languages, spelling, reading, etc. Usually practice and drill programmes provide different sets of questions with varied formats at this level the computer asks questions and seeks responses objectively using a very respective type of procedure.

Learners are given the opportunity to try several times before the correct answer is represented by the computer. Practice and drill levels has the future of offering individualized instruction, whereby the learners are usually allowed to determine the level of difficulty, the volume of work and the contents to be covered in each practice and drill programme. Different levels of difficulty are incorporated, in fact, the practice and drill level consist of series of questions and answers that are usually computer generated in a random pattern in varying quantities and levels of difficulty in accordance to individual capabilities and needs. This level tries to consolidate and ensure proper mastery of information.

Tutorials: For this level, Moduser, Tur-Kaspa & Lerthe, (2009) are of the opinion that tutorial lecturing includes both the presentation of information and its extension into different form of work and the computer essentially acts as the teacher or instructor. The

tutorial level takes over the main computer programme. Every interaction is between the computer and the learner. The computer presents new concepts and principles and once the learner exhibits clear understanding, he immediately goes over to the next activity. The pattern followed in this level is essentially that of branching programmed instruction in that, instruction is presented in small units followed by a question, the response by the learner is analyzed by the computer in comparison with responses programmed into the computer by the programme writer or author and appropriate feedback is given.

It can thus be said that tutorial level of the CAI makes it a teaching machine and most of all a programmed instruction content materials are presented in small steps or unit, active learner participation enlisted, in addition to frequent feedback and reinforcement. In designing computer programme for tutorial level, the same precise analysis of the learning task and specification of objectives must be used as is used in designing programmed instruction texts.

Dialogue: This is the highest level and it involves a sophisticated interaction between the learner and the computer. The learner can interact or communicate with the machine by giving the responses and also asking new questions, which the computer understands. (Muhammad, 2005)

Game: Ugwu (2005) views an instructional game as a structured activity which sets rules for play in which two or more students interact to reach clearly designed instructional objectives. A game is an activity in which participants follow prescribed rules that differ from those of reality as they strive to attain a challenging goal. Games have the potentially relaxed atmosphere and this has proven to be very conducive to effective learning. The positive influence of gaming in the instructional process is highly enhanced

by computer. Instructional games via computer are probably very similar to practice and drill level of CA1. This one can rightly say that games via computer are particularly appropriate for practice and drill of learning.

Ugwu, (2005) also observe that drill and practice exercises can become tedious, leading to rapid turn-out of interest, hence putting the practice and drill exercises into game format will make it more reliable. This will help keep a learner on task for along time and with great satisfaction. In any game mode, there are rules, peculiar moves/elements of competition or co-operation and the framework which provides a game-like situation through learner to interact with the computer. Ugwu (2005) observes that an important purpose of use of game in instruction is to motivate learners to interact with instructional material. Gaming can be a highly motivating framework, especially for repetitions drills. Computer has been found useful in mathematics, social science, languages, arts etc.

Simulation: Simulation refer to a concentrated learning exercise especially designed to present important real life activities by providing the learners with the essence or essential elements of the real or actual situation without its hazards, cost or time constraint. Put simply, simulation usually plays a role that involves them in interactions with other persons and or some other elements of the simulated environment. Simulations provide a framework for implementing discovery learning, experimental learning or deduction teaching/learning strategies. Computer is also useful in simulation exercise. Learners involve in simulation exercise are able to manipulate things which might otherwise be too voluminous, time consuming costly, risky, dangerous, and impractical in the ordinary classroom or laboratory settings. Aggarwal, (2009) observes that in a setting where

computer incorporates simulation, learner is focused on the simulated experience in which they can freely manipulate the computer controlled model which has replaced the real objects, people, etc. When the attributes of a simulation and those of a game are conducted we have a simulation game.

Problem solving: Modusertur-Kaspa and Leither, (2009) categorize problem solving into two. The first is usually written by the learner or another person to assist a learner solve problems. In learner written programmes, a learner defines problems logically and writes a computer programme to solve the problem. In this instance the computer carries out the required calculations and or manipulations to provide the audience to the learner. Thus the computer assists the learner attain problem solving skills by carrying out complex calculations and manipulations. The other category is where the computer is the problem solver in this instance the computer makes the calculation and the learner manipulates one or more variables. Perez (2007) and Day (2006) are of the view that this approach helps children develop specific problem solving skills and strategies.

Information Handling: Clark and Feldson, (2005) opine that another use of computer in instruction is the handling and processing of information such that it can be called upon by the learner, the teacher and even the school counselor or a researcher. An area in which the information-handling capacity of computer is being utilized to advantage is in guidance and counseling.

2.4.1 Models of Computer Assisted Instruction

There are two models of designing interactive educational programmes. The first is instructional system design (ISD), the traditional model determines on goals, set objectives, deliver instruction, formulates test questions and evaluates learning. The

second, hyper media design (HND), focuses the students goal and quest to access information. While, ISD is concerned with designed goals, HMD focuses on users goals. Selection of CAI web based design should be base on whether the programme is well designed and meet the needs of intended users (Dewald, 1999). There are many design models for CAI available in developed countries. One model developed by Fourier in 1994 consisted of seven phases.

1. Determination of the need and situation analysis.
2. Formulation of aims and performance objectives and development of items for evaluation.
3. Design of study materials including strategy development, teaching strategy and media selection and integration (e.g. the inclusion of sound and video).
4. Development and preparation of programmes.
5. Implementation and usage.
6. Assessment of student progress.
7. Formative and summative evaluation on a continues basis.

2.5 Characteristics of Computer Assisted Instruction

Computer assisted instruction has been perceived as being interactive. Audu&Agbo, (2008) conclude that the learner is an active participant and actually interact by responding to the stimulus materials presented by the computer. Computer assisted instruction affords the learner the opportunity of interacting with expert that they would not normally have been opportuned to relate with face to face. A team of experts can produce programmes that can be used simultaneously by learners at

different locations. Some characteristics common to computer assisted instruction are hereby presented and discussed.

Learner Controlled Instruction: The learner has control over his learning in terms of choice of material and this is usually in accordance with his intellectual ability. It should be noted that the kind of material that can be incorporated in the course are:

- i. Diagnosis materials which are linear and this allow one path for all learners.
- ii. Review materials, the review materials allow a lot of flexibility in respect of what learner would wish to study, the time he would want to devote to the material and also the level of difficulty he would want to attempt in simple terms with computer assisted instruction, learners are allowed some control over the rate and sequence of this learning,

Feedback Possibilities for the Learners: This seems to be most important and perhaps the most impressive characteristics of computer assisted instruction, feedback in CAI can be of two types, immediate and delayed. Immediate feedback is usually used in an active learner encounter so as to inform the learner of the correctness or otherwise of his responses to stimuli when interest is on giving feedback to the learner when learning task is completed. The delayed feedback would be adopted, thus delayed feedback is used when a test is administered at the end of a task and learners have responded or completed the test accordingly. Whatever the type of feedback, the highly personalized responses to learner action associated with CAI yield a high rate of reinforcement.

- i. **Self-spacing:** This means that the learner goes through the learning activities in accordance with his speed and ability.

- ii. **The lessons have more than one purpose:** Multipurpose lessons are usually provided in C.A.I. multipurpose lesson allow some learning activities to be utilized to reach different objectives.
- iii. **The Designer Informed about Content:** In C.A.I system, the teacher is able to breakdown the content or subject matter and generate optional paths. The teacher who is a C.A.I software designer become better informed about the intricacies associated with learner and instruction.
- iv. **Multiple Users Characteristics:** The C.A.I programmes are such that many students can utilize the same lesson at one time.
- v. **Random access C.A.I:** The random generator facility possessed by C.A.I makes the presentation to students of a variety of stimuli and problem possible.
- vi. **Editorial Ease and Revision Possibilities C.A.I:** Is associated with dynamic instructional thoroughness and modification flexibility. It is very easy with C.A.I composed to other media of instruction to remove, replace modify any activity or information. There is always possibilities of constant updating and improvement of instruction in CAI system.
- vii. **Adaptability of Instruction:** The methods or strategies of instruction can be modified or changed so as to meet the needs abilities or interest of the learners, several paths can be provided within a single lesson and thus learners can make their choice of path to follow. Also the range, depth and topic of a lesson can be modified, or changed to meet the needs abilities and interest of the learners.

2.6 Benefits of Computer Assisted Instruction

Leo (2007) pointed out those recent advances in computer technology offers several benefits which includes access and quality.

Access and Quality

Computer Assisted Instruction increases the quality and standard of education system and institution. Well developed software eliminates the problem of poor lesson presentation, which often characterizes public presentation. Aspects such as fatigue burden, and loss of attention could be minimized (Quinn, 2000).

Benefits for Learners

This enables the learner exercise control over where and when to study and it allows them to direct their own learning (Rouse, 2009). Also, it assists the learner to see their own pace of studying. The learner can switch the computer off and go for a walk to restore their concentration even before the lesson has been completed (Quinn, 2000). Computer Assisted Instruction increases the possibility of having enjoyable learning experience. The individual nature of computer Assisted Instruction leads to decrease experience of peer pressure on the part of the educator. The learners experience more freedom to learn from their mistakes, or to repeat sections, which they struggle to understand. These promote learning retention (Joose, 2006).

Benefit for Educators

Computer Assisted Instruction free the educator from reputations aspect of teaching and enable them to become more of facilitator of learning and communication,

than a transmitter of information. It accesses their work hard and allow more time for course development (Joose, 2006).

Increase Motivation and Reinforcement

It increases motivation and reinforcement. Interactive science games stimulate learning through fun competition by bringing science to video age in a format they respond to. It was notated that high school Biology students that had interactive video disc/computer lesson indicated an overall level satisfaction with the strategy. The students frequently remarked that video disk instruction gives them more efficient use of instructional time than the conventional mode (Ajewole, Jegede and Okebukola 2000). Noted further that the computer appeared to be a strong motivational device for students identified as educationally disadvantage and it burthens the scope of the scientific content that can be included in the curriculum.

Improves problem solving and critical thinking skills

It improves problem solving and critical thinking skills. Studies by Beth Wilson (1988), showed that thoughtfully designed computer software can present multiple dynamically linked representation in ways that are impossible with static media, such as books and chalkboards. Some of the most fruitful application of computer technology drive it capacity to present educationally powerful. Dynamic visual image particularly in the area of science, different representation of complex idea emphasized different aspect of the idea and afford different sorts of analysis (Beth Wilson, 1988). It reduces time and cost to tolerable level. This indicates that with CAI it can take the result of real

experiment, difficult or costly to produce in teaching situation and make computer simulations.

