Title Page

SKILL IMPROVEMENT NEEDS OF TEACHERS OF AGRICULTURAL EDUCATION IN SOIL CONSERVATION IN COLLEGES OF EDUCATION IN SOUTH-EASTERN NIGERIA

BY

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A THESIS SUBMITTED TO
DEPARTMENT OF VOCATIONAL TEACHER EDUCATION
FACULTY OF EDUCATION
UNIVERSITY OF NIGERIA,
NSUKKA.

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF DEGREE OF DOCTOR OF PHILOSOPHY (Ph.D) IN AGRICULTURAL EDUCATION.

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May, 2012

APPROVAL PAGE

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This is to certify that Ifeanyieze, Florence Obiageli, a post-graduate student in the Department of Vocational Teacher Education and with registration number PG/PhD/06/42114 has satisfactorily completed the requirements for the research for the degree of Doctor of Philosophy in Agricultural Education. The work embodied in this thesis is original and has not been submitted either in part or in full for any other diploma or degree of this or any other university.

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DEDICATION

This work is dedicated to the researcher's children Chidera, Chinonso, Kenechukwu, Chisom and Chioma for their growing interest and passion for academics.

ACKNOWLEDGEMENTS

The researcher is grateful to Professor N.J Ogbazi, the supervisor for all his guidance towards the completion of this work. Special gratitude goes to Professor S.O Olaitan for his efforts in directing the researcher. The researcher extends appreciations to Doctors R.O Mama, T.C. Ogbuanya, F.M Onu and E.C. Osinem who have contributed appreciably to the success of this work by reading it at different stages.

The researcher's special thanks go to Chief E.M Ifeanyieze (the husband) and the Children Ifeyinwa, Chidera, Chinonso, Kenechukwu, Chisom, Chioma and other members of the family whose encouragement and moral support made this work successful. The researcher also appreciates the effort of Dr A. U. Eze of EZUTH Hospital Enugu for his financial support and other assistance. The researcher is also thankful to Rev. Frs. J. Nwafor, D. Omego, G. Nnamani, brothers Arinze Aneke and Chukwudi for their special prayers.

Finally, special thanks go to Almighty God for His protection, kindness and guidance throughout the course of this study.

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Abstract

This study was carried out to determine the skill improvement needs of teachers of Agricultural Education in soil conservation in Colleges of Education in South-eastern Nigeria. Four research questions were developed and answered while two null hypotheses were formulated and tested at 0.05 level of significance and 100 degrees of freedom. Descriptive survey research design was adopted for the study. The entire population of 109 respondents consisting of 20 lecturers in the University and 89 teachers in Colleges of Education, in South-eastern Nigeria were used for the study. A 242 ï item structured questionnaire, developed from the literature reviewed for the study was used to collect data from the respondents. Each questionnaire item was divided into two categories of required and performance. The required category had a 4 response options of Highly Required (HR), Averagely Required (AR), Slightly Required (SR) and Not Required. The performance category also had 4 response options of High Performance (HP), Average Performance (AP), Low Performance (LP) and No Performance (NP). The questionnaire items were face validated by five experts. The internal consistency of the questionnaire was determined using Cronbach alpha method and coefficients of 0.83 and 0.97 were obtained for professional and technical skill questionnaire respectively. The 109 copies of the questionnaire were admininstered on the respondents with the help of five research assistants. 102 copies of the questionnaire administered were retrieved and analysed. Weighted mean, standard deviation and Improvement Need Index (INI) were used to answer the research questions while t-test statistic was used to test the null hypotheses. The findings of the study revealed that 39 skill items in instruction and 203 skill items in soil conservation were required for effective teaching of students in Colleges of Education in the study area. It was also found out that, teachers of Agricultural Education need improvement in 38 out of 39 skill items in instruction and 152 out of 203 skills items in soil conservation. The findings on hypotheses revealed that there was no significant difference in the mean ratings of the respondents (lecturers and teachers) on 35 out of 39 skill items in instruction, and 174 out of 203 skill items in soil conservation that were required for effective teaching of students in Colleges of Education in South-eastern Nigeria. It was therefore recommended that the teachers of Agricultural Education should utilize the identified skills in instruction and soil conservation to seek for sponsorship from their administrators to re-train themselves in the areas of their deficiency

CHAPTER 1

INTRODUCTION

Background of the Study

Production of crop plants and animals is carried out on the soil by man. Soil is, therefore, a natural resource that supports life. Olaitan and Lombin (1985) said that soil is a natural body of loose unconsolidated material which constitutes a thin layer several meters deep on the earth's surface. The authors further stated that soil is derived from weathered parent rock materials, decaying organic matter and composed of solid particles with liquid and gasses occupying the spaces between the particles. Herran and Donahue (1991) stated that soil is the mineral and organic surfaces of the earth capable of supporting upland plants. The authors affirmed that soil has been formed by the active factors of climate and biosphere exerting their influence on parent material. With reference to this study, soil refers to the loose material derived from weathered rocks, decayed organic matter and formed through the action of climate and biosphere on the rocks.

Soil is composed of air, water, organic matter and living organisms. Brady and Weil (1999) stated that soil with its components perform five functions which are: as a medium for plant growth; a system for storage, supply and purification of water; a recycling system for plant nutrients and organic matter; a habitat for organisms and as an engineering medium.

As a medium for plant growth, soil holds the plant firmly. The soil particles that are together make the soil to be compact. When the plant grows, the meristem of the plant penetrates into the compact soil in such a way that the plant becomes anchored and stands firmly on the earthǒs surface without falling over. Olaitan and Lombin (1985) observed that soil serves as an anchorage for most plants except for some of the creepers and climbers. Brady and Weil (1999) indicated that the soil mass provides physical support by anchoring the root system so that the plant does not fall over. The authors concluded that due to the ability of the soil to hold the plant firmly, the soil therefore, determines the nature of vegetation present and indirectly the number and types of animals (including people) that the vegetation can support in a place.

The soil acts as a medium of storage of nutrients for plants, harbouring 16 nutrient elements. The 16 nutrient elements are classified into two; major and minor nutrient elements. The major ones are Nitrogen, Phosphorus, Potassium, Calcium, Magnesium and Sulphur while iron, cobalt and manganese among others are minor or trace elements. These nutrient elements are absorbed in ionic form through the process of Cation Exchange Capacity (CEC). CEC is the amount of exchangeable cation adsorbed per unit weight of the soil (me/100g) at a particular pH. Brady and Weil (1999), stated that the nutrient elements are utilized at different rates and amount, interacting metabolically to influence the biochemical and biophysical characteristics of plants and yield. The authors further stated that when an essential element such as Nitrogen, Phosphorus or Potassium is limiting or becomes stressed in the soil, biochemical and biophysical changes occur in plants, which produces specific visible changes of deficiency symptoms for various crops. This is an indication that the store house of the soil for such element is empty or very low to satisfy the plant during nutrient removal.

The soil also stores water for plantô use. When rain falls, the water is absorbed by the soil through the process of infiltration. The water is then retained in the soil by adhesive (mutual attraction between the soil solids and water molecules) and cohesive (the attraction water molecules have for each other) forces. The water in the soil dissolves the soil nutrients and also helps in the transportation of these absorbed nutrients from the root and food manufactured by the leaves to other parts of the plants. According to Munson (1990), soil moisture (water) is extremely important in the uptake and utilization of all the essential elements in the soil. Its availability in the soil replaces the moisture lost through the stomata of the leaves. Brady and Weil (1999) observed that as long as plant leaves are exposed to sunlight, the plant requires a continuous stream of water from the soil to use in cooling, nutrient dissolution and transportation, turgor maintenance and photosynthesis. The authors concluded that plants use water continuously, so, the water holding capacity of the soil is essential for plantsô survival.

Soil provides favourable environment for living organisms to function. The soil, therefore, harbours, protects and provides them with sufficient air and water for their survival. Brady and Weil (1999) observed that soil is a habitat for many macro and micro organisms. Enrenfeld (2001), declared that soil is a biological habitat, harbouring and sustaining a myriad of living organisms. The soil living organisms utilize soil and in return act on dead plants and animals causing them to decay, thereby increasing the nutrients capacity of soil. Brady and Weil (1999) noted that within the soil, waste products, dead bodies of plants, animals and people are decomposed and assimilated; and their basic elements made available for re- use by the action of living organisms. Goetz (2005) affirmed that soil living organisms are important to the soil because they improve the soil fertility by breaking down the plant and animal tissues. During this process, the nutrient content of these tissues are released to the soil and minerals that were formerly fixed are released for further use by the subsequent plants growing on the soil. It therefore means that when the soil is provided with organic manure, the nutrient status of the soil is increased through the action of soil living organisms.

The soil functions as an engineering medium, to support buildings, roads, airports and people. Brady and Weil (1999) stated that in human built system, soil serves as an engineering medium, providing materials in form of earth-fill and bricks and foundations for virtually every road, airport and house. Eijackers and Hamers (2007) indicated that soil functions as a platform for man-made structures like buildings, airports and highways. This means that the soil serves as a base material that enhances the construction of farm structures and buildings in addition to providing materials used for conserving it. For example concreting in erosion control is made possible by mixing soil with other materials.

The soil performs invaluable functions that positively affect plants, animals and man. To enable the soil continue to function interactively and continuously to the benefit of the plants, animals and man, it requires conservation.