2.7 Students Academic Performance

Students Upon graduation from universities, may either continue their studies into the post-graduate or become manpower for government and private sector. Thus, students academic performances are critical in ensuring that the supply chain is maintained. Academic performance according to Rothstein (2009), refers to a successful accomplishment of performance in particular subject area. It is indicated by grades, marks and score of descriptive commentaries. Academic performance, refers to how students deal with their studies and how they cope with or accomplish different task given to them by their teachers in a fixed time or academic year. Performance of students has for long generated a lot of interest among educators, researchers, government officials, parents, and the students themselves. Many studies have examined the factors that influence students performance in primary and secondary education as well as at other levels, with purpose of enhancing learning at these stages and reducing drop-out. Performance of students' according to Condrand Chambers (2008), cangenerally bereferredto as the way and manner students deal with their studies and how they cope with or accomplish different tasks given to them by their teachers. In other words, it is students ability to study and remember facts and being able to communicate knowledge verbally or on paper. Kobaland and Musek (2011) defineacademic performance as performance on task with measures including comprehension, quality and accuracy of answers of tests, quality and accuracy problem solving, frequently and quantity of desired outcome, time or rate to solution, time on task, level reasoning and critical thinking

creativity, recall and retention and transfer of tasks. Lafer and Marker (2009) explained that there are broad groups of definitions of academic performance. The first one refers to numerical scores of a pupils knowledge, which measure the degree of a pupil's adaptation to school work and to the educational system. The second group is a more subjective one, it is a determination of academic success in relation to upon the student's attitude towards his academic achievement and himself, as well as by the attitudes of significant others towards his/her success and him/herself.

2.8 Gender and Use of Computer Assisted Instruction

Gender bias is a reference to preference for or favoring of one sex over the other in computer use and access (The American Heritage Dictionary, 2013). The educational system is believed to influence the gender gap in computer use. One argument states that the gender separation in the use of the computer education begins as far back as kindergarten. (Wilder, Marchie and Cooper, 2005).

All students should have equal accessibility regardless of sex, race, socioeconomic background, or disability. It is important for teachers to be informed of innovations in classroom management plans and teaching strategies which are fair and equitable to all students. Sitting in the same classroom and listening to the same teacher is received differently by boys and girls which is the case with computers education (Sadker, 2004).

In the 1980s, research in Europe and North America identified boys' greater access to computers in schools also noted boys' dominance in computer related tasks and discussions. This research commonly found boys to be more active in computer-related

classroom discussions, to make more spontaneous comments, and to be asked more questions by teachers (Volman, 2002). Girls, on the other hand, more often lacked confidence in computing, tended to underestimate their computer-related competence.

Initial explanations of these findings in Europe and North America focused on boys far greater hands-on experience of computers at home, their greater enthusiasm to use computers, their greater confidence in using computers, and their tendency to rate themselves better than girls.

Important contributing factors to boys' greater computer confidence can be the attitudes and behavior of their teachers. Research shows that some teachers assume a certain expertise in boys, turn to boys for expert assistance when technical difficulties arise. ICTs have the potential to alleviate or remove some of the barriers or constraints that prevent girls from accessing educational opportunities, such as illiteracy, poverty, time scarcity, mobility, and relevancy. But there are additional factors that prohibit girls from ICT usage such as restricted access to the technology, high costs and lack of skills and information. However, the lack of participation of girls in the use of ICTs can primarily be attributed to social behavior, culture, and religious traditions (UNESCO Asia and Pacific regional bureau for education).

Girls are deprived of any opportunity to gain ICT related knowledge and skills in school. This may inhibit their acquisition of the levels of literacy and confidence that might enable them to access and use ICTs in school context. Because of the critical role that education has to play in opening up ICT-related opportunities, access to education is consistently identified by gender equality advocates as one of the most important factors

involved in enabling girls and women of all ages to benefit from new information technologies (Rathgeber , 2001). ICTs should be equally accessible to boys and girls. As girls enter adolescence; large numbers of them tend to lose interest in science, math, and computer technology. (Closing the gender gap: Gender Gaps Fact Sheet, 2007). This is attributed to the different treatments by educators which divert girls from science and technology (Robinson and Lubienski, 2011).

There is considerable evidence to suggest that boys use computers more than girls; this difference, like computer attitude, only emerges in middle school. In one study of 6,800 students, computer use by boys and girls in the fourth grade was about equal, but by the eighth grade, boys reported significantly higher use (Barker, 2006). According to Whitley (1997), boys use computers more frequently than girls at their homes, their friends' homes, and after-school clubs. They use computers to play games, use educational software, and access the Internet, whereas girls use computers for email, instant messaging, and homework. Boys tend to be more assertive and dominant about computer use and girls tend to be more passive. Teachers let girls give up more easily than boys when solving computer-related problems. Girls appear to prefer to use computers for goal-oriented activities with meaningful contexts. Girls like co-operative learning based on inquiry and diversity of topics. There are a number of strategies that teachers can use to address gender differences in computer attitude and use. The following has been suggested by American Association of University Women (2002).

Develop a positive computer culture: It is important for teachers to establish a clear set of rules and behaviors for using computers. A co-operative, supportive atmosphere needs to be emphasized. In addition, computer time must be monitored

closely. Finally, girls should be encouraged not to give up too quickly; teachers should offer thoughtful support and hints instead of doing the task for them (American Association of University Women, (2002).

One way to limit aggressive, dominating behavior by boys is to create same-sex computer study groups (Kay, 2006). Kay is of the opinion that teachers should be sensitive to differentiated learning since boys and girls may have different learning styles when it comes to computers. Rather than looking for a gender-neutral solution, Kay suggests that we should seek ways to validate different views of technology. This means that a variety of needs to be encouraged: working in pairs to address a problem; using in a wide range of contexts; and allowing for creativity in projects, so that boys and girls can pursue tasks that interest them (Kay, 2006).

The American Association of University Women (2000) adds that girls are often more interested in using computers to complete personally meaningful tasks. For example, a Web Quest (<http://www.webquest.org/>) is an ideal activity that encourages collaboration to solve authentic, real-world problems. Activities that encourage students to be resourceful and construct their own knowledge should be promoted. In addition; computers should be integrated into a variety of contexts and subject areas.

Focusing on a curriculum that emphasizes learning specific computer skills out of context may discourage girls from using computers. The common practice of using computers as a reward should probably be discouraged, because it tends to promote more aggressive and assertive behavior from boys. Some girls may back off and defer to more self-confident boys. (Butler, (2000)). Well-planned activities are essential to address

gender differences effectively. According to Butler (2000), it is important to improve teachers' computer skills: It is important that teachers become capable enough to design effective computer-based lessons. Without the confidence and ability to use computers in an educational setting, it will be hard for teachers to design effective computer-based lessons or to guide meaningful computer use. In addition, gender perceptions will never change unless female teachers demonstrate that they are capable users of technology (Jenson, 2003).

2.9 Empirical Studies

A study conducted by Yigit, (2007) used a pre-test post-test design to evaluate the impact of educational computer game on 2nd grade students in Mathematics achievement and retention. The educational software (Tux math scrabble) and (treasure Hunt math) were used in the experimental group and paper and pencil based traditional method was used in the control group. Forty seven (47) students participated in the study. The experimental group of 22 students received 4 hour of instruction using educational computer assisted games. A control group of 25 students were taught four operations using the traditional instruction methods for total of 4 hours. At the end of the study, the post test achievement score of both groups indicated that the use of educational computer assisted instruction games did not lead to higher test scores. Similarly, retention test was conducted after two weeks of the completion of the intervention. Although the results of Yigit's study did not produce any significant differences, there was evidence that the educational games using mathematics lessons had a positive impact on students mathematics performance. With a mean difference of 6.3 and 3.2 in favour of experimental group.

The similarities between the study of Yigit (2007), with this research work was the grouping of the subject in pre-test post-test. But the major difference is that in Yigit (2007), study it was based on mathematics, while this work is conducted on agricultural science, also Yigit used 69 students divided into 47 control group and 22 experimental groups but this work is centered on 20 students as the total sample for the study. Both the previous and the present researches investigate the effect of CAI on students' academic performance,

Ogla (2008), conducted research on the effect of computer assisted instruction on the achievement, retention and attitude of fourth grade students in mathematics, in Turkish Republic of Northern Cyprus. The research study was conducted on two groups (experimental and control) of primary school students from Shk Osman Ahmet primary school in Gazinragusa, north Cyprus were used in the study. The control group was taught using a lecture based traditional teaching method and experimental group was taught using educational software namely fribi mathematics. The control group consisted of 26 students, while the experimental group consisted of 29 students. In total 55 students were selected using random sampling techniques. The research had two objectives and two research questions were formulated by the research. The objective was to compare achievement in mathematics, retention and attitude towards mathematics and computer assisted learning. The study was conducted in spring semester of 2006 - 2007 academic year and the focus was on two units, namely multiplication of natural numbers and division of natural numbers. At the beginning of the study, and four (4) months later, mathematics attitude scale and computer assisted learning attitude scale were administered only two times; at the

beginning of the study and immediately after the completion of the study. A series of ANOVA for repeated measures revealed a significant difference between the group on the post achievement tests and attitude scales in favour of experimental group. However, statistically significant difference in favour of treatment group on the retention test was attained on the multiplication and division units, but not on fractions.

The evidence indicated that the use of CAI for teaching and learning mathematics at the primary school levels in Turkish Republic of Northern Cyprus was more effective, and in the level of retention this was in favour of the experimental group. The similarities between the study of Oglu (2008) and the present study are that both of them used grouping of students into experimental and control groups. Also a pre-test and post-test were administered, and lecture teaching method and CAI were used in both researches. The differences between the previous and present study is that Oglu's study was conducted in primary school, while this research is conducted in tertiary institution, Oglu's work centered on Mathematics but this work is centered on agriculture and Oglu's study was in Turkey, while this study is in Nigeria.

Kolawole and Okam (2010), carried out a study to investigate the effect of CAI on the academic achievement of Junior secondary school students in social studies. The objective of the study was to examine the interactive effect of treatment of academic ability on students achievement in students from four co-education public schools in Osogbo and Ile-Ife Central Local Government Area in Osun state. Simple random sampling was employed in selecting 1960 students from four co-educational public secondary schools. The study had two objectives, two research

questions. The study used a 2×2 factorial analysis of ANOVA and three null hypotheses were tested. Four instruments were used namely social studies achievement test (SSAT), computer assisted instruction guide for social studies (CAIGSS), teacher operational guide for social studies instruction (TOGSSS) and student academic ability test (SAAT) with reliability coefficient of 0.87, 0.79, 0.71 and 0.78 respectively. Data were analyzed using analysis of co-variance procedure. The result indicated that there was no significant main effect of treatment (computer assisted instruction and conventional method) on students achievement in social studies ($f(1,153) = 0.415, p > 0.05$). The result also revealed that there was significant main effect of academic ability on students achievement in social studies ($F(1,153) = 7.852, p < 0.05$) the high academic ability student were significantly better than the low ability students in their achievement in social studies. The finding further revealed that there was no significant effect of treatment on social studies academic ability in their achievement in social studies ($f(1,153) = 0.087, p > 0.05$).