Conservation as explained in Encyclopaedia Britannica (2000) means the concern and strategies surrounding the protection of natural resources from over-use or degradation. Goetz (2005) stated that conservation is a planned management of a natural resource or the total environment of a particular ecosystem to prevent exploitation, pollution, destruction or neglect and to ensure the future use of the resource. Wikipedia (2008) stated that conservation is the act of preserving and renewing resource to assure their highest economic or social benefit over the longest period of time. The author further stated that clean water, healthy soil and clean air are the natural resources that are worth conserving for future generations. Silvertooth (2001) said that conservation of soil is an important responsibility of those involved in crop production and land management. This according to the author is because the more every acre of land is cultivated for higher yields, the more that land is deprived of its nutrients. In the context of this study, conservation is a process of assisting the soil to acquire and store nutrients, water and organic matter for the sustainability of plants, animals and man. It is also for making the soil free from degradation activities and nutrient losses due to actions of man and other environmental hazards like landslides and erosion.

Soil conservation is very important as it brings about enhancement in the quality and content of the soil. In the submission of Franzen (1997), soil conservation brings about increase in the organic matter content of the soil; while protecting it from moisture and nutrient losses. Elsevier (2006) summarized the importance of soil conservation to include; enhancement in the chemical, biochemical and physical properties of the soil; which means that when the soil is conserved, there is increase in the number of living organisms, nutrient elements, water and organic matter content of the soil thereby increasing the potential of the soil in the sustainability of crop or animal production for better survival of man.

Conservation of the soil can be carried out in many ways. These include application of manure (organic and inorganic), practicing crop rotation, soil testing, mulching and cover cropping. Harris (1998) stated that soil conservation practices include recycling of organic materials within the soil; while integrating crop and livestock production. Uri, Atwood and Sanabria (2004) said that soil conservation involves minimum or zero tillage, crop rotation, periodic use of cover crops, use of manure and adequate fertilizer, seeding of areas of runoff with grasses, planting rows of trees or shrubs to act as wind-brake, terracing and application of ground limestone to control soil acidity. Agricultural and Agri-field Canada (AAFC) Report series (2007) outlined conservation practices to include addition of manure, reduced tillage, rotating crops, growing legumes and trees, restricting the density of animals, rotational grazing, mulching and terracing, among others. Crook (2007) affirmed that soil conservation practices include: mulching heavily with hay, construction of channels to create access for water and planting of cover crops and trees. In this study, soil conservation practices include such activities as tillage practices, soil testing and analysis, manure preparation and application, crop rotation, erosion prevention and control and irrigation. Soil conservation practices are taught as a component of soil science in Agricultural Education programme.

Agricultural Education in the view of Ukonze and Olaitan (2009) is a programme designed for equipping students with competency (knowledge, skills and attitudes) in different areas of Agriculture to enable them impart same to learners in schools. Wikipedia (2010) stated that Agricultural Education is an instruction about crop production, livestock management, soil conservation and water conservation among others. Agricultural Education programme is taught to students in Universities and Colleges of Education.

Colleges of Education are tertiary institutions that prepare teachers for a minimum of three years to make them qualify to teach their respective subjects including agriculture in either primary or junior secondary schools. Those who teach Agricultural Education Programme to students in Colleges of Education are called lecturers but in this study are referred to as teachers.

A teacher as defined by the Teachersô Registration Council of Nigeria-TRCN, (2002) is a person who possesses the capability to impart the acquired competency to learners in a given subject area. Emeka in Azunku (2007) explained a teacher as a person who has acquired special competency required to effectively teach a particular subject area to a group of learners. In the opinion of Wikipedia (2010), a teacher is a person that facilitates learning in a school or college. In this study, a teacher is someone who has been trained in Agricultural Education programme in a University to enable him/her teach same course to students in Colleges of Education. The teacher is hired to teach the course content of agricultural Education because he is expected to possess the required skills.

Skill in the opinion of Jamestrom (2000) is the capability of a person in carrying out a predetermined task with minimum time, energy and material resources. Osinem and Nwaoji (2005) stated that skill is the ability of a person to perform a given task well as a result of training and practice. In the context of this study, skill is the capability, which teachers of Agriculture must possess to enable them teach Agricultural Education including soil conservation practices effectively to their students. To teach soil conservation practices effectively to students, teachers of Agricultural Education must possess both instructional and technical skills.

Instructional skills in the view of Saskatoon (2009) refers to the categories of teaching behaviours that are necessary for structuring appropriate learning experiences for students. Cortified (1996) stated that a person undergoes a prolonged academic training to enable him or her acquire instructional skills that would help such a person to perform the teaching activities. In this study, instructional skill means the competencies which a teacher of Agricultural Education possesses, that enables him to teach soil conservation practices effectively to students. Such instructional skills are demonstrated in planning, implementing and evaluating different topics in soil conservation. Planning instruction in the view of Encarta (2008) is an act of stating in advance what one intends to do and the means of doing it. In this study, planning means the act of stating in advance what to teach, how and when to teach it. Implementing instruction refers to the actual teaching of the planned instruction to students while evaluation deals with determining how far the objectives set out during planning have been achieved. A teacher that possesses the professional skill in planning, implementing and evaluating instruction is also expected to possess the technical skills.

Technical skill as explained by Higins (1994) means the ability of an individual to use specialised knowledge and technique to carry out a task; that is, the capability a person has that enables him utilize different methods and techniques in a task to accomplish such a task successfully. With reference to this study, technical skill refers to the ability teachers of Agricultural Education possess for teaching soil conservation practices effectively to their students in the Colleges. Technical skill in soil conservation refers to capabilities displayed by teachers while teaching tillage operation, soil testing and analysis, manure preparation and application, crop rotation, soil erosion prevention and control and irrigation. Lee (2007) submitted that technical skill is the most important factor in job success. For the success of Agricultural Education programme, teachers who graduated from Agricultural Education programme in Universities are hired to teach Agricultural Education including soil conservation to their students in Colleges of Education. This means that teachers with professional and technical skills from Agricultural Education Programme in Universities teach the course to their students in Colleges of Education to enable them teach Agriculture effectively to pupils and students in basic schools. It is therefore expected that graduates of Agricultural Education from Colleges of Education should teach Agriculture effectively to pupils and students in basic schools having been trained professionally and technically in the Colleges.

World Bank report on Africa (2004) indicated that teachers recruited into the teaching positions do not meet the quality required for effective teaching. The Nigerian Education Research and Development Council (NERDC) in Iheji, Ifeanyieze and Olaitan (2010) indicated that 50% of the teachers in Nigerian educational system are found incompetent. Teachers of Agricultural Education in Colleges of Education in South-eastern Nigeria were not exempt from the World Bank and NERDC report as a study carried out by Ella (2007) revealed that graduates of Agricultural Education programme of Colleges of Education in south-eastern Nigeria acquired low competence in content areas of Agricultural Education during their training. For teachers of Agricultural Education in Colleges of Education to be exonerated from the blame, there is need to find out if they possess the required professional (instructional) and technical (soil conservation) skills or not. The process of determining the skills these teachers possess in instruction and soil conservation could be carried out through assessment.

Assessment according to American School Report (1996) is the process used to gather information and make decision about how well an individual demonstrates skills while carrying out a given task. Okoro (2000) defined assessment as a form of evaluation that uses collected data to estimate the effectiveness of what is being judged. Encarta (2008) stated that assessment means the judgement about something based on understanding the situation. Wikipedia (2010) viewed assessment as the process of documenting knowledge, skills, attitudes or beliefs of an individual in a particular subject area or field of study. In this study, assessment refers to the process of gathering information about the skills teachers of Agricultural Education in Colleges of Education possess in instruction and soil conservation practices to find out areas of strengths and weaknesses. That is, finding out the skills these teachers possess in planning, implementing and evaluating instruction and in soil conservation practices which are tillage operation, soil testing and analysis, manure preparation and application, soil erosion prevention and control and irrigation to determine area of their deficiencies through comparism with standard.

There are two steps that could be followed while carrying out assessment. They are as follows

- determine the assessment procedure: that is, specific activities or tasks that will be used to evaluate how well the individual can carry out the expected task, example demonstrating tillage operation to students.

- decide on how to judge the person: that is, determining the way to rate the person carrying out the task. The assessment of the teachers of Agricultural Education Programme was carried out by rating their performances.

Performance as viewed by Quirk (1995) means the process of carrying out a piece of work or function. In the view of Hornby (2006), performance means how well or bad an individual carries out a given task. In the context of this study, performance means how well the teachers of Agricultural Education in Colleges of Education could demonstrate the skills required in teaching soil conservation practices to their students. To find out how well teachers of Agricultural Education could demonstrate the required soil conservation skills, there must be needs assessment.

Need assessment in the view of Rouda and Kussy (1995) is a systematic explanation of the way things are and the way they should be. The authors further stated that need assessment is usually associated with what an individual is expected to perform. In the opinion of Archer, Cripe and McCaslin (2009), need assessment is a process of identifying gaps, that is, discrepancies between what should be and what the current situation is. In this study, need assessment was determined by identifying the skills required in instruction and soil conservation practices and the level teachers of Agricultural Education in Colleges of Education could perform each required skill items. This is to help determine the gap. This gap according to Rosette and Sheldon (2001) could be obtained through observation or perception. Observation is the actual rating of the subjects with a rating scale when they are performing tasks while perception is the use of questionnaire to obtain information on how the respondents could perform the required tasks when they are asked to do so. This study employed the use of questionnaire to obtain information from the respondents on the level each skill item in instruction and soil conservation was required and the level teachers of Agricultural Education could perform each required skill item; the difference between the two views constituted the gap. Identification of positive gap in any skill item means that they need improvement.