The similarities between this study and the work of Kolawole and Okam is that random sampling is used to draw the samples, and also there is a pretest and post-test administered on all groups. The difference between the two studies is that Kolawole and Okam used 2×2 factorial in their analysis and four instruments were used in their findings. The research was carried out on students of junior secondary schools in only 2 LGAs and in Osun state Nigeria, while in this study, the researcher used descriptive and inferential statistics for analyzing data. This study is centered on one tertiary institution and the focus is on agricultural science. In this research also only one

instrument is used for collection of data, that is agricultural science achievement test (ASAT).

Even though in the study of Kolawole and Okam (2010) their focus was on too many areas such as CAI in junior secondary school, achievement in social studies and interactive effect of treatment of academic ability on students achievement, it is important to note that conventional instruction method in junior secondary schools are so many and one research may not deal with all of them effectively so it is good to focus on specified few items.

Alice (2012) conducted a study on the topic, effects of computer based science simulations on students academic achievement in the concept of food test at senior secondary school in Zaria metropolis. A total of 60 SS 2 students with average age of 17.2 years were randomly sampled from Zaria educational zone, Kaduna State, Nigeria form the sample for the study. The instrument used for collecting data was a 50 item-4 option multiple choice and 4 essay questions biology achievement test (BAT) developed by the researcher on the concept of food tests. The BAT was used to measure students achievement in the pre-test and post-test. The investigator developed lecture method and computer-based science simulations lesson notes. The test items, lesson notes and marking scheme for lecture and computer based science simulations were validated and found reliable before use. The test had a reliability of 0.83 determined using test-retest approaches. The experimental group was taught using computer based science simulations methods, while the control group was taught using lecture method. One hypothesis was stated and tested at 0.05 level of

significance. The t-test independent groups results showed that subjects taught with computer-based science simulations instruction performed better.

The study is similar to this one since both investigated the effect of CAI and lecture method, on students academic performance in Kaduna State. The studies also differed in a number of areas, i.e. in Alice (2012) the focus is on biology and in secondary schools and a sample of 60 students were involved while this study is focused on agricultural science students in tertiary institution and 20 students are involved in this study.

Ndukwe, (2012), in a study, attempted to find out the effectiveness of computer assisted instruction and lecture method on students academic performance in science education. Four NCE II computer science education combinations were randomly selected out of seven combinations of students from NCE regular programme. Hundred students were sample out of 150 population, both male and female students were considered appropriate for the study. The design used for the study is quasy experimental pre-test post-test group design. The instrument used for data collection was twenty five (25) multiple choice test questions developed by the researcher using a concept in computer spread-sheet package named computer usage achievement test (CUAT). Lecture method and computer assisted instruction lesson plan were developed by the researcher based on the chosen concept, mean and standard deviation were used to analysed data on level of agreement while t-test was used to test the significance at 0.05 alpha level. Based on the result from the data analysis it was found out that students taught with computer performed better 22.55 and 9.41 in favour of

experimental group similarly the gender performance of the students post test result was 22.05 and 22.7 in favour of female students.

The major difference between the study conducted by Ndukwe (2012) was the large size of sample population from which the sample was drawn and the subject combinations which make up the study population. However, the study of Ndukwe, (2012), is similar in all aspect of the research approach taken and the findings in favour of experimental group.

Iliyasu, Yahaya and Mamman (2013) investigated the effect of a Computer Mediated System Teaching Approach (CMSTA) used to teach Mathematics to Engineering Students in Nigerian polytechnics on the students achievement. The objective of their study was to determine (a) the mathematics achievement levels (MALs) of the students taught mathematics using the (CMSTA) and those not taught with the same approach; (b) whether the mathematics achievement levels of the males and females students taught mathematics using the LMSTA differed. Consequently two research questions and two null hypotheses were formulated for the study. A combination of convenient purposive and random sampling procedure was used to select a sample of 470 subjects with 267 and 203 in the experimental and control groups respectively. A four stages procedure were adopted for the experiment, with treatment administration lasting twelve (12) weeks. The mathematics examination scores were used for determining mathematics achievement levels (MAL) of the students. Significant difference were found between the mathematics achievement levels (MAL) of the experimental and the control groups as well as that of the

female students of the experimental group it was generally concluded that the treatment was able to enhance the subject MALs among others.

The similarities within the study done by Iliyasuet *al*, (2013) and this study is the use of experimental design, random sampling technique, gender and the use of pre-test pre-test, post-test approach. The difference between the study done by Iliyasuet *al*, (2013) with this research work is that Iliyasuet *al*, (2013) used 470 samples and their focus was Mathematics in Engineering teaching, treatment was done for twelve (12) weeks. Two null hypotheses and two research questions were formulated, while in this study the researcher used 20 samples and focus is on Agricultural science teaching, treatment was for six (6) weeks with 4 null hypotheses and 4 research questions formulated for the study.

2.10 Summary of Reviewed Literatures

This chapter reviewed literature on computer assisted instruction, beginning with theoretical framework. Basically the framework reviewed was based on the theory of teaching and learning by Skinner. The chapter also reviewed various works of some authors who have worked on the same or similar topics carried out by the researcher. This was based on classified sub-headings such as the historical development of CAI, the use of computer in education, types of computer assisted instruction. The characteristics of CAI, gender and use of CAI. The literature also reviewed the opinion of different researchers on students academic performance and factors influencing students academic performance in agricultural science such as demographic factors parents influence, students characteristics and effect technology. Finally six (6) empirical studies relevant to the present study were reviewed and

from these reviewed works the researcher observed that of all the studies reviewed non of them was carried outon the effect of CAI on academic performance of students in the field of agricultural science in a tertiary institutionlevel in Kaduna state.

Similarly it was observed that the finding of previous studies were location specific and not inclusive enough to have captured the effect of computer assisted instruction (CAI) on the academic performance of Agricultural students. It was against this observed paucity of data on its effect across gender, that the studywas carried out.

CHAPTER THREE

METHODOLOGY

The chapter presents research design method and procedures. The sub-headings discussed in it are the:

- 3.1 Research Design
- 3.2 Population for the Study
- 3.3 Sample Size and Sample Procedure
- 3.4 Instrument for Data Collection
 - 3.4.1 Validity of the Instrument
 - 3.4.2 Pilot Study
 - 3.4.3 Reliability of the Instrument
- 3.5 Procedure for Data Collection
- 3.6 Procedure for Data Analysis
- 3.1 Research Design

A quasi experimental pre-test/post-test control group design (PPGD) was used for the study. The pre-test post-test control group design is a factorial design used for social science research especially in education and psychology. The pre-test post-test control group design is one of the mix design; it is one of the most widely used experimental design in order to determine the effectiveness of the experimental process whether the variation between the two groups is significantly different when tested by means of T or F test (Buyukoztork, 2010)

This design is used because if there is any effect on the use of CAI as a medium of instruction, it will show in the post test result.

3.2 Population of the Study

The population for this study comprised of all NCE II students studying agricultural science as a course in Kaduna State College of Education, Gidan-Waya. The population consists of sixty one (61) students (33) male and (28) female from 2015/2016 session. This level is chosen to elicit the use of full settled students for the research.

Table 1: Population for the study

NCE II students of agricultural education department in the college of education Gidan-way

	Number of students		
	Male	Female	Total
NCE II students	33	28	61

Source: *Department of Agric, 2016*

3.3 Sample Size and Sampling Procedure

The target population for the study is the NCE II students of Kaduna State College of Education Gidan-Waya. The actual population for the study is 61 students of Agricultural Education Department 2015/2016 session. A sample of twenty (20) students was selected using random sampling technique (10 male and 10 female). They were further grouped into two groups experimental and control group making 5 male and 5 female in each group to form experimental and control groups.

Shitu (2007) posit that if data will be obtained from a small population, the whole area should be sampled to give a true representation of the entire area of study.

3.4. Instrument for Data Collection

An agricultural science achievement test was used to collect data. The instrument consisted of section A and B. Section A was objective test consisting of twenty (20) multiple choice questions and four marks were allocated for each correct answer given making a total of 80 marks. Section B consisted of two essay questions. Only one question was to be answered and twenty (20) marks were allocated for it, given a total score of hundred (100) marks. All questions covered aspects of the course AGE 222 (soil fertility). The course is a core course for all students of agricultural science education at NCE (II) level.

3.4.1 Validity of the Instrument

Content validity of a pre-test and post-test instrument for data collection were determined by three (3) experts, two (2) from the faculty of Education Ahmadu Bello University Zaria not below the rank of a senior lecturer and one (1) from Federal College of Education, Katsina with the rank of a chief lecturer. They offered very meaningful observations and made several corrections and suggestions which were fully incorporated before the tests were administered to the sampled students.

3.4.2 Pilot Study

A pilot study was conducted at Federal College of Education Katsina, Katsina State. It has similar features with Kaduna State College of Education Gidan-waya. Ten (10) students offering agricultural science courses were selected and randomly grouped into experimental and control groups. A pre-test was administered to both groups on the same day. Lecture method was used to teach the first group (control group) for two (2) weeks and at the end, a test was administered to the group and the scores recorded.

Computer assisted instruction was then used to teach the second group (experimental group) for another two (2) weeks and at the end, a test was administered to the group. Data for the two test pre-test and post-test were analyzed using mean and standard deviation. In order to determine the performance difference between the two mean scores of the groups, t-test statistical was used to test the null hypothesis.

3.4.3 Reliability of the Instrument

To determine the reliability of the instrument, test- retest method was used on ten (10) students randomly selected in the Federal College of Education (FCE) Katsina. At the end of the pilot study, the reliability coefficient was performed and analyzed. The correlation coefficient for the pilot study was 0.85. This is in line with Olayiwola (2007) who state that a reliability test should have a correlation range of 0.7 - 0.9. According to this range of reliability the reliability coefficient used in this study was adjudged to be reliable.

3.5 Procedure for Data Collection

A letter of introduction was collected by the researcher from the Department of Vocational and Technical Education, Faculty of Education, Ahmadu Bello University Zaria to introduce the researcher to the authorities of Kaduna State College of Education Gidan-way.