Improvement in the opinion of Princeton (2007) means a change for better, that is, progress in development. Galesburg (2007), viewed improvement as an activity undertaken based on meeting the target objectives and satisfaction from lower achievement. With reference to this study, improvement connotes the performance gap to be filled by teachers of Agricultural Education in Colleges of Education in order to train their students effectively. That is, this study collected information from the respondents through the use of questionnaire to determine what they possess and what they should possess thereby, generating gaps that are to be filled by the findings of this study in teaching soil conservation practices as contained in Agricultural Education curriculum of Colleges of Education in South-eastern Nigeria.

Statement of the Problem

Agriculture is a skill oriented programme that is taught to students in schools, colleges and universities. The Federal Republic of Nigeria in its National Policy on Education (2004) stated that primary education should afford every child the opportunity to develop manipulative skills in Agriculture. The document further stated that pre-vocational programme in junior secondary school should provide students with entry level skills as a basis for acquiring occupational skills for employment in Agricultural industries in later years. Gbeyega in Iheji, Ifeanyieze and Olaitan (2010) noted that teachers of Agriculture are responsible for helping pupils and students master manipulative skills needed for employment in agricultural occupations in later life. It is, therefore, expected that the pupils and students on graduation should be able to demonstrate basic skills in Agriculture but this expectation is far from being realized. Evidences abound ((World Bank report (2004), NERDC Report in Iheji et al (2010) and Ella (2007), to show that teachers of Agricultural Education at Colleges of Education are deficient in soil conservation practices and, therefore, they are not competent enough to expose their students effectively to all areas of Agricultural Education including soil conservation practices. Interaction of the researcher with some teachers of Agriculture in junior secondary schools in a workshop organised by Ohozara local government council in 2009 for teachers of the basic schools on ‟school farm management skills in schools” revealed that they blame their teachers for not exposing them well to skills in soil conservation practices during their training at Colleges of Education.

Inadequate exposure of graduates of Agricultural Education by their teachers to curriculum content areas of Agriculture while in training affects their delivery to pupils and students they teach. Their teachers, therefore, need improvement because any improvement on the competence of these teachers of Agricultural Education in the Colleges will help improve the quality of teachers of Agriculture in basic schools in future. In determining the improvement needed, the teachers must be assessed on the skills they possess and what they need to possess; the difference between the two constituted the gap that this study determined. It was, therefore, necessary to determine skill improvement needs of teachers of Agricultural Education Programme in instruction and soil conservation in Colleges of Education in South-eastern Nigeria.

Purpose of the Study

The major purpose of this study was to determine the skill improvement needs of teachers of Agricultural Education in soil conservation in Colleges of Education in South-eastern Nigeria. Specifically, the study sought to:

1) identify instructional skills required by teachers of Agricultural

Education for effective teaching of soil conservation in Colleges of Education in South-eastern Nigeria.

2) identify soil conservation skills required by teachers of Agricultural Education for effective teaching of students in Colleges of Education in South-eastern Nigeria.

3) determine the instructional skills in which teachers of Agricultural Education need improvement for effective teaching of soil conservation in Colleges of Education in South-eastern Nigeria.

4) determine the soil conservation skills in which teachers of agricultural Education need improvement for effective teaching of students in Colleges of Education.

Significance of the Study

This study is of immense benefit to teachers and students of agricultural education programme, farmers and administrators of Colleges of Education in Nigeria. The study provided information to teachers on professional and technical skills required in soil conservation practices and areas where they need improvement. This information could be utilized by the teachers to seek for assistance from their institutions for a re-training programme in soil conservation either through workshops or short duration courses to improve themselves.

The students of Agricultural Education in Colleges of Education could also benefit from the findings of this study as they would have the opportunity of benefiting from the enriched knowledge of their teachers in soil conservation. This could help to equip them professionally and technically for teaching soil conservation component of Agricultural curriculum in primary or junior secondary schools in the study area.

The farmers in the communities could also benefit from the information generated by this study. This is because teachers of Agricultural Education Programmes interact with farmers in the communities; so improvement of these teachers will definitely assist them to counsel farmers on how to conserve the soil.

The administrators of Colleges of Education could benefit from the findings of this study on the areas of instruction and soil conservation practices where their teachers need improvement. This is because the administrators will be aware of the deficiencies of their teachers thereby realistically assisting them for re-training on their staff development programme of the college.

Research Question

The following research questions guided the study. They were:

1) What are the instructional skills required by teachers of Agricultural Education for effective teaching of soil conservation in Colleges of Education in South-eastern Nigeria?
2) What are the soil conservation skills required by teachers of Agricultural Education for effective teaching of students in Colleges of Education in South-eastern Nigeria?

3) What are the instructional skills where teachers of Agricultural Education needs improvement for effective teaching of soil conservation in Colleges of Education in South-eastern Nigeria?
4) What are the soil conservation skills where teachers of Agricultural Education needs improvement for effective teaching of students in Colleges of Education in South-eastern Nigeria?

Hypotheses

The following null hypotheses were formulated for the study and tested at 0.05 level of significance.

Ho_1 There is no significant difference in the mean ratings of the responses of lecturers of Agricultural Education in Universities and Teachers of Agricultural Education in Colleges of Education on the instructional skills required by teachers for effective teaching of soil conservation in Colleges of Education in South-eastern Nigeria.

Ho_2 There is no significant difference in the mean ratings of the responses of lecturers of Agricultural Education in Universities and teachers of Agricultural Education in Colleges of Education on the soil conservation skills required by teachers for effective teaching of students in Colleges of Education.

Scope of the Study

The study was restricted to the identification of professional and technical skills required for effective teaching of soil conservation content of Agricultural education programme in Colleges of Education in South Eastern Nigeria. The study specifically covered identification of skills required in instruction (planning, implementing and evaluation) and soil conservation practices (tillage, soil testing, manure, crop rotation, soil erosion and irrigation) for effective teaching of students.

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CHAPTER II

REVIEW OF RELATED LITERATURE

The review of related literature for this study was presented under the following sub-headings

- **Conceptual Framework of the Study**

  Concepts of Colleges of Education, Agricultural Education, Teacher, Assessment and Improvement.

  Approaches to the identification of skill needs of teachers of agriculture.

  Task analysis
  Job Analysis
  Modular Approach

  instructional Skills required for Teaching of Soil Conservation
  Planning Instruction
  Implementing Instruction
  Evaluating Instruction
  Soil Conservation Skills Required for Effective Teaching of Students in Colleges of Education.
  Tillage Operations
  Soil Testing and Analysis
  Manure Preparation and Application
  Crop Rotation
  Soil Erosion Prevention and Control
  Irrigation
- **Theoretical framework of the study**

  Theories of Teaching
  Principles of soil Conservation
  Need Assessm

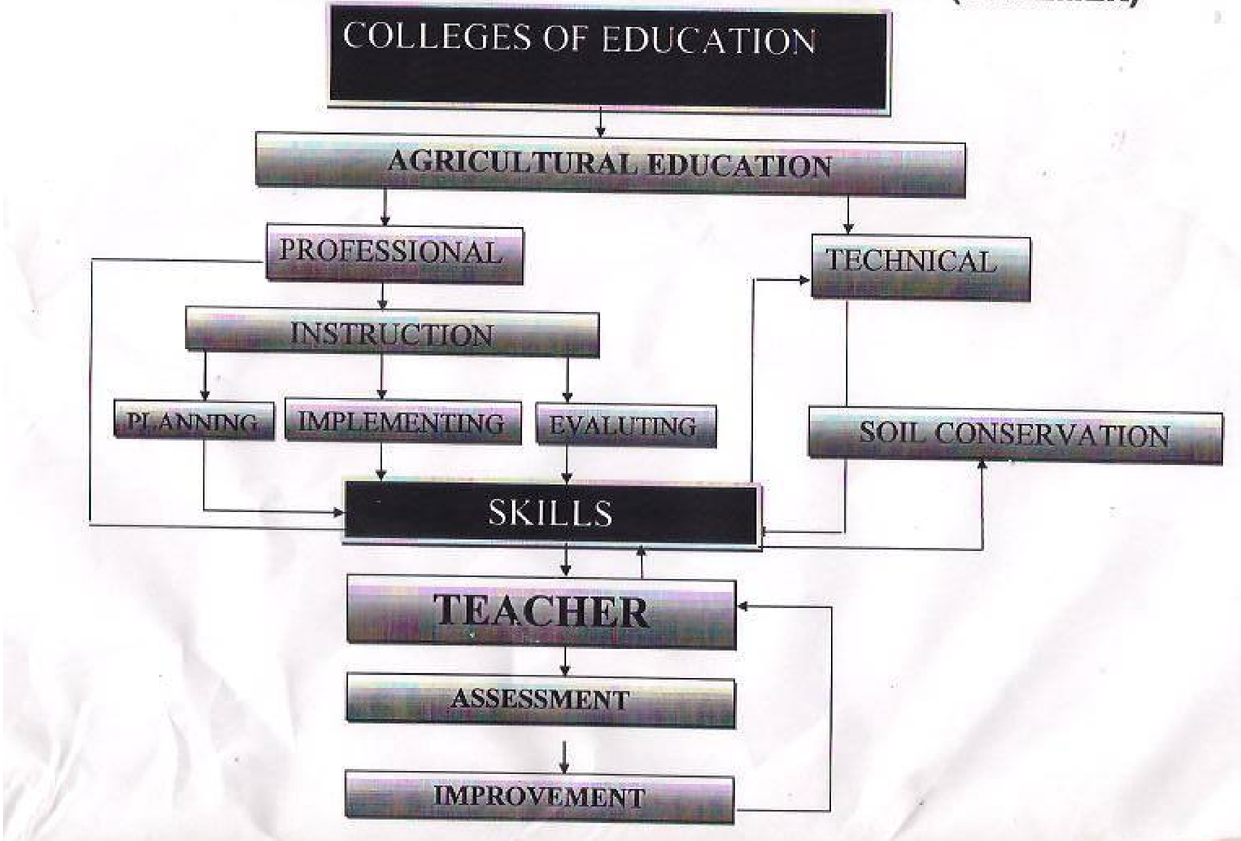
- **Review of Empirical Studies**
- **Summary of Review of Related Literature**