An agricultural science achievement test designed by the researcher was used as pre-test and post-test instrument to find the effect of CAI on students academic performance. The test comprised of twenty (20) multiple choice questions and two (2) essay test questions. The test had instructions to guide the students as to what was

expected of them. Each question carried four (4) marks for the multiple choice question that is (80) marks and 20 marks were allocated for the essay giving the total maximum marks (for both essay and objective) of hundred (100) marks. The students previous knowledge was assessed by the pre-test administered to both groups (control and experimental) before the commencement of the study with a view to determining the students background knowledge in agricultural education. A lecture method of teaching was used to teach the control group for a period of seven (7) weeks, while the experimental group was exposed to CAI package for seven (7) weeks too. The same test items were used at the end of the study as post-test to assess the students academic performance. The objective of post-test was to assess the effect of treatment on experimental group.

3.6 Procedure for Data Analysis

The statistical tool used to analyze the data obtained from the pre-test and post-test are mean and standard deviation. A t-test was used to test the null hypotheses in line with the position of Huck (2006) who endorsed t-test statistics as a good tool for gaining insight into the differences in group of means. The null hypotheses were tested at 0.05 level of significance.

CHAPTER FOUR

PRESENTATION AND ANALYSIS OF DATA

A total of 10 or 50.0% of them were males and 10 also representing 50.0% were female Agricultural Science students.

4.1 Answers to Research Questions

The answers to the four research questions were arrived at using mean and standard deviation. The post-test scores of agricultural science students in the experimental and control groups in objective test were used to answer research question one, the post-test scores of agricultural science students in essay test in experimental and post-test scores of control group in essay test were used to answer research question two, the post-test scores of agricultural science students in both objective and essay tests in experimental and post-test scores of control group in both objective and essay tests were used to answer research question three, while the post-test scores of the male agricultural science in experimental and post-test scores of the female were used to answer research question four. Mean and standard deviation values generated from the analysis are presented in Table 2,3,4 and 5 respectively.

Research Question One: *What is the effect of using CAI on students' academic performance in agricultural science in objective test in Kaduna State College of Education Gidan-waya?*

Table 2: Relative Mean Scores (Objective) of Academic Performance of Students Taught with and without CAI

Variables	N	Mean	Std. Deviations	Std. Error Mean
Posttest control group	10	34.800	9.437	2.984
Posttest experimental group	10	44.800	7.254	2.293

Source: Fieldwork, 2016

Table 2 shows that that,mean and standard deviation of CAI for post-test were 44.800 and 7.254 respectively, while the mean and standard deviation for the post-test control group of the objective test were 34.800 and 9.437. This showed that the post-test mean for CAI was greater than that of the post-test control group. This implied that students performed better when they were taught using CAI than lecture method.

Research Question Two: *What is the effect of using CAI on students'academic performance in agricultural science in essay test in Kaduna StateCollege of Education Gidan-wayaya?*

Table 3: Descriptive Statistics on Difference in Essay Mean Academic Performance of Agricultural Students Taught Using Computer Assisted Instruction (CAI) and those in Control Group

Variables	N	Mean	Std. Deviations	Std. Error Mean
Post test control group	10	46.000	6.599	2.087
Post test experimental group	10	60.100	7.248	2.292

Source: Fieldwork, 2016

Table 3 showed that in essay, mean and standard deviation of CAI for post-test were 60.100 and 7.248, while the mean and standard deviation for the post-test control group of the essay test were 46.000 and 6.599. This showed that the post-test mean for CAI was greater than that of the post-test control group. The result implied that students performed better when they were taught using CAI than lecture method. It is also an indication that CAI has effect on students' academic performance.

Research Question Three: *What is the mean difference in both objective and essay tests in academic performance of agricultural science students taught using CAI in Kaduna State College of Education Gidan-waya?*

Table 4: Difference between Students' Performances in Objective and Essay Tests When Taught Using CAI

Variables	N	Mean	Std. Deviations	Std. Error Mean
Posttest control group (Obj)	10	34.800	9.437	2.984
Posttest experiment group (Obj)	10	44.800	7.254	2.293
Posttest control group (Ess)	10	46.000	6.599	2.087
Posttest experimental group (Ess)	10	60.100	7.248	2.292

Source: Fieldwork, 2016

Table 4 shows that in objective and essay, means and standard deviations of computer assisted instruction for post-test were 44.800 and 60.100, and 7.254 and 7.248, while the means and standard deviations for the post-test control group of the objective

and essay tests were 34.800 and 46.000 and 9.437 and 6.599. This showed that the post-test means for computer assisted instruction were greater than those of the post-test control groups. This implied that students performed better when taught using computer assisted instruction than lecture method. The result implies that computer assisted instruction has effect on students' academic performance.

Research Question Four: *What is the effect of using CA) on academic performance of both male and female agricultural science of students in Kaduna State College of Education, Gidan-wayaya?*

Table 5: Descriptive Statistics between Male and Female Agricultural Science Students in their Academic Performance When Taught Using CAI

Variables	N	Mean	Std. Deviations	Std. Error
Male Post test	5	41.6000	3.577	1.600
Female Posttest	5	48.000	8.944	4.000

Source: Fieldwork, 2016

Table 5 showed that the mean and standard deviations of the performance of male and female students taught using computer assisted instruction for post-test were 41.6000 and 48.000 and 3.577 and 8.944 respectively, while the means and standard deviations for the post-test control group of the performance of male and female students were respectively 28.00 and 31.20 and 5.657 and 6.573. This showed that the post-test means for computer assisted instruction were greater than those of the post-test control groups. The implication is that the female students performed better than their male counterpart

when taught using computer assisted instruction. This indicates that CAI has effect on the academic performance of female than male students

4.2 Testing of Null Hypotheses

The results of the test of null hypotheses are presented in Table 6, 7,8 and9. To test the null hypotheses 1 to 4, the post-test scores of students taught using CAI were compared with the post-test scores of the control group, while hypothesis three was tested by comparing the post-test scores of students taught agricultural science using CAI on objective and essay tests. The t-test statistics was used to test the null hypothesesat 5% level of significance ($p=.05$).

Null Hypothesis One:*There is no significant difference between the academic performanceof agricultural science students taught using CAI and those taught using conventional teaching method.*

Table 6: Independent T- test Statistics on Significant Difference in Objective Mean Performance of Experimental and control group

Variable	Groups	N	Mean	Std. Dev	Std. Err	Df	t calculated	t critical	P
Objective performance mean scores	Experimental	10	44.800	7.254	2.293	18	2.162	1.474	0.018
	Control	10	34.800	9.437	2.984				

Source: Fieldwork, 2016 *Calculated p < 0.05*

Table 6 result shows that the t-calculated was 2.162, which is greater than the t-critical value of 1.474. This result therefore, indicates that CAI has significant effect on

students' academic performance in objective test. Hence the null hypothesis that state there is no significant difference between the academic performance of agricultural science students in Experimental and control group in objective was rejected.

Null Hypothesis Two: *There is no significant difference between the academic performance of agricultural science students taught using computer assisted instruction (CAI) and those taught using conventional teaching method in essay test.*

Table 7: Independent T-test Statistics on Significant Difference in Essay Mean Academic Performance of Agricultural Science Students Taught Using CAI and Those in Control Group

Variable	Groups	N	Mean	Std. Dev	Std. Err	Df	t calculated	t critical	P
Essay performance mean scores	Experimental	10	60.100	7.248	2.292	18	2.153	1.468	0.045
	Control	10	46.000	6.599	2.087				

Source: Fieldwork, 2016 *Calculated p < 0.05*

Table 7 t-test result showed that the t-calculated is 2.153, which is greater than the t-critical value of 1.468. This result indicated that CAI has significant effect on students' academic performance in essay test. Hence the null hypothesis that there is no significant difference between the academic performance of agricultural science students taught using computer assisted instruction (CAI) in essay test in Kaduna State College of Education Gidan-Waya was rejected.

Null Hypothesis Three: *There is no significant difference between the academic performance of agricultural science students taught using CAI and those taught using conventional teaching method in objective and essay tests.*

Table 8: Paired Sample T-test on Significant Difference between Academic Performance of Students Taught with CAI on Objective and Essay Test

Variable	Performance type	N	Mean	Std Dev	Std. Err	Df	T Calculated	P
Performance	Essay	10	44.800	7.254	2.293	18	-30.7	0.000
	Objective	10	60.100	7.248	2.292			

Source: Fieldwork, 2016 *Calculated p < 0.05*

Table 8 showed the t-test analysis of the difference between the level of students academic achievement in agricultural science when taught using computer assisted instruction in both objective and essay test. The result showed that the p-value is 0.000, which is less than the alpha .05 level of significance. This result therefore, implies that computer assisted instruction has significant effect on students' academic achievement in both objective and essay tests. Hence the null hypothesis that there is no significant difference between the academic performance of agricultural science students taught using CAI on objective and essay test in Kaduna State College of Education Gidan-Waya was rejected.

Null Hypothesis Four: *There is no significant difference between gender in academic performance of agricultural science students taught using CAI and those taught using conventional teaching method.*

Table 9: Independent T-test Statistics on Significant Difference between Gender in Academic Performance of Agricultural Science Students Taught Using CAI

Variable	Gender	N	Mean	Std. Dev	Std. Err	Df	t calculated	P
Mean	Male	5	41.6000	3.577	1.600			
Academic						8	0.914	0.000
Performance	Female	5	48.000	8.944	4.000			

Source: Fieldwork, 2016 *Calculated p < 0.05*

Table 9 showed the t-test analysis for the difference between academic performance of male and female students taught using CAI. The result showed that the p-value is 0.000, which is less than the alpha .05 level of significance. This result therefore, showed that computer assisted instruction has significant effect on academic performance of female than in male students. Hence the null hypothesis that there is no significant difference between gender and academic performance of agricultural science students taught using CAI in Kaduna State College of Education, Gidan-Waya was rejected.

4.3 Summary of Major Findings

The findings of this research which was carried out to determine the effects of computer assisted instruction on academic performance of agricultural science students in College of Education GidanWaya Kaduna State were based on the results of the descriptive (mean and standard deviation) and inferential statistical analysis (t-test). The major findings were summarised as follow:

1. CAI has significant effect on students' academic performance in Agricultural Science in objective test.

2. Computer Assisted Instruction (CAI) has significant effect on students' academic performance in Agricultural Science in essay test.
3. Computer Assisted Instruction (CAI) has significant effect on students' academic performance in Agricultural Science.
4. Computer Assisted Instruction (CAI) has significant effect on the academic performance of female students than on male students in Agricultural Science.

4.4 Discussion of Major Findings

The finding of the study revealed that significant difference existed in the objective test of agricultural science students taught using CAI. It had a significant effect on the students' academic performance. This was shown in Table 2 where the mean score (44.80) for those taught using CAI is greater than the mean score (34.80) for students in the control group. The t-test analysis result on Table 6 also showed that CAI had significant effect on students performance as t-calculated (2.162) is greater than the critical t value of (1.474). This implies that using CAI in teaching agricultural science has positive effect on students' objective test performance. The result of this study agrees with that of Abubakar (2011) who reported that CAI effectively enhanced the teaching of agricultural science in Katsina State.