Conceptual Framework of the Study

Conceptual Framework in the view of Mujer (2003) refers to a set of coherent ideas or concepts organised in a manner that makes them easy to communicate to others. It can also mean an organised way of thinking about how a project takes place and how its activities can be understood. It is an overview of ideas and practices that shape the way a study is carried out. With reference to this study, conceptual framework means a coherent set of ideas arranged in such a manner that makes it easy for readers to understand the activities carried out in the study. Michiko (2009) said that conceptual framework is used in a research to help outline possible course of action or present preferred approach. To the author, conceptual framework can act like a map that gives coherent direction to empirical inquiry. Conceptual framework takes different forms depending on the research questions or problem of the study and so helps to explain why a project is carried out in a particular way. The conceptual framework of this study was presented in form of a schemer.

A schemer refers to a group of related things (Encarta, 2009). Houghton (2009) said that schemer means a chart, or diagram showing orderly related parts. With reference to this study, schemer means a chart showing related activities carried out to ensure effective teaching of Agricultural Education including soil conservation in Colleges of Education as in fig 1

CONCEPTUAL FRAMEWORK OF THE STUDY (SCHEMER)



Colleges of Education are tertiary institutions that prepare teachers for a minimum of three years to make them qualify to teach their respective subjects in either primary or junior secondary schools. Agricultural Education is one of the programmes in Colleges of Education.

Agricultural Education is a programme designed for equipping students with professional and technical skills in Agriculture to enable them teach effectively in basic schools. The professional area refers to instructional skills in planning, implementing and evaluating lessons while the technical area refers to soil conservation skills in tillage, soil testing and analysis, manure preparation and application, soil erosion prevention and control and irrigation. For effectiveness of Agricultural Education programme in Colleges of Education, individuals that are professionally and technically trained in the Universities are hired to teach the programme. Professionally, the individuals must be competent in planning, implementing and evaluating instruction and technically, the individual must be competent in specialized area of Agriculture which in this study is soil conservation. Both instructional and technical areas of Agriculture are taught to students in Agricultural Education Programme by the teacher. A teacher in this study means someone who has been trained professionally and technically in Agricultural Education Programme in a University to teach Agricultural Education including soil conservation skills to students in College Education. In this study, skill is the capabilities which teachers of Agricultural Education must possess to enable them teach Agricultural Education including soil conservation practices effectively to their students in Colleges of Education. To ensure effective teaching of Agricultural Education in Colleges of Education, the teachers need to be intermittently assessed. Assessment refers to the process of identifying knowledge, skills and attitudes of teachers of Agricultural Education in instruction and soil conservation in order to determine their performance.. If the performance of the teachers is found below expectation it means that they require improvement to enable them perform up to expectation. Improvement refers to intervention programme given to teachers to make up for their deficiencies for better performance of their job.

Approaches to the Identification of Skill Needs of Teachers of Agriculture

This study identified some approaches that were utilised in the identification of skills required by teachers of agriculture for effective teaching of the course in Colleges of Education in South-eastern Nigeria. Some of these approaches were discussed below.

Task Analysis Approach

Task in the opinion of Mager in Olaitan (2003) is a logically related set of activities required for the completion of a job. Ethan (1997) said that task analysis is an integral part of job analysis. Specifically, the author explained that task analysis addresses the process of analysing a particular task into its various elements. That is, performance steps; and performance details, tools, equipment materials and methods. The author concluded that the information resulting from task analysis provides a basis for developing the knowledge and performance based learning activities of the training programme. Task analysis in the view of Osuala (1999) is the procedure of breaking down job activities to determine the teachable topics in terms of operation, tools, processes and technical information to be organised into course of study and arranged into sequence of difficulty. The author stated further that the procedure in developing task analysis includes

1) Task listing: This shows the various tasks that make up a particular job.

2) Breaking down of each task into detailed activities for training.

3) Arranging the activities in sequence or order for performance and training.

4) Selecting, descriptive information, tools and materials for teaching contents.

Olaitan, Nwachukwu Igbo, Onyemachi and Ekong (1999) explained that task analysis is the identification of classes of learning behaviours expected to be performed by an individual. The authors outlined five steps involved in task analysis as follows:

a) Break an occupation area into various tasks.

b) Break the task into specific learning activities.

c) Validate the activities through a review of job functions to be performed.

d) Identify materials to be used for performing each activity.

e) Implement the activities.

In a similar manner, Metteson in Olaitan (2003) said that task analysis is the process of breaking down work into smaller components which make up occupational area. This means that the occupational area is broken down into tasks which are further sub-divided into subtasks. The author stated further that task analysis is the identification of classes of learning behaviours expected to be performed by an individual. The author then outlined the steps involved in task analysis thus:

a) break occupation into various tasks.

b) break the tasks into specific learning activities.

c) validate the learning activities through a review of job functions to be performed.

d) identify materials and methods for performing each activity.

e) implement/carry out the activities.

Jonassen, Tessmmen and Harman (1999) said that task analysis is a process of analysing and articulating what one expected the learner to know how to perform. The purpose of task analysis in the view of the authors includes

1) determine the instructional goals and objectives.

2) define and describe in detail the tasks and sub-tasks that students will perform.

3) specify the knowledge type (deductive, structural and procedural) that characterise a job or task.

4) select learning outcomes that are appropriate for instructional development.

5) prioritize and sequence tasks.

6) determine instructional activities and strategies that foster learning.

7) select appropriate media and learning environment.

8) construct performance assessment and evaluation.

The authors further stated that there are five types in task analysis which are performance analysis, learning task analysis, cognitive task analysis, content or subject matter analysis and activity analysis. Each of the five methods involves different procedure for conducting the analysis and makes use of different assumptions. The author outlined the steps involved as

a) classify tasks according to learning outcomes.

b) Inventory of tasks; this involves the identification of tasks or generating a list of tasks.

c) selecting tasks ï prioritize tasks and choose those ones that are more feasible and appropriate if there is an abundance of tasks to train.

d) decomposing tasksð identifying and describing the components of the task goals and objectives.

e) sequencing tasks and sub-tasks. That is designing the sequence in which instruction should occur that will best facilitate learning.

This study identified with task analysis by dividing soil conservation practices into different tasks, example manure application, soil testing and identified the learnable skills in each task.

Job Analysis

Job in the view of Encarta (2008) means a piece of work of a particular nature. The author defined job analysis as a study of job to define it, Ethan (1997) said that job analysis is the process of mapping out a job into its various components. That is organising structure, work activities and informational content. The process in the view of the author results in a relevant timely and tailored database job-related information that can be used in a variety of ways such as to create and classify job titles, write job descriptions, prepare organisational charts, determine the quality assurance standard and write both knowledge and performance related employee evaluation measures. The author outlined 3 basic questions to ask in the process of job analysis as

a) what is the structure of the occupation? (teaching of agricultural Education in Colleges of Education).

b) what does the worker do? (teaching).

c) what does the worker need to know? (skills in teaching soil conservation).

The first question concerns the structure in framework of the occupation being analysed. If the data derived from the job analysis are used in a situation where organisational structure is important to the product being developed, then the structure of the occupation can serve as a basis from which the organisational structure of the product is developed. The 2nd question addresses the activities of the workers in terms of both tasks and performance. Whenever procedure is an issue, the performance steps of the tasks come into play as the performance steps help in the provision of a variety of related materials. The third question involves identifying the knowledge or information component of the occupation, technical, environmental and career. The author

concluded that in some cases, all or most of the information gained in complete job analysis is used in the development of the final product while in other cases only a portion of the job analysis data is used. Carter (1997) in his own view stated that job analysis is the process of identifying in details the particular job duties, their requirement and relative importance of these duties for a given job. The author further said that the process involved in job analysis include

- Identify the job area
- Draw up the activities within each duty schedule
- Arrange the activities orderly to aid performance or practice.

The author concluded by stating that the major purpose of job analysis is to identify specific job requirements and work environment factors that could affect job performance. This means that job analysis can be used in training or re-training individuals in skills required for entry into or progress in various jobs and occupation. Osuala (1999) described job analysis as detailed listing of duties operations and skills necessary to perform a clearly defined job. Such operations and skills are organised into logical sequence which may be for teaching or employment or classification purposes. Clark (1999) seems to share with the view of Osuala as he submitted that job analysis attempts to list or analyse all the knowledge, skills and attitudes the learner must learn as a pre-requisite to function in the job. In the view of Heathfield (2008), job analysis is the process used in collecting information about the duties; responsibilities and necessary skill outcomes in addition to work environments of a particular job. It simply means identifying the skills that employees need to be successful on job. The author further stated that job analysis may include such skills as:

- Carryout internet search to view samples of job descriptions
- Analyse the work, duties, tasks and responsibilities that need to be accomplished by the employee filling the position
- Research for and share with other companies that have similar jobs
- Articulate the most important outcomes on contributions needed.