This study also revealed that significant difference existed in the academic performance of students in essay test of agricultural science students taught using CAI. This is shown in Table 3 where the mean score of the post test are (60.100) and (46.000) respectively in favour of experimental group. Also the t-test analysis in Table 7 showed that computer assisted instruction CAI had a positive effect on students academic

performance in essay test as the t-calculated (2.153) greater than the critical-t value of one point (1.468) at 0.05 level of significant. This implies that using CAI in teaching agricultural science has positive effect on students' academic performance in essay test. This finding is in line with that of Alice (2012) who observed that computer-based teaching in sciences had a significant effect on the performance of the students in essay test.

In the same vain significant difference was revealed to exist between academic performance of students taught using CAI in both objective and essay tests. The result in Table 4 shows that mean scores in post test, experimental and control groups were (44.800) and (34.800) respectively. While the essay mean scores were (60.100) and (46.00) respectively in favour of experimental group. The paired sample t-test analysis result in Table 8 showed that the p-value is 0.00 which is less than the alpha 0.5 level of significance. This implies that using CAI in teaching agricultural science has a positive effect on students academic performance in both objective and essay tests. This finding agreed with those of Cetin (2007) and Iliyasuet *al.* (2013) who reported that computer utilization in teaching significantly affected the general performance of the students in both objective and essay test.

The finding of research question four showed that there is difference between male and female students' academic performance in agricultural science taught using CAI. In Table 5, the computed means of academic performance in agricultural science were (41.6000) and (48.000) for male and female students respectively. This implies that a mean difference of 6.4 in favour of female students was recorded. This means that female students benefited more than the male counterpart from the use of CAI. This finding is

different from the finding of Muonemeet *al.* (2015) that using computer related teaching device had no significant difference in the performance of male and female students.

Gender difference in Agricultural Science achievement test may be attributed to social factors and anxiety among males rather than subject matter or teaching methodology. This seems to be the case in this study as both male and female learn under the same condition, yet the male have lower scores. Therefore, other factors are mostly to be the intervening factors responsible for the difference as in previous study cited above the result in this study suggest that the female student seems to have outperformed better than their male counterpart both at pretest and posttest level.

The finding of the null hypothesis one revealed that the use of CAI in teaching agricultural science has significant effect on students academic performance in objective test. This implies that in order to improve the performance of students in agricultural science, the predominant lecture method used in teaching students has to be changed to the use of CAI. This finding aligned with that of Abubakar (2011) who found that CAI effectively enhanced the teaching of Agricultural Science in Katsina State.

The finding of the null hypothesis two indicated that the use of CAI in teaching agricultural science students has significant effect on their academic performance in essay test. The implication of this finding is that students' performance in agricultural science can be improved using CAI and should be adopted. This finding concurs with that of Alice (2012) which revealed that computer-based teaching in sciences had a significant effect on the performance of the students.

It was also revealed from the null hypothesis three that the use of CAI in teaching agricultural science has positive effect on students' performance in both objective and essay test. This indicates that using CAI in teaching the agricultural science students is much better than teaching with the conventional lecture method. This finding agrees with those of Cetin (2007) and Iliyasu et al. (2013) who discovered that using computer in teaching significantly affected the general academic performance of students.

Null hypothesis four, further revealed significant difference between gender in academic performance in agricultural science students taught using computer assisted instructions. This means that male students need to be exposed more using CAI if their performance is to be improved. This finding agreed with that of Mohammed (2012) who reported that the use of computer in teaching students (male and female) significantly improved their performance.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

This chapter presents the summary, conclusion and recommendations of the study. Suggestions for further studies are also presented in this chapter.

5.1 Summary

The study was carried out to determine the effects of CAI on academic performance of agricultural science students in College of Education GidanWaya Kaduna State. Pre-test, post-test quasi-experimental design was adopted for the study. The study had four (4) specific objectives, four (4) research questions and four (4) null hypotheses which were used as guide in the study. The entire 2015/2016 61 N. C. E. II Agricultural Science students of the Kaduna State College of Education Gidan-waya formed the population for the study; Twenty (20) students were randomly selected to form the sample size for the study. The sampled students were divided into two (2) groups: A and B with 10 students in each group. Data collection lasted for a period of seven (7) weeks. Pre-test was carried out before exposing the students to the treatment variable (computer assisted instruction) followed by a post-test treatment.

Descriptive (mean and standard deviation) and inferential (t-test) statistic were used to analyse research questions and hypotheses respectively. All the hypotheses were tested at 5% level of significance ($p=.05$). The result of analysis revealed that students taught using computer assisted instruction performed better than those taught using the conventional teaching approach. The result of null hypotheses also revealed a significant difference between students exposed to computer assisted instruction and those exposed

to conventional approach (lecture approach); as the calculated t-values of 2.162 and 2.153 were both greater than the critical t-values of 1.474 and 1.468 at .05 level of significance respectively.

When the mean scores of students taught using CAI for both objective and essay tests (44.800 and 60.100) were compared with mean scores of the conventional approach (lecture method) for both objective and essay tests (34.800 and 46.000), computer assisted instruction was more effective. The t-test analysis revealed a significant difference in the acquisition of agricultural skills among students from the two groups. The mean score and t-test results showed that students exposed to computer assisted instruction for essay test with a mean score of 60.100 were better compared with their counterpart exposed to objective test using the same computer assisted instruction with mean score of 44.800. The findings led to the rejection of all the four (4) stated null hypotheses at 0.05 probability level of significance.

5.2 Conclusion

The following conclusions are drawn from the study:

1. Computer assisted instruction improved teaching of Agricultural Science in college of education and Gidan-Waya.
2. Computer assisted instruction improved the performance of students in Agricultural Science in essay in college of education.
3. Computer assisted instruction had positive effect in teaching of agricultural science in colleges of education and can improve students academic performance in both objective and essay test.

4. The academic performance of female Agricultural Science students was better than their male counterpart when taught using Computer Assisted Instruction (CAI).

5.3 Contributions to Knowledge

The following are the contributions of this study to existing body of knowledge:

1. The teachers of agricultural science will now be motivated by the result of this study and they can see the need to adopt and employ this innovation in their daily learning delivery exercise.
2. This study has also provided agricultural science teachers with the idea of being able to prepare their own application packages for the purpose of helping them enhance learning among their students through the use of such application packages.

5.4 Recommendations

Based on the findings and conclusion of the study, the following recommendations were made:

1. The use of computer assisted instruction should be widely adopted/ adapted by agricultural science lecturers in Colleges of Education in particular and other tertiary institutions in general.
2. Occasionally the school authority should invite specialists (educational technologist, instructional material technicians and computer experts) to assist agricultural science

- teachers on how to design computer enriched packages that are relevant to teaching and learning of agricultural science.
3. Computer assisted instruction should be integrated into the agricultural education curricular in view of its benefits to learners at all levels of education in Nigeria.
 4. Agricultural education lecturers in Nigerian Colleges of Education and other tertiary institutions in general should be supported by authorities of their institutions to continuously engage in professional development in the area of computer usage and application in teaching.

5.5 Suggestion for Further Study

1. Similar study should be conducted in other colleges of education on an experimental basis to ascertain the outcome.
2. Further study should also be conducted to assess the adequacy of agricultural education curriculum with a view to updating and upgrading it.
3. A good core research where a complete vocational area is taught computer assisted instruction should be carried out to cover Colleges of Education in the whole of north western Nigeria.

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APPENDIX I



DEPARTMENT OF VOCATIONAL & TECHNICAL EDUCATION
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Your Ref: _____
Our Ref: _____

P14EDVE8014

11th August, 2016
Date: _____

Letter of Identification

AGWAM YUSUF – P14EDVE8010

This is to certify that the above mentioned name is a Postgraduate student (M.Sc (Ed) Agric Education) in the Department of Vocational and Technical Education, Faculty of Education, Ahmadu Bello University, Zaria, carrying out a research topic: ***Effect of Computer Assisted Instruction on Academic Achievement of Agricultural Science Students in Colleges of Education Gidan-waya.***

Please, kindly give him every assistance he may require.



Dr. E.E. Adamu
HEAD OF DEPARTMENT

APPENDIX II

LECTURE NOTES

FACTORS INFLUENCING NUTRIENT AVAILABILITY IN THE SOIL

The factors which influence the availability of nutrient in every soil include the following.

1. Soil PH: the degree of acidity and alkalinity of the soil affects the availability of nutrients both in the soil and also to the plant.
 - I. A low pH (high acidity) will encourage the disintegration of clay and minerals like calcium, iron and aluminum which are leached away from the top soil.
 - II. At high pH (high alkalinity) calcium and magnesium ions accumulate in the soil and this affect the growth of plants.
 - III. A low pH also reduce the activities of soil living organisms which aid the decompositionof organic matter.
2. Concentration of other nutrients:
 - I. The presence of certain elements in high concentration may prevent the absorption or utilization of other elements
 - II. The concentration of Nitrogen and phosphorus in the soil results in the non-availability of potassium.
 - III. This condition results in retarded growth, low yield or even death of the plant.
3. Leaching:
 - I. This is the removal of nutrients from the top soil to the inner parts of the soil beyond I he root zones.

- II. It results in the loss of nutrients such as calcium, magnesium, potassium from the top soil in solution.
 - III. It also results in the accumulation of aluminum and hydrogen ions which become acidic and toxic to plants.
4. Crop removal:
- I. Nutrients are removed from the soil by crops for growth, development and reproduction.
 - II. When crops are harvested the nutrients contained in them are never returned to the soil.
 - III. The rapid removal of nutrients from the soil by continuous cropping completely deprive the soil of such nutrients.
5. Oxidation and reduction of organic material:
- I. Some compounds such as ammonium radicals are oxidized to gaseous ammonia.
 - II. Nitrates are also reduced to molecular nitrogen or oxides of nitrogen by denitrifying bacterial.
 - III. These products (i.e. ammonium radicals and nitrates) which escape into the atmosphere in form of gases make the soil become poorer in nutrients.
6. Burning:
- I. It exposes the soil to erosion which can wash away plant nutrients in the soil
 - II. It burns the organic matter content of the soil, thereby reducing the amount of nutrients in the soil.
 - III. it kills or reduces the numbers of soil organisms which aid decomposition of materials and consequently, most nutrients may not be available to the soil.

7, Soil texture:

- I. Fine texture such as clay and silt, ensure the availability of nutrients in the soil
- II. But coarse texture like sand prevents the availability of nutrients in the soil
- III. Coarse texture encourages the leaching of nutrients from the soil.

8. Erosion:

- I. Heavy rainfall causes the washing or carrying away of top soil which is rich in plant nutrient.
- II. Top soil can also be blown away by winds, resulting in nutrient reduction ill the soil.

APPENDIX III

LESSON PLAN FOR CONTROL GROUP (WEEK 1)

Name	Yusuf, AGWAM
School	College of education Gidan-waya
Department	Agricultural education
Registration Number	MSc/Educ/P14EDVE8010
Level	NCE II
Gender	Male and Female
Course	AGE 222: Soil Fertility
Topic	Factors Influencing Nutrient Availability in Soil
Duration	1hour
Date	17 th August, 2016
Teaching Method	Lecture Method
General Objectives	To teach students the factors influencing nutrient availability in soils.
Behavioural Objective	At the end of the lesson the students should be able to: 1 - List the factors affecting nutrient availability in soil. 2. Explain how soil PH and concentration of other nutrient affect the availability of soil nutrient.
Previous Knowledge	The students have learn the types of soil and characteristics of the different types of soil.
Introduction	The teacher introduces the lesson by brief highlight of previous lesson
Presentation	
Step I	The factors influencing nutrient availability in soil are as follows: 1. Soil pH 2. Concentration of other nutrients 3. Leaching 4. Crop removal 5. Oxidation and reduction of organic materials

	<p>6. Burning</p> <p>7. Soil texture</p> <p>8. Erosion</p>
Step II	<p>(1) Soil pH: the degree of acidity and alkalinity of the soil affects the availability of nutrients both in the soil and also to the plant.</p> <p>I. A low pH (high acidity) will encourage the disintegration of clay and minerals like calcium, iron and aluminum which are leached away from the top soil.</p> <p>II. At high pH (high alkalinity) calcium and magnesium ions accumulate in the soil and this affect the growth of plants.</p> <p>III. A low pH also reduce the activities of soil living organisms which aid the decomposition of organic matter.</p>
Step III	<p>(2) Concentration of other nutrients:</p> <p>I. The presence of certain elements in high concentration may prevent the absorption or utilization of other elements.</p> <p>II. The concentration of Nitrogen and phosphorus in the soil results in the non-availability of potassium.</p> <p>III. This condition results in retarded growth, low yield or even death of the plant.</p>
Summary	The teacher concludes the lesson by summarizing the main points in the lesson.
Conclusion	The teacher concludes his lesson by allowing the students to ask questions
Evaluation	<p>The teacher evaluates the lesson by asking the students questions.</p> <ol style="list-style-type: none"> 1. Mention the factors influencing availability of nutrient in the soil. 2. State how soil PH influence nutrient availability in the soil. 3. State how concentration of other nutrient influence the availability of nutrient in the soil.

LESSON PLAN FOR CONTROL GROUP (WEEK 2)

Name	Yusuf, AGWAM
School	College of education Gidan-waya
Department	Agricultural education
Registration Number	MSc/Educ/P14EDVE8010
Level	NCE II
Gender	Male and Female
Course	AGE 222: Soil Fertility
Topic	Factors Influencing Nutrient Availability in Soil
Duration	1hour
Date	24 th August, 2016
Teaching Method	Lecture Method
General Objectives	To teach students the factors influencing nutrient availability in soils.
Behavioural Objective	At the end of the lesson the students should be able to: <ol style="list-style-type: none"> 1. Define leaching 2. State how leaching influence nutrient availability in the soil.
Previous Knowledge	The students have learn soil PH, concentration of other nutrients and how they influence nutrient availability in soil.
Introduction	The teacher introduces the lesson by brief highlight of previous lesson
Presentation	
Step I	Leaching this is the removal of nutrient from the top soil to the inner point of the soil beyond the root zone
Step II	<ol style="list-style-type: none"> 1. It results in the lost of nutrient such as calcium, potassium, and magnesium from the top soil in solution. 2. It result in the accumulation of aluminum and hydrogen ion which becomes acidic and toxic to plants
Summary	The teacher concludes the lesson by summarizing the main points in the lesson.
Conclusion	The teacher concludes his lesson by allowing the students to ask questions
Evaluation	The teacher evaluates the lesson by asking the students questions <ol style="list-style-type: none"> 1. Define the term leaching 2. State how leaching influence the availability of nutrient in the soil

LESSON PLAN FOR CONTROL GROUP (WEEK 3)

Name	Yusuf, AGWAM
School	College of education Gidan-waya
Department	Agricultural education
Registration Number	MSc/Educ/P14EDVE8010
Level	NCE II
Gender	Male and Female
Course	AGE 222: Soil Fertility
Topic	Factors Influencing Nutrient Availability in Soil
Duration	1hour
Date	31 st August, 2016
Teaching Method	Lecture Method
General Objectives	To teach students the factors influencing nutrient availability in soils.
Behavioural Objective	At the end of the lesson the students should be able to: <ol style="list-style-type: none"> 1. Define crop removal 2. State how crop removal influence nutrient availability in the soil.
Previous Knowledge	The students have already learn leaching, and its influence on nutrient availability in soil.
Introduction	The teacher introduces the lesson by brief highlight of previous lesson
Presentation	
Step I	When plant nutrient are available in a given soil and crops are planted on such soil. The crops tends to make use of the soil nutrients that are in the soil and gradually the availability of nutrient in the soil becomes less due to crops utilizing the nutrients in a number of processes.
Step II	<ol style="list-style-type: none"> 1. Nutrients are removed from the soil by crops for growth,

	<p>development and reproduction.</p> <ol style="list-style-type: none"> 2. When crops are harvested the nutrient content in them are never returned to the soil. 3. The rapid removal of nutrient from the soil by continuous cropping, completely deprived the soil of such nutrients
Summary	The teacher concludes the lesson by summarizing the main points in the lesson.
Conclusion	The teacher concludes his lesson by allowing the students to ask questions
Evaluation	<p>The teacher evaluates the lesson by asking the students questions</p> <ol style="list-style-type: none"> 1. What is crop removal 2. State how crop removal influence nutrient availability in the soil.

LESSON PLAN FOR CONTROL GROUP (WEEK 4)

Name	Yusuf, AGWAM
School	College of education Gidan-waya
Department	Agricultural education
Registration Number	MSc/Educ/P14EDVE8010
Level	NCE II
Gender	Male and Female
Course	AGE 222: Soil Fertility
Topic	Factors Influencing Nutrient Availability in Soil
Duration	1 hour
Date	7 th September, 2016
Teaching Method	Lecture Method
General Objectives	To teach students the factors influencing nutrient availability in soils.
Behavioural Objective	At the end of the lesson the students should be able to: <ol style="list-style-type: none"> 1. Explain the concept of oxidation and reduction process 2. Explain how oxidation and reduction influence nutrient availability in the soil
Previous Knowledge	The students have already learned crop removal, and its influence on nutrient availability in soil.
Introduction	The teacher introduces the lesson by brief highlight of previous lesson
Presentation	
Step I	<p>When a reacting atom losses one or more electrons to other atoms, the atom is said to be oxidized. Atoms that gain electrons are said to be in the reduced stage as (Fe²⁺) can be oxidized to other stages as (Fe³⁺). When free gas (oxygen) is available to accept some of the electrons giving up by Fe²⁺</p> <p>Reduction Fe²⁺ + 2e⁻ → Fe⁰ (gain of electrons) (Ferrous Iron) (neutral iron metal)</p>

	<p>Oxidation $\text{Fe}^{2+} \longrightarrow \text{Fe}^{3+} + \text{e}^{-}$</p> <p>(loss of electron) (ferrous Iron) (Ferric Iron) (electron)</p>
Step II	<p>Oxidation and reduction of organic material:</p> <p>I. Some compounds such as ammonium radicals are oxidized to gaseous ammonia.</p> <p>II. Nitrates are also reduced to molecular nitrogen or oxides of nitrogen by denitrifying bacterial.</p> <p>III. These products (i.e. ammonium radicals and nitrates) which escape into the atmosphere in form of gases make the soil become poorer in nutrients</p>
Summary	The teacher concludes the lesson by summarizing the main points in the lesson.
Conclusion	The teacher concludes his lesson by allowing the students to ask questions
Evaluation	<p>The teacher evaluates the lesson by asking the students questions</p> <ol style="list-style-type: none"> 1. Explain the concept of oxidation and reduction 2. State how oxidation and reduction influence nutrient availability in the soil

LESSON PLAN FOR CONTROL GROUP (WEEK 5)

Name	Yusuf, AGWAM
School	College of education Gidan-waya
Department	Agricultural education
Registration Number	MSc/Educ/P14EDVE8010
Level	NCE II
Gender	Male and Female
Course	AGE 222: Soil Fertility
Topic	Factors Influencing Nutrient Availability in Soil
Duration	1hour
Date	14 th September, 2016
Teaching Method	Lecture Method
General Objectives	To teach students the factors influencing nutrient availability in soils.
Behavioural Objective	At the end of the lesson the students should be able to: <ol style="list-style-type: none"> 1. Define burning 2. State how burning influence nutrient availability in the soil
Previous Knowledge	The students have already learned about oxidation and reduction of soil nutrient and its influence on nutrient availability in soil.
Introduction	The teacher introduces the lesson by brief highlight of previous lesson
Presentation	
Step I	Burning is the act of setting fire on the on the surface previous stuck of vegetation on the farm.
Step II	Burning: <ol style="list-style-type: none"> I. It exposes the soil to erosion which can wash away plant nutrients in the soil. II. It bums the organic matter content of the soil, thereby reducing the amount of nutrients in the soil.