Wikipedia (2008) stated that job analysis refers to various methodologies for analysing requirement of a job; the purpose of which is to document the requirement of a job and the work performed. The author further explained that the methods adopted in conducting job analysis are many among; which are

- Conducting interviews with incumbents and supervisors,
- Use of questionnaire (may be structured, open ended or both)
- Use of observations and gathering background information such as duty statements or classification.

The author then emphasized that in quest to perform job analysis, the job analyst may tour the job site and observe workers performing their job, collect materials that directly or indirectly indicate required skills,(duty statement) instructor safety manuals and quality charts), meet with a group of workers or incumbents and finally administer a survey questionnaire to make the workers rate themselves on their ability in performing the job. As regards the most commonly used method of job analysis, Fine and Cronshaw (1999) said that questionnaire are the most common method employed by certification test developers, although the content of the questionnaire (often lists of tasks that might be performed) are gathered through interviews on focused groups. The authors concluded that the general purpose of job analysis approach is to document the requirements of a job and the work performed as a preliminary to successive actions to define job domains, write a job description and create performance appraisal among others. Charles in Olaitan (2003)explained that job analysis is a statement of all related facts concerning a job which reveals its content and the modifying factors that surround the job., that is, it is an attempt to list all the knowledge, skills and attitudes that the learner must be taught if he is to learn the complete trade. A handbook on job analysis (2007) explained that job analysis identifies the competencies as directly related to performance on the job. That is, it is a systematic procedure for gathering, documenting and analysing information about the content, context and requirement of a job. The author concluded by listing the methods adopted in job analysis;

- Develop a comprehensive list of the tasks and competencies that define the job
- Rate the tasks and competencies accordingly
- Based on the ratings, analyse the competencies that are crucial to the position and which competencies if any that should be used as selective and quality ranking factors.
- Create a sample accomplishment worksheet to determine what rating various accomplishments will receive
- If needed, create sample multiple choice/yes or no ratingsôsheets to evaluate tasks and competencies.

Job analysis approach was utilized by this study by limiting itself more to the identification of knowledge, skills and attitudes needed for job performance in soil conservation and training content,. It was utilized in the identification of soil conservation skills to meet the professional and technical skill needs of teachers of agriculture in Colleges of Education in South Eastern Nigeria. In utilising job analysis in conjunction with other approaches, literature was reviewed to identify professional and technical skills from where questionnaire items was generated and used to find out the step by step of teaching a particular conservation method and how far each teacher of agriculture could perform the task. This was carried out by rating the items with regard to their agreement to the performance on the skills identified. With the gap identified, a training material/package was developed for the re-training of these teachers in the areas where gaps existed. The re-training package could be utilized by any hired teacher or instructor for the purpose of retraining them through workshops or other means.

Modular Approach

A module is a self contained component of system which has a well defined interface to the other components. In the opinion of Postlewart (1991) it is a self contained and independent unit of instruction with the primary focus on well defined objectives. The author further stated that a module consists of material and instructions needed to accomplish these objectives and that boundaries of a module are definable only in terms of the stated objectives. Stating further, the author affirmed that modular approach is characterised by some specific elements which offer opportunities for individualized study on the part of the trainee or learner. These elements are

(a) The students have full control of the study thus they can progress at their own pace.

(b) The students are fully involved in the learning process.

(c) The students are not forced to cover materials which are already familiar to them.

(d) Each student can learn each module completely before proceeding to the next unit.

(e) Each student can participate in the decision as to whether he/she has learnt the subject matter adequately.

(f) Each student has the opportunity to develop a sense of responsibility to his/her learning.

Anyanwu, Nzemiwu & Akudolu (2004) defined modular approach as a compilation of many jobs and tasks into useful training material or instructional package. The authors emphasized the need to define the target population in order to design or structure the training appropriately. The authors concluded that the basic question to be asked to help provide useful hint in the design of module may include

- What are the job titles for the intended participants in the training process?
- How are they initially trained for their job?
- What are their educational/professional backgrounds?
- Are they still in school, graduates or already practicing on the job?
- How are they accustomed to learning?
- What language do they speak and read?
- By who are they supervised or taught?
- Are they willing or ready to learn?
- Are they interested in learning?

In his own view, Akuma in Olaitan (2003) defined modular approach in terms of developing a performance training materials which produce a well designed instructional package. In the opinion of the author the processes involved are:

1. Define the target population for the training, example -teacher of agriculture.

2. List the tasks to be performed by target population using persons already in the job example -soil conservation practices.

3. List the knowledge, skills and other requirements needed to complete the task (technical and professional skills).

4. Select the knowledge and skills to be taught with training objectives (conservation skills in crop rotation and others).

5. Organise the selected knowledge and skills into suitable teachable units called module with training methods.(skills identified)

6. Draft expanded outlines of module including instructional objectives, main body, text, and descriptions of training methods (skills in each cluster of soil conservation skills).

7. Get experts to provide realistic examples and information for use in the exercise (validation by lecturers of Agricultural Education).

8. Draft the complete module, clusters in instruction (A to C) and soil conservation (A to F in chapter 4)

9. Field test the training materials or instructional package. (if it is a new one)

10. Revise and finalize training based on field test report or feedback.

From the above, it can be deduced that the first four steps make up the task analysis which are necessary to design and develop relevant and useful training material or instructional package while 5-10 constitute the design and development process.

In the view of the relevance of Modular approach to this study it was not explicitly utilized. This was because there was no need to include instructional materials, training methods or guidelines as stated in number 6 because the Lecturers of Agricultural Education programme in Universities are experts that train or re-train teachers that are found deficient in instruction or soil conservation skills. They only require knowing the skill clusters that they are to teach. Furthermore, the programme is already in existence. The lecturers and teachers of Agricultural Education as experts could identify the appropriate skills required in instruction and soil conservation so there was no need for field testing the identified skills as specified in number 9. The teachers were only to indicate the level each skill is required and the level of their performance of each skill item. It is expected that teachers would not be required to undergo training in areas where they were found competent as specified by Postlewart in number ćô(The students are not forced to cover materials which are already familiar to them).

Instructional Skills Required for Effective Teaching

Teaching profession is an occupation that requires extensive training in order to enable the trainee to acquire the necessary skills required for imparting knowledge to the learners. One of the necessary skills required by the teacher is instructional skill. Reyan (2008) defined instruction as procedures or techniques utilized to effectively present facts or ideas to a group of learners in a particular subject area. Instructional skill in the view of Saskatoon (2009) means teaching behaviours that are necessary for structuring learning experiences for students. In this study, instructional skills refer to the competencies a teacher of agriculture possesses that enable him prepare, deliver and evaluate lessons in soil conservation effectively. According to McCoy (2008) there are at least 34 instructional skills which are subsumed in planning, implementing and evaluating teaching-learning process. It therefore means that instructional skills are demonstrated in planning, implementing and evaluating teaching. Akinpelu in Offorma (1994) explained that teaching is a deliberate effort by a mature or experienced person to impart information, knowledge, skills and attitudes to immature or less experienced person through a process that is morally and pedagogically acceptable. The experienced person that imparts the information, knowledge, skills and attitudes to less experienced person is the teacher while the receiver of the information, knowledge, skills and attitudes is the learner. Terry (2008) described a teacher as a facilitator of learning in the classroom (an area where teaching-learning takes place).

To effectively facilitate learning, the teacher is expected to possess planning, implementing and evaluating skills in addition to exhibiting different teaching methods. This may be why Shank and Terril (1995) described the teacher as a planner of content, sole deliverer of instruction, controller of classroom and an evaluator of achievement. This means that the first stage of teacherọs work is planning for the teaching-learning process.

Planning in the view of Clark, Ross and Shackleton (1994) is a decision made about the objectives, means to be employed and how they are employed to help achieve the objectives. The authors stated further that planning is an activity or a process for decisively and deliberately moving from a known situation where the individual is currently to a defined target situation in the future. Encarta (2008) said that planning is an act of stating in advance what one intends to do. With reference to classroom instruction, Olaitan (2003) said that it is a process of deciding on what content, media and activities (teacher and student) that are relevant in the instruction. In the opinion of Carrie, Michelle, Sabrina and Laine (2008), lesson plan is a window into a teacherøs preparation to deliver content, scaffold the development of studentsô skills and manage the learning environment. Collum (2008) said that lesson plan is a framework for a lesson which shows where to start, where to finish and the route to get there. Offorma (1994) said that planning is a prelude to an instruction because it is at this stage that objectives are identified, learning experiences and materials selected based on making the objectives achievable, questions (assessment) and expected answers from the students included. Answering the questions at the planning stage as suggested by the author brings out the correct answers and exposes the obscurity in the instruction while providing opportunities for improving on them. Strong (2002) stated that lesson plans are positively related to improve student outcomes when the plan is able to:

- link students learning objectives with teaching activities,
- describe teaching practices to maintain studentsô attention,
- align students learning objectives with required standard, and
- accommodate students with special needs.

Wilen et al in McLaughlin (2008) said that planning for instruction involves making decisions about the selection of appropriate varieties of techniques, methods and strategies to achieve the goals and objectives of units and lessons. In planning, the teacher focuses on significant parts of the content, accounts for prior knowledge, range of studentõs abilities and experience, in addition to designing diversified lessons which motivate students to learn. It is good to reflect on value and purpose of each lesson so as to provide the insight into how to design lessons that address the knowledge and cognitive process dimensions (McLaughlin (2008)). Queenland in McLaughlin (2008) said that effective teachers build on studentsô prior knowledge and cultural experiences, integrate a range of subject areas and demonstrate connectedness of learned information to society through having standard identity to solve real world problems related to their own experiences.