	III. It kills or reduces the numbers of soil organisms which aid decomposition of materials and consequently, most nutrients may not be available to the soil.
Summary	The teacher concludes the lesson by summarizing the main points in the lesson.
Conclusion	The teacher concludes his lesson by allowing the students to ask questions
Evaluation	The teacher evaluates the lesson by asking the students questions <ul style="list-style-type: none"> 1. What is burning 2. State how burning influence nutrient availability in the soil

LESSON PLAN FOR CONTROL GROUP (WEEK 6)

Name	Yusuf, AGWAM
School	College of education Gidan-waya
Department	Agricultural education
Registration Number	MSc/Educ/P14EDVE8010
Level	NCE II
Gender	Male and Female
Course	AGE 222: Soil Fertility
Topic	Factors Influencing Nutrient Availability in Soil
Duration	1hour
Date	21 st September, 2016
Teaching Method	Lecture Method
General Objectives	To teach students the factors influencing nutrient availability in soils.
Behavioural Objective	At the end of the lesson the students should be able to: <ol style="list-style-type: none"> 1. Define soil texture 2. List the types of soil texture 3. State how soil texture influence nutrient availability in the soil
Previous Knowledge	The students have already learned about burning and its influence on nutrient availability in soil.
Introduction	The teacher introduces the lesson by brief highlight of previous lesson
Presentation	
Step I	Soil texture is the relative proportion (sizes) of the various particles of soil in other words, it refers to the degree of fineness and coarseness of the various soil particles.
Step II	The types of soil texture are: <ol style="list-style-type: none"> (1) Clay (2) Silt

	<p>(3) Fine sand</p> <p>(4) Coarse sand</p> <p>(5) Gravels</p>
Step III	<p>Influence of Soil texture in nutrient availability</p> <p>I. Fine texture such as clay and silt, ensure the availability of nutrients in the soil.</p> <p>II. But coarse texture like sand prevents the availability of nutrients in the soil.</p> <p>III. Coarse texture encourages the leaching of nutrients from the soil.</p>
Summary	The teacher concludes the lesson by summarizing the main points in the lesson.
Conclusion	The teacher concludes his lesson by allowing the students to ask questions
Evaluation	<p>The teacher evaluates the lesson by asking the students questions</p> <ol style="list-style-type: none"> 1. Define soil texture 2. List the types of soil texture 3. State how soil texture influence nutrient availability in the soil

LESSON PLAN FOR CONTROL GROUP (WEEEK 7)

Name	Yusuf, AGWAM
School	College of education Gidan-waya
Department	Agricultural education
Registration Number	MSc/Educ/P14EDVE8010
Level	NCE II
Gender	Male and Female
Course	AGE 222: Soil fertility
Topic	Factors Influencing Nutrient Availability in Soil
Duration	1hour
Date	28 th September, 2016
Teaching Method	Lecture Method
General Objectives	To teach students the factors influencing nutrient availability in soils.
Behavioural Objective	At the end of the lesson the students should be able to: <ol style="list-style-type: none"> 1. Define soil erosion 2. State the types of soil erosion 3. State how soil erosion influence nutrient availability in the soil
Previous Knowledge	The students have already learned about soil texture and its influence on nutrient availability in soil.
Introduction	The teacher introduces the lesson by brief highlight of previous lesson
Presentation	
Step I	Soil erosion is the gradual washing away of soil particles by water or by wind.
Step II	Types of soil erosion <ol style="list-style-type: none"> (1) Splash erosion (2) Sheet erosion (3) Rill erosion

	(4) Gully erosion
Step III	<p>Erosion:</p> <p>I. Heavy rainfall causes the washing or carrying away of top soil which is rich in plant nutrient.</p> <p>II. Top soil can also be blown away by winds, resulting in nutrient reduction in the soil.</p>
Summary	The teacher concludes the lesson by summarizing the main points in the lesson.
Conclusion	The teacher concludes his lesson by allowing the students to ask questions
Evaluation	<p>The teacher evaluates the lesson by asking the students questions</p> <p>(1) Define soil erosion</p> <p>(2) List the types of soil erosion</p> <p>(3) State how soil erosion influence nutrient availability in the soil</p>

APPENDIX IV

LESSON PLAN FOR EXPERIMENTAL GROUP (CAI) (WEEK 1)

Name	Yusuf, AGWAM
School	College of education Gidan-waya
Department	Agricultural education
Registration Number	MSc/Educ/P14EDVE8010
Level	NCE II
Gender	Male and Female
Course	AGE 222: Soil Fertility
Topic	Factors Influencing Nutrient Availability in Soil
Duration	1hour
Date	19 th August, 2016
Teaching Method	Computer Assisted Instruction (CAI)
General Objectives	To teach students the factors influencing nutrient availability in soils.
Behavioural Objective	At the end of the lesson the students should be able to: 1 - List the factors influencing nutrient availability in soil. 2. Explain how soil PH and concentration of other nutrient affect the availability of soil nutrient.
Previous Knowledge	The students have learn the types of soil and characteristics of the different types of soil.
Introduction	The teacher introduces the lesson by brief highlight of previous lesson
Presentation	
Step I	The factors influencing nutrient availability in soil are as follows: 1. Soil pH 2. Concentration of other nutrients 3. Leaching 4. Crop removal 5. Oxidation and reduction of organic materials

	<p>6. Burning</p> <p>7. Soil texture</p> <p>8. Erosion</p>
Step II	<p>(1) Soil pH: the degree of acidity and alkalinity of the soil affects the availability of nutrients both in the soil and also to the plant.</p> <p>I. A low pH (high acidity) will encourage the disintegration of clay and minerals like calcium, iron and aluminum which are leached away from the top soil.</p> <p>II. At high pH (high alkalinity) calcium and magnesium ions accumulate in the soil and this affect the growth of plants.</p> <p>III. A low pH also reduce the activities of soil living organisms which aid the decomposition of organic matter.</p>
Step III	<p>(2) Concentration of other nutrients:</p> <p>I. The presence of certain elements in high concentration may prevent the absorption or utilization of other elements.</p> <p>II. The concentration of Nitrogen and phosphorus in the soil results in the non-availability of potassium.</p> <p>III. This condition results in retarded growth, low yield or even death of the plant.</p>
Summary	The teacher concludes the lesson by summarizing the main points in the lesson.
Conclusion	The teacher concludes his lesson by allowing the students to ask questions
Evaluation	<p>The teacher evaluates the lesson by asking the students questions.</p> <ol style="list-style-type: none"> 1) Mention the factors influencing availability of nutrient in the soil. 2) State how soil PH influencing nutrient availability in the soil. 3) State how concentration of other nutrient influencing the availability of nutrient in the soil.

LESSON PLAN FOR EXPERIMENTAL GROUP (CAI) (WEEK 2)

Name	Yusuf, AGWAM
School	College of education Gidan-way
Department	Agricultural education
Registration Number	MSc/Educ/P14EDVE8010
Level	NCE II
Gender	Male and Female
Course	AGE 222: Soil Fertility
Topic	Factors Influencing Nutrient Availability in Soil
Duration	1hour
Date	26 th August, 2016
Teaching Method	Computer Assisted Instruction (CAI)
General Objectives	To teach students the factors influencing nutrient availability in soils.
Behavioural Objective	At the end of the lesson the students should be able to: 1. Define leaching 2. State how leaching influence nutrient availability in the soil.
Previous Knowledge	The students have learn soil PH, concentration of other nutrients and how they influence nutrient availability in soil.
Introduction	The teacher introduces the lesson by brief highlight of previous lesson
Presentation	
Step I	Leaching this is the removal of nutrient from the top soil to the inner point of the soil beyond the root zone
Step II	1. It results in the lost of nutrient such as calcium, potassium, and magnesium from the top soil in solution. 2. It result in the accumulation of aluminum and hydrogen ion which becomes acidic and toxic to plants
Summary	The teacher concludes the lesson by summarizing the main points in the lesson.
Conclusion	The teacher concludes his lesson by allowing the students to ask questions
Evaluation	The teacher evaluates the lesson by asking the students questions 1. Define the term leaching 2. State how leaching influence the availability of nutrient in the soil

LESSON PLAN FOR EXPERIMENTAL GROUP (CAI) (WEEK 3)

Name	Yusuf, AGWAM
School	College of education Gidan-waya
Department	Agricultural education
Registration Number	MSc/Educ/P14EDVE8010
Level	NCE II
Gender	Male and Female
Course	AGE 222: Soil Fertility
Topic	Factors Influencing Nutrient Availability in Soil
Duration	1hour
Date	2 nd September, 2016
Teaching Method	Computer Assisted Instruction (CAI)
General Objectives	To teach students the factors influencing nutrient availability in soils.
Behavioural Objective	At the end of the lesson the students should be able to: <ol style="list-style-type: none"> 1. Define crop removal 2. State how crop removal influence nutrient availability in the soil.
Previous Knowledge	The students have already learn leaching, and its influence on nutrient availability in soil.
Introduction	The teacher introduces the lesson by brief highlight of previous lesson
Presentation	
Step I	When plant nutrient are available in a given soil and crops are planted on such soil. The crops tends to make use of the soil nutrients that are in the soil and gradually the availability of nutrient in the soil becomes less due to crops utilizing the nutrients in a number of processes.
Step II	1) Nutrients are removed from the soil by crops for growth,

	<p>development and reproduction.</p> <p>2) When crops are harvested the nutrient content in them are never returned to the soil.</p> <p>3) The rapid removal of nutrient from the soil by continuous cropping, completely deprived the soil of such nutrients</p>
Summary	The teacher concludes the lesson by summarizing the main points in the lesson.
Conclusion	The teacher concludes his lesson by allowing the students to ask questions
Evaluation	<p>The teacher evaluates the lesson by asking the students questions</p> <ol style="list-style-type: none"> 1. What is crop removal 2. State how crop removal influence nutrient availability in the soil.

LESSON PLAN FOR EXPERIMENTAL GROUP (CAI) (WEEK 4)

Name	Yusuf, AGWAM
School	College of education Gidan-waya
Department	Agricultural education
Registration Number	MSc/Educ/P14EDVE8010
Level	NCE II
Gender	Male and Female
Course	AGE 222: Soil Fertility
Topic	Factors Influencing Nutrient Availability in Soil
Duration	1 hour
Date	9 th September, 2016
Teaching Method	Computer Assisted Instruction (CAI)
General Objectives	To teach students the factors influencing nutrient availability in soils.
Behavioural Objective	At the end of the lesson the students should be able to: <ol style="list-style-type: none"> 1. Explain the concept of oxidation and reduction process 2. Explain how oxidation and reduction influencing nutrient availability in the soil
Previous Knowledge	The students have already learned crop removal, and its influence on nutrient availability in soil.
Introduction	The teacher introduces the lesson by brief highlight of previous lesson
Presentation	
Step I	<p>When a reacting atom losses one or more electrons to other atoms, the atom is said to be oxidized. Atoms that gain electrons are said to be in the reduced stage as (Fe²⁺) can be oxidized to other stages as (Fe³⁺). When free gas (oxygen) is available to accept some of the electrons giving up by Fe²⁺</p> <p>Reduction $Fe^{2+} + 2e^{-} \longrightarrow Fe^0$ (gain of electrons) (Ferrous Iron) (neutral iron metal)</p> <p>Oxidation $Fe^{2+} \longrightarrow Fe^{3+} + e^{-}$</p>