With reference to this study, planning refers to preparation of lesson in advance by stating what, how and when to teach. With regard to skills in planning, Wikipedia (2008) said that possessing the skills in planning is the basis of successful teaching as it begins with the identification of the goals of a particular teaching-learning situation, encompassing a means of attaining these goals, including the activities and required materials and ends with the procedures for evaluating the goals. The author affirmed that good lesson plan has the potential to build confidence in the lesson excursion and demanded that it is necessary to include closure activity. Closure active as perceived by the author is designed to foster a sense of completion among students. It may be an essential part of the assessment process or function as a standalone activity. McLaughlin (2008) outlined the skills in carrying out the lesson plan as follows:

- consult curriculum standards
- consider and include the activities that will equip students with the needed knowledge and skills
- identify the skill that needs to be scaffold
- identify materials/resources that are best suited for accomplishing the unit objectives.

Allen (2008) in his own view said that planning activities include the following:

- conduct a need analysis of the programme/lesson to determine the basic skills required.
- develop objectives for the programme/lesson
- gather text materials and realia
- design class activities that may involve speaking, reading writing manipulating and so on
- identify opportunities for learners to put the skills into practice outside the teaching learning environment.
- Provide instructional strategies that include a variety of activities focusing on the objectives
- Design a lesson that is learner-centred. In a learner-centred lesson, the teacher creates an environment in which learners can take initiatives in choosing what and how they learn.

The author warned that the teacher must ensure that he controls the class, guides the learners and provides classroom interaction and assessment that would both provide evidence of student mastery of instructional content. Wikipedia (2008) concluded that in higher institutions, while a new teacher writes down the lesson plan, an experienced one jots down the major points or teaches without either unit plan or jotting down.

After the instructional planning, the next step is to implement the plan. Implementation according to Web (2008) is the execution of a plan; that is, an action that must follow any preliminary activities in order for something to actually happen. In the view of Offorma (1994), implementation as regards instruction is the practical phase when the learners actually engage with the planned learning opportunities; a stage when the teacher and learners are involved in negotiation aimed at promoting learning; a stage when the students on their own are actively involved in the process of interaction with the learning activities.

With reference to this study, implementation refers to the teaching of the planned lesson to the students in a learning environment which may be in the classroom, agricultural laboratory or land laboratory. Carrie, Olive, Sabrina and Laine (2008) said that although teachers may be able to craft high quality lesson plan, it is equally as important to link these plans with what occurs in the classroom. This means that the activity in the implementation stage determines the quality or importance of the plan. Richard and Gabrielle (2002) said that the teacher needs to provide students with clear statement of the lesson objectives as the first thing during implementation. This is because the authors observed that clarity of expectations is the first stage in learning cycle; an essential precursor to the provision of feedback and the students benefit from an understanding of the journey and destination that lies ahead including both the subject specific and generic skill development that are anticipated. Fogg (2007) in support of the Richards and Gabrielle©s statement said that while setting realistic goals, the teacher has to share them with the students. The author is of the opinion that the first thing to do at the implementation stage is to explain the teacher©s philosophy to the students while taking time to learn what the students expect of him as well. Anderson and Kratwohl in McLaughlin (2008) said that it is important to build on studentsô prior knowledge base, scaffolding both from basic knowledge to procedural and meta-cognitive knowledge. Donovan and Bransford in McLaughlin (2008) observed that studentsô prior knowledge base is both culturally and environmentally influenced and so advised teachers to assess their pre-conceptions regarding the topic to ensure effective methodology. McLaughlin (2008) advised teachers to use start-up-activities in assessing studentsô prior knowledge especially when a new concept is to be introduced and to link lessons within units. The author added that start-up-activities give students opportunities to apply knowledge learned in school through everyday experience to new situations. Examples of start-up-activities as identified by the author may be probing questions that asses what the students already know about the topic, what misconceptions they might have harboured.

Richard and Gabrielle (2002) advised that during implementation the teacher should bear in mind that students learn in different ways; at different rates as their understanding vary considerably according to personality. The authors outlined skills of the teacher at this stage as:

- Intimate students with the objectives
- Provide students with clear statement of skill outcome
- Provide students with clear statement of assessment requirements
- Present the subject content in a coherent manner and at appropriate level
- Focus the learning experience on achieving the objectives set in the plan
- Treat students as individuals with particular abilities, aspirations and concerns
- Accommodate studentsôdifferent learning styles and approaches.
- Respond sympathetically to their problem and demand experience of students.
- Provide appropriate assistance and support to individuals as they develop their own strategies for overcoming difficulties.
- Provide opportunities to make individual consultations after the lesson
- Modify the lesson based on studentsôreply on start-up-activities.

Renner, Greenwood and Scotch (1996) outlined the skills in implementation of instruction as

- Focus on desired learning outcomes for students in the form of knowledge, understanding, skills and attitudes.
- Assist students to form broad conceptual understanding while gaining depth knowledge

- Encourage the informed of the critical questing of accepted theories and views.
- Develop awareness of the linked and provisional nature of current knowledge in all fields.
- Engage students in discussion of ways which tasks can be undertaken
- Respect students rights to express views and opinions
- Incorporate a concern for the welfare and progress of individual students.
- Proceed from an understanding of students knowledge, capabilities and backgrounds
- Encompass a range of perspective from groups of different technical backgrounds, socio-economic status and sex.
- Acknowledge and attempt to meet the demands of students with disabilities
- Utilise instructional strategies and tools to enable many different styles of learning,
- Adopt assessment method and tasks appropriate to the desired learning outcomes of the course and topic; and to the capabilities of the students.

Olaitan (2003) summarised the skills during teaching/implementation stage to include:

- introduce the lesson by using array of the following techniques.
- give summary or revision of the previous lesson to link it with the day's lesson.

- (For a new lesson), test the studentsô entry behaviour with generally stimulating questions that are familiar but in the direction of the lesson.
- Inform the students technically the objectives of the lesson, that is, what they are expected to know or should be able to do at the end of the lesson.
- Deliver the new content step by step bearing in mind the logical arrangement of concepts in the lesson and the entry behaviour.
- Use stimulating questions to guide learnersô responses to questions and help to correct wrong answers where nobody could do so in the class.
- Introduce learning materials at appropriate time.
- Assess performance as learners practise during the class and correct error.
- Induce students to make corrections and submit for approval.

Fogg (2007) said that the skills required in implementation of instruction include:

1. identify at least one quality appreciated in each student and keep the appreciated quality in mind while entering the class; as this makes one smile on entering into the class.
2. Distribute handouts at the start of the semester and make sure the students understand why the subject matter of the course is worth learning and how it relates to real world.
3. Teach the topic.

4. Encourage students to give a feedback on the teaching (pass a card and ask the students to state what they would like to see more of and less of.)

5. Give at least one assignment that requires each student to meet with the teacher one on to one basis in the office.

Omstead (2008) explained that there are two major responsibilities of a teacher during teaching and they include:

- focus on the desired learning outcomes for students in form of knowledge, skills and altitudes.
- Assist students to form broad conceptual understanding while gaining depth of knowledge.

Some authors identified the skills in implementation based on the teaching methods employed. McCarthy (1992), explained that the teachers utilize appropriate methods and materials during implementation with aim of guiding studentsô learning. The author outlined the methods to include lecture, discussion, brainstorming, role-playing, case study and worksheets. McLaughlin (2008) agreed that teachers while teaching use varieties of teaching methods and strategies. The aim according to the author is to capture the interest, promote debt of intellectual question and increase the knowledge base of students who learn in different ways. The author concluded that; demonstration is to make students think about the dayôs topic, lectures to convey facts and concepts in depth; discussion to allow students pose questions and develop greater understanding; inquiring-based laboratory exercise to practise concepts, procedures and higher order thinking skills; and worksheets and book works to reinforce concepts. Strong (2002) said that teachers who successfully employ a range of strategies reach more students because they tap into more learning styles and students interest.

Morris (1993) included other methods as experiment, projects, campaign, games and competition. Offorma (1994) included dramatisation and field trips/excursion to the methods outlined above. According to these authors, the skills of the teacher depend on the method applied during teaching. With reference to lecture method, Offorma (1994) explained that it involves telling the students facts about a particular topic and expecting the students to recount what they have been told. This method as observed by the author is good because it is used for a large number of students, helps teachers cover the syllabus, makes students work hard in addition to covering the teachersôignorance as there is no room for questions. The author further said that the method is disadvantageous because it makes the students passive and the longer the talk, the less the recall. The author then advocates the use of lecture with other methods like discussion. McCarthy (1992) said that lecture is more effective when it is used along side with discussion, and that the following skills are required of the teacher while adopting lecture and discussion methods.

- Introduce the lesson
- Provide experience which inspires
- Stimulate thinking to open discussion by preparing the questions prior to discussion
- State time and content limit
- Involve audience after the lecture

- Give the audience room for question, clarify any challenge.

In the view of Tudor (2008) a fifty ï minutes lecture remains the core teaching methods for most undergraduate courses. In contrast to Offormasôview, the author said that the role of the lecture is best suited to providing an overview of the subject mater rather than disseminating facts. The author concluded that the key ingredient to quality lecture is when the teacher is able to:

- Present a clear objective (these can be in the course handbook with the lecture summaries to avoid provision of them being forgotten)
- Provide a clear overhead acetate or slide.
- Provide a paced delivery bearing in mind that the more difficult the materials or class size the slower the pace.
- Distribute appropriate handouts- which provide students with complex diagrams or difficult or critical texts. Good handouts also help to avoid the communication difficulties which can arise during lecture.
- Provide agreed time and places
- Occasionally replace lecture with structure exercises that is resource-base.
- At the end, provide exercises

Another method of teaching is experimentation. Experimentation in the view of Offorma (1994) is a method that helps one to discover facts. During experimentation according to the author, one goes beyond transforming evidence to new insight which involves heuristic approach (approach that helps one create question and allow students find answer). In experimentation the students are encouraged to observe and or manipulate while the teacher has to

- Create the problem
- Guide students find answers by themselves

- Create room for manipulation of living and non-living objectives
- Introduce concepts that describe or explain what has been observed
- Provide other experiences that illustrate concepts
- Provide opportunities for students to discover.

Apart from the above methods, a teacher can also utilize dramatization while teaching. Dramatisation methods as observed by Offorma (1994) involve the ability to do something as it is being done by someone or something else. The author further said that there is total participation as the learners get involved directly in the learning activity. To make dramatization effective, as identified by the author the teacher has to

- Summarise the events to be dramatised to the students.
- Highlight the important points to be learned
- select the character or ask for volunteers
- tell students on their role
- tell students on how to enter and leave the stage.
- Provide forum for players to practise and rehearse their respective parts.
- Set up the environment and create a stage for the drama.
- Organise the students to criticize their performance and
- Invite suggestions on how to improve the drama.

The author is of the opinion that a teacher can sometimes utilise game as a teaching method. Game in this context is a competitive experience regulated by established rules, where players seek to attain their goals; it is a symbolic representation of a real life situation in which two or more players compete against each other according to a definite set of rules and where a winner normally emerges as one outcome of play. Game as observed by the author improves understanding, helps learners develop critical thinking and generates empathy. Okon and Ibanga in Offorma (1994) suggested the following steps in organising games as learning activities;

- Specify the time lag.
- Select appropriate games that suit the purpose, the level and the interest of the class.
- Determine and make available the materials to be used
- Identify principles/rules of the game
- Explain the role of each player
- Select players or call for volunteers.
- Arrange the room to suit the nature of the game
- State how and when the game is to be won.
- Begin the game.
- Set the end of the game, let learners summarise what they have leant through discussion.

Field Trip/Excursion is another method of teaching. Field trip is an educational visit made outside the classroom to places of interest for the purpose of making relevant observations and collecting useful information example a visit to an erosion site. Offorma (1994) said that field trips give students opportunity to see and gain on the spot experience, observe, classify and collect and manipulate objects. These activities make classroom encounter to become clearer, sharpen studentsôobservational abilities and awaken their interest in the subject area. The author, therefore, identified the skills of the teacher to include:

- Make preliminary preparations.
- Take a trip to the location.
- Explain the purpose of the visit to the person in charge of the location.
- Secure approval of the date and time of the visit.
- Collect any available descriptive or informative materials.
- Make a tentative route plan.
- Explain the purpose of the trip to the students.
- Tell students what to look for and how to obtain the information that necessitated the trip.
- Advise the students on the required materials like books, pencils.
- Make the trip as scheduled.
- Give students opportunities to observe for themselves and make notes based on their observation.
- Arrange for a post ï excusive class discussing.
- Demand from students a report on their experiences

Evaluation

Evaluation in the view of Offorma (1994) is a process of determining how far the objectives have been attained. Olaitan (2003) explained evaluation as a process of obtaining information on what one is doing towards achieving an objective: how far one could go in the achievement, the constraints hindering the progress and how to overcome the constraints. Kizlik (2008) explained evaluation as a process designed to provide information that will help make a judgement about a given situation. To the author, any evaluation process requires information about the situation in question; a situation is therefore the umbrella that takes account of such ideas on objectives, goals, standards, procedures among others. This means that when evaluation takes place, the process will yield information regarding the worthiness, appropriateness, goodness, validity, legality of what is in focus for which a realistic assessment has been carried out. The author further stated that evaluation is a process by which information is obtained relative to some known objectives or goals. Evaluation in the view of the author is a abroad term that includes testing. That is, evaluation yields information relative to an objective or goal and so it is carried out to determine whether or not an objective or goal has been achieved. The author observed that teachers are constantly evaluating students and such evaluations are carried out in the context of comparison between what was intended and what was obtained. The author concluded by saying that ñwe assess learning and evaluate the result based on criteriaò Keifers (2008) *evaluation is synonymous with assessment or appraisal;* it is an act of determining the strength or weakness of programme, policies, and personnel in organizations with a view to improve their effectiveness. With reference to classroom instruction, Olaitan (2003) said that it is an act of ascertaining the effectiveness of the specific objectives identified at the planning stage. Habour-Peters (1999) said that evaluation requires both quantitative and qualitative description of pupilsô behaviour in addition to making value judgement concerning the desirability of the behaviour. The author further stated that during evaluation, there is an assurance that

a) instructional objective have been previously identified,

b) pupils have been exposed to some content and

c) a systematic process of observing pupilsô behaviour have been identified.

Competent teachers frequently evaluate their students in relation to leaning goals. This according to Santrock (2004) takes place before, during and after instruction. Stiggins (2007) has found that assessment-related activities can consume up to half of a teacher's professional time. Teachers can spend up to 10% of their time on formal testing alone (Newman & Stallings, 1982) but in the opinion of Stiggens (2007), 20-30% of professional time of the teacher deals with assessment matters; Brookheart (2002) warned that with so much time spent on assessment, it is necessary that it is carried out properly. In the view of the above warning, McLaughlin (2008) identified informal, formative and formal assessment designs for proper evaluation of the learners, and instruction.

Informal assessment according to the author refers to the spontaneous day-to-day observation of how students perform in class. They are on-going and integrated within everyday studentsôperformance. In the view of the author, informal assessment provides evidence that students either understand the lesson or are struggling with the provided materials in order to understand. Informal assessment is used to measure the effectiveness of the dayös instructional tasks and activities, the rate of learning and assimilation in addition to determining when to change style and method of instruction. Stiggens (2007) identified 8 skills in informal assessment as

- observe the studentsôbody language
- observe students frequently off-task behaviours in the classroom
- observe students in group discussions
- pose closure questions to students at the end of each day
- provide additional activities to keep students involved on task
- provide cross-word puzzles or a more challenging worksheet to keep fast working students busy and advance ones engaged.
- Allow students play content review games
- Engage students in jeopardy prior to examination as this serve as an excellent opportunity for students to review the concepts and clear up any misconceptions in addition to assessing their own strength and weakness regarding the subject matter.

Formative assessments on the other hand refer to evaluations that occur before or during instruction to facilitate instructional planning and enhance student learning. The author further said that it helps teachers determine how well students understand the topic at hand, what misconceptions they have and whether they need more practice on a particular skill in addition to informing the teacher the knowledge as well as abilities students already posses. In the view of Guabatz in Terry (2008) teachers benefit most from formative assessment when they have helped to shape the questions properly, understand the feedback provided and when assistance and resource for making improvement are available. McLaughlin (2008), identified 3 skills required of the teacher in formative assessment as

- Use start up activities/questions
- Assign no official grades to studentsôresponses
- Modify/fine-tune the lesson to reflect studentsôabilities

Formal assessment in the view of the author means the evaluation of studentsô achievement as planned in advance and used for specific purposes of the instructions In the opinion of Ormond (2006), it intends to yield information about a particular instructional objective or content standard and assesses student mastery of the content. In the view of the author, a particular time is set aside for it and the students prepare for it ahead of time. McLaughlin (2008) said that formal assessment is of two types: these are performance and traditional assessment

Performance assessment according to the author refers to tasks and projects which provide evidence that students are able to use their knowledge in context. It assesses science process skills while allowing students greater opportunity to personalize tasks. Examples of performance assessment include laboratory reports, studentsô projects, presentations and writing assignments. Traditional assessment on the other hand evaluates essential knowledge and skills through academic prompt. Examples include worksheet and textbook questions that assess problem-solving skills. Ormond (2006) gave the example as summative pencil and paper assessment such as quizzes and tests which assess factual recall and conceptual understanding. In the view of the author, quizzes and tests provide information about studentsô performance, progress and weaknesses; get them in the habit of reviewing materials and studying notes and lessen their anxiety; while textbook questions provide opportunity to review, practice and apply what they learned.

Barrett in Carries, Olive, Sabrina and Laine (2008) grouped evaluation into formative and summative assessments. According to the author, formative assessment is carried out to provide teachers with feedback on how to improve performance and the type of professional development opportunities that will enhance practice by the learners while summative assessment is used to make a final decision about the learner. Carries, Olive, Sabrina and Laine (2008), in their own opinion said that although both seek to measure performance, the formative evaluation identifies ways to improve performance while summative evaluation determines whether the performance has improved sufficiently. The authors further explained that while each type is valuable, neither of them can serve a teacher and school well on its own; this is because without formative evaluation, a teacher may not be informed of the areas of weakness and so when summative evaluation takes place, these areas of weakness may still exist. Similarly, on-going summative evaluations without any consequences provide minimal incentives for teachers to act on the feedback. McLaughlin (2008) also added that there is need to include summative assessments in lesson unit as: the students study class material more and learn better when they are told that they will be tested on it, and on the other hand their act of reviewing materials for examination helps to foster long-term memory of concepts while feedback from examination let them know what they have or have not mastered.