	(loss of electron) (ferrous Iron) (Ferric Iron) (electron)
Step II	<p>Oxidation and reduction of organic material:</p> <p>I. Some compounds such as ammonium radicals are oxidized to gaseous ammonia.</p> <p>II. Nitrates are also reduced to molecular nitrogen or oxides of nitrogen by denitrifying bacterial.</p> <p>III. These products (i.e. ammonium radicals and nitrates) which escape into the atmosphere in form of gases make the soil become poorer in nutrients</p>
Summary	The teacher concludes the lesson by summarizing the main points in the lesson.
Conclusion	The teacher concludes his lesson by allowing the students to ask questions
Evaluation	<p>The teacher evaluates the lesson by asking the students questions</p> <ol style="list-style-type: none"> 1) Explain the concept of oxidation and reduction 2) State how oxidation and reduction influencing nutrient availability in the soil

LESSON PLAN FOR EXPERIMENTAL GROUP (CAI) (WEEK 5)

Name	Yusuf, AGWAM
School	College of education Gidan-waya
Department	Agricultural education
Registration Number	MSc/Educ/P14EDVE8010
Level	NCE II
Gender	Male and Female
Course	AGE 222: Soil Fertility
Topic	Factors Influencing Nutrient Availability in Soil
Duration	1hour
Date	16 th September, 2016
Teaching Method	Computer Assisted Instruction (CAI)
General Objectives	To teach students the factors influencing nutrient availability in soils.
Behavioural Objective	At the end of the lesson the students should be able to: <ol style="list-style-type: none"> 1) Define burning 2) State how burning influence nutrient availability in the soil
Previous Knowledge	The students have already learned about oxidation and reduction of soil nutrient and its influence on nutrient availability in soil.
Introduction	The teacher introduces the lesson by brief highlight of previous lesson
Presentation	
Step I	Burning is the act of setting fire on the on the surface previous stuck of vegetation on the farm.
Step II	Burning: <ol style="list-style-type: none"> I. It exposes the soil to erosion which can wash away plant nutrients in the soil. II. It bums the organic matter content of the soil, thereby reducing the amount of nutrients in the soil.

	III. It kills or reduces the numbers of soil organisms which aid decomposition of materials and consequently, most nutrients may not be available to the soil.
Summary	The teacher concludes the lesson by summarizing the main points in the lesson.
Conclusion	The teacher concludes his lesson by allowing the students to ask questions
Evaluation	The teacher evaluates the lesson by asking the students questions <ol style="list-style-type: none"> 1. What is burning 2. State how burning influence nutrient availability in the soil

LESSON PLAN FOR EXPERIMENTAL GROUP (CAI) (WEEK 6)

Name	Yusuf, AGWAM
School	College of education Gidan-waya
Department	Agricultural education
Registration Number	MSc/Educ/P14EDVE8010
Level	NCE II
Gender	Male and Female
Course	AGE 222: Soil Fertility
Topic	Factors Influencing Nutrient Availability in Soil
Duration	1hour
Date	23 rd September, 2016
Teaching Method	Computer Assisted Instruction (CAI)
General Objectives	To teach students the factors influencing nutrient availability in soils.
Behavioural Objective	At the end of the lesson the students should be able to: <ol style="list-style-type: none"> 1) Define soil texture 2) List the types of soil texture 3) State how soil texture influence nutrient availability in the soil
Previous Knowledge	The students have already learned about burning and its influence on nutrient availability in soil.
Introduction	The teacher introduces the lesson by brief highlight of previous lesson
Presentation	
Step I	Soil texture is the relative proportion (sizes) of the various particles of soil in other words, it refers to the degree of fineness and coarseness of the various soil particles.
Step II	The types of soil texture are: <ol style="list-style-type: none"> 1. Clay 2. Silt

	<ol style="list-style-type: none"> 3. Fine sand 4. Coarse sand 5. Gravels
Step III	<p>Soil texture:</p> <ol style="list-style-type: none"> I. Fine texture such as clay and silt, ensure the availability of nutrients in the soil. II. But coarse texture like sand prevents the availability of nutrients in the soil. III. Coarse texture encourages the leaching of nutrients from the soil.
Summary	The teacher concludes the lesson by summarizing the main points in the lesson.
Conclusion	The teacher concludes his lesson by allowing the students to ask questions
Evaluation	<p>The teacher evaluates the lesson by asking the students questions</p> <ol style="list-style-type: none"> 1) Define soil texture 2) List the types of soil texture 3) State how soil texture influence nutrient availability in the soil

LESSON PLAN FOR EXPERIMENTAL GROUP (CAI) (WEEK 7)

Name	Yusuf, AGWAM
School	College of education Gidan-waya
Department	Agricultural education
Registration Number	MSc/Educ/P14EDVE8010
Level	NCE II
Gender	Male and Female
Course	AGE 222: Soil Fertility
Topic	Factors Influencing Nutrient Availability in Soil
Duration	1hour
Date	30 th September, 2016
Teaching Method	Computer Assisted Instruction (CAI)
General Objectives	To teach students the factors influencing nutrient availability in soils.
Behavioural Objective	At the end of the lesson the students should be able to: <ul style="list-style-type: none"> 1) Define soil erosion 2) State the types of soil erosion 3) State how soil erosion influence nutrient availability in the soil
Previous Knowledge	The students have already learned about soil texture and its influence on nutrient availability in soil.
Introduction	The teacher introduces the lesson by brief highlight of previous lesson
Presentation	
Step I	Soil erosion is the gradual washing away of soil particles by water or by wind.
Step II	Types of soil erosion <ul style="list-style-type: none"> (1) Splash erosion (2) Sheet erosion (3) Rill erosion

	(4) Gully erosion
Step III	<p>Erosion:</p> <p>I. Heavy rainfall causes the washing or carrying away of top soil which is rich in plant nutrient.</p> <p>II. Top soil can also be blown away by winds, resulting in nutrient reduction in the soil.</p>
Summary	The teacher concludes the lesson by summarizing the main points in the lesson.
Conclusion	The teacher concludes his lesson by allowing the students to ask questions
Evaluation	<p>The teacher evaluates the lesson by asking the students questions</p> <p>(1) Define soil erosion</p> <p>(2) List the types of soil erosion</p> <p>(3) State how soil erosion influence nutrient availability in the soil</p>

APPENDIX V

AGRICULTURAL SCIENCE ACHIEVEMENT TEST (ASAT)

School:.....

Name:.....

Reg. no:.....

Sex:.....

Department:.....

Instruction: Answer All Questions from section A and One question from section B.

1. Which of the following is an environmental factors affecting agricultural production?
 - A) Crop removal
 - B) Leaching
 - C) Wind
 - D) Concentration of other nutrients
2. All these are ways by which soil pH affect nutrients availability in the soil except.
 - A) Encourages the disintegration of clay minerals
 - B) Leads to accumulation of soil minerals
 - C) Reduction of microbial activities
 - D) Increases the vigorous growth in crops
3. At low pH a soil is adjudged to be
 - A) Neutralized
 - B) Humorous
 - C) Acidic

- D) Alkaline
4. Leaching in soil leads to the following except.
- A) Removal of nutrients from the top soil
 - B) Increasing the soil stability
 - C) Result in the accumulation of ions toxic to plants
 - D) Movement of soil and water from one horizon to the other
5. Crop removal will affect the availability of plants nutrients in the following ways.
- A) Nutrients are removed from the soil by plants for growth
 - B) Crops are harvested with the nutrients contained in them
 - C) Nutrient up take by the crops
 - D) Plough back of soil nutrient.
6. Non availability of phosphorous in soils could result in the following except?
- A) Reared growth
 - B) Low yield
 - C) Death of the plant
 - D) Luxury growth
7. Nitrogen is fixed in the soil by bacteria! Called
- A) Humorous bacteria
 - B) Denitrifying bacteria
 - C) Bacteria wilt
 - D) Bacteria blight
8. All the following are effect of oxidation of soil nutrients except.
- A) Nutrients are reduced to molecular nitrogen oxides by denitrifying bacterial

- B) Nitrogen are washed away by rain.
 - C) Nitrates are reduced to molecular nitrogen by denitrifying bacteria
 - D) The escape of nutrients into the atmosphere in form of gases makes the soil become poorer.
9. Soil Nitrogen can be removed by all the following except
- A) Washing away by rain
 - B) Crops uptake
 - C) Fertilizer application
 - D) leaching
10. Bush burning causes the following on soil except.
- A) Encourage crop vigour
 - B) Reduce the soil organic matter content of the soil
 - C) Exposes the soil to erosion
 - D) Kill the soil organisms
11. Leaching simply refers to as
- A) Removal of soil nutrient and water from top soil to subsoil.
 - B) Removal of nutrient by erosion
 - C) Removal of excess water rain
 - D) All of the above
12. Which of the following statement is not true about soil texture?
- A) Fine texture ensures the availability of nutrients in the soil
 - B) Coarse texture like sand prevent nutrients accumulation
 - C) Fine texture encourages accelerated erosion

- D) Coarse texture encourages leaching
13. Which of the following is not true about soil erosion?
- A) It cause by heavy rainfall
 - B) Top soil can also be blown away by winds
 - C) It involves transport of soil particles and nutrients
 - D) Nutrient are leached below the root zone
14. The two important agents of erosion include
- A) Win speed and velocity
 - B) Rainfall and wind
 - C) Water and heat
 - D) All of the above
15. Which of the following does not influence the texture of a soil?
- A) Sand
 - B) Silt
 - C) Clay
 - D) Nutrients
16. Nutrients availability in soil is determined by the following except.
- A) Soil pH
 - B) Soil erosion
 - C) Crop removal
 - D) Size of the ridges in the soil

17. From figure below at what point is pH adjudged to be neutral?

- A) 0-5
- B) 6-8
- C) 9-12
- D) 0-12

18. The high concentration of Nitrogen and phosphorus in soil result in the following except:

- A) Retarded growth
- B) Low yield
- C) Rigorous crop growth
- D) Death of plant

19. Rapid removal of nutrient from the soil causes:

- A) Increase fertility in soil
- B) Degradation of soil
- C) Deprive the soil of such nutrients
- D) Increase crop growth

20. Lack of sufficient soil microorganisms is attributed to the following except:

- A) Low organic matter decomposition
- B) Low soil aeration
- C) High water holding capacity
- D) High organic matter decomposition

SECTION B

1. Define the term soil erosion and list any 4 types of soil erosion
2. Define the term soil and state any 4 types of soil

APPENDIX VI

MARKING SCHEME SECTION A

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

Each correct answer is 4 marks $4 \times 20 = 80$

MARKING SCHEME SECTION B

Q1: Soil Erosion is the gradual washing away of soil particles by water and wind = 4 marks

Splash erosion = 4 marks

Rill erosion = 4 marks

Sheet erosion = 4 marks

Gully erosion = 4 marks

Total = 20 marks

Q2: Definition of soil:- This is the upper most loose layer of the earth which support the growth of plant. = 4 marks

Sandy soil = 4 marks

Silt soil = 4 marks

Clay soil = 4 marks

Loamy soil = 4 marks

Total = 20 marks