Course development report (2008) in McLaughlin (2008) grouped evaluation into 5 areas, which are: summative, formative, formal, informal and other forms of assessment. To the author, summative assessment gives feedback at the end of a semester to indicate amount of what is learned. A score on a midterm or final examination is an example of summative assessment. Formative assessment according to the author covers feedback given to the students through the course, topic, or semester with the intent of improving understanding. In this, students have time to reflect on the feedback they received with the aim to make amend where necessary. Formal assessment on the other hand refers to a case where student materials are assessed towards a final grade. It includes paper, examinations, clinical work, and service learning; while in informal assessment, studentsô material are assessed but no value is assigned that would contribute towards the final grade. Other forms of assessment as outlined by the author are

Peer assessment- which refers to group works where classmates give feedback to their peers. Initial assessment- is an assignment on a given content area before it is directly presented to the students. Depending on student answers, it helps to determine if they have an appropriate knowledge of the topic or if they have misconceptions to be addressed. Middle assessment is an assessment given to students at the mid-point of a unit or semester to determine their progress and can be used as a means to plan the final portion of the unit. Middle assessment can provide valuable information to an instructor and to the student and enable them assess the learning. Middle assessment may also be the most difficult to plan; this is because it can be very difficult to "know" how much a student should know at the middle of a unit or semester. Middle assessment can become very individualized and requires detailed feedback from the instructor and or classmates. Final assessment- as the name suggests, is the assessment given at the end of a unit or semester. Final assessment could be summative, formative, and formal. Spring (1996) in McLaughlin (2008) explained that assessment is the process used to gather information and make decisions about how well students have learned the skill or concepts in a lesson. There are two major steps to designing an assessment:

- determine the assessment procedures
- decide how to judge the performance.

The assessment procedures in the view of the author are the specific activities or tasks that are used to evaluate how well students have learned the objectives which need to reflect the knowledge and skills described in the objective and mirror the way they were taught and practised. The assessment procedures may use traditional paper and pencil activities, performance assessments, or portfolios. The second step in planning an assessment is to determine how to judge studentsô performance. This is important because the mastery criteria come directly from the lesson objective. It's a good idea to develop an answer or response key, rubric, or other tool to use to evaluate student performance as such tool promote consistency and objectivity as studentsô performance is judged.

Accommodations should also be incorporated. Accommodations in the view of the author are changes to the way a student accesses instruction and demonstrate performance. When accommodations are incorporated into the assessment, they meet the needs of individual students and often the entire class benefits. Some accommodations may need to be provided on an individual basis. The author stated further that it is necessary to note that student assessment are designed to demonstrate what students are learning and what they can do with their knowledge. These assessments require students to "perform" in some way--by writing, demonstrating, explaining, or constructing a project or experiment This is because teaching requires students to apply academic learning to important realistic problems and so many classroom teachers routinely evaluate students by asking them to write extended essays or to complete projects, experiments, and portfolios. The assessment may be

a) an open-ended or constructed response items that ask students to respond in their own words--to "construct" their answers to questions that may have multiple good answers. Students usually reason out their solutions as part of their answers. Usually students can answer these questions in just a few minutes,

b) Performance-based items or events: questions, tasks, or activities that require students to perform an action. Although performances can involve demonstrations or presentations, most typically they involve students explaining how they would answer the question or solve a problem by writing a few sentences or paragraphs, drawing and explaining a diagram, or performing an experiment. Such tasks may take from 15 minutes to an hour or more and may involve some work with a group of students who think through the answers and later provide their own individually written answers.

c) Projects or experiments: extended performance tasks that may take several days or even several weeks to complete. Students generate problems, consider options, propose solutions, and demonstrate their capabilities in providing solutions. Students often work in groups, at least for some of the project, to analyze options and to consider ways to present their thinking and conclusions.

d) Portfolios: refers to collections of studentsô work that show teachers and others who may "score" portfolios within the range and quality of studentsô work over a period of time and in various content areas. There are almost as many approaches to compiling and evaluating portfolios as there are proponents of this form of assessment. Portfolios can be used both formally and informally; ideally, portfolios capture the evolution of students' ideas and can be used instructionally and as progress markers for students, teachers, and program evaluators.

McLaughlin (2008) advised that whatever type or form of assessment, chosen the teacher has to deliberately

- design the assessment focusing on the content that is most important for students to learn.
- Give students multiple opportunities and context to demonstrate their achievements.
- Modify the assessment to accommodate students with learning disabilities.

- Be authentic in grading.
- Use assessment results to evaluate studentsôinterest in the content.
- utilize a variety of informal, formative and summative assessment designed to highlight students with varying abilities and skills
- give them opportunity to demonstrate their understanding of the concept in multiple ways and at different cognitive levels.

The author further stated that assessment can take the form of paper and pencil test, project and assignments among others. In project, the author indicated that the skill include

- write a project in the class.
- pose questions about everyday phenomena
- state the purpose of the project
- specify variables to manipulate
- ask the students to design the project
- give students date to submit the proposal
- approve the proposal before students begin working
- allow students ask questions about the project materials
- include short presentation to allow students practice public speaking

On take home assignments, the following skills were identified by the author

- give take-home assignments that assess studentsôcreative application of knowledge
- let students create an inventory
- provide a performance check list
- remind students to complete their assignments

- grade the assignment
- provide feedback
- Tests
- design tests that are related to National and State curriculum standards
- provide/set extra-credit questions which provide opportunity to outstanding to demonstrate their knowledge.

Barbara, Groh and Lieu (2008) said that classroom assessment should be based on understanding how students learn. The teacher should

- design questions in real-world context
- assess students using written and oral examinations, quizzes, term paper, projects, oral reports, laboratory reports group work, observation portfolio analysis among others. In each case, he needs to
- assess content covered at several Bloomǿs level (KCAASE)
- accommodate individual differences,
- clearly explain grading criteria to students
- be valid and have a reliable process
- ask for frequent feedback from students. This allows for adjustments
- provide timely feedback for improvement
- provide end of course ratings

eHow (2009) said that assessing students helps to determine what they are learning and what they are having difficulty with. The author further observed that teachers that assess their students help them reach their goals easier and faster. The author then identified 6 steps with 11 skills that a teacher needs to possess to enable him effectively asses the students. They are

Step 1

- create a project for the students
- give them instructions and a schedule date to submit the project
- record their performance in 3 categories. (how they generate problems, how they solve problems and how they organise their thoughts)

Step 2

- assign a group project to the class. This will help to know if the students interact well with each other and how they participate in group setting.
- add group interaction to the record in step 1

Step3

- give an open-ended question test
- ask the students to explain their thought-process in arriving at the answer. This can be through verbal or in short essay

Step4

- keep the records together for later reference for each student

Step5

- revise the project later in the school year
- compile data on each student in a year. This will provide an assessment of how each student has performed and how much they still need to learn.

Step6

- review past assessment tests for each student
- compare them with the present assessment.

- Review previous test scores to have idea of a studentôs previous knowledge
- Compare it with the present assessment
- Offer a glimpse of the kind of improvement expected of each student.

This study identified with evaluation procedures outlined by the authors above and so picked the skills required in evaluating lessons in soil conservation practices during teaching as contained in this study.

Technical Skills Required in Soil Conservation Practices

Soil conservation practices include tillage operation, soil testing and analysis, manure preparation and application, crop rotation, soil erosion prevention and control and irrigation. The skills in soil conservation were identified based on the each of the outlined practices and discussed as follows:

Tillage Operation

Tillage in the view of Forth (1990) is a mechanical manipulation of the soil to modify its conditions for plant growth. In the opinion of Crook (2007), tillage aims at optimizing soil physical and biological conditions for crop production while ensuring timely seedbed preparation, planting and weed control. The author advised the use of tillage methods that do not make the soil surface fine and powdery. Friedrich (2008) advocates deep tillage as it increases infiltration rate and when combined with application of organic and green manures becomes efficient method of increasing soil quality. The author concluded by outlining 3 major skills involved in tillage operations as

- turning the soil with mouldboard-plough to bury surface materials,
- mixing the soil with chisel plough, and
- loosening the soil.

Troeh, Hobbs and Donahue (1993) recommended the use of manual tillage tools and power equipment as both perform the same function except that the power equipment works faster, stirring, mixing and burying plant residue deeper. The authors identified 11 skills in tillage operation as

- Stir the soil with hoe and or shovel
- Bury the weeds
- Scrape the soil surface
- Smoothen the crushed surface
- break the soil leaving straw and stubble on the surface.
- construct flat land
- construct ridges and furrows
- make cross bars
- In a farm where old ridges exist, break the old ones to build new ones on the furrows by inverting half of the soil from adjacent ridges on both left and right and heaping the soil in the centre which is the furrow.
- If beds are required, make/construct wide beds that can accommodate two rows of crop plants.
- Mulch the constructed ridges or beds with crop residues and dried grasses.

Franzen (1997) observed that it is important to use tillage techniques that can conserve moisture as it increases crop yield and limits the devastating consequences of drought. The author further said that there is need to adopt no-till farming and if tillage must be carried out, it must be with the implements that retain crop residues, leave rough soil surface and limit soil drying. The author advised that it is necessary to perform tillage at right angles to the prevailing winds and follow the contour of the land in hilly landscape to intercept water on the event of heavy rainfall.

Brady and Weil (1999) stated that farmers use hand, hoe or mechanical drawn implement to stir the soil. The authors identified 4 skills in tillage as

- Break the soil with hoe or tillage equipment
- Twist and collect the soil with the hoe
- Raise the hoe with the soil
- ,invert the hoe with the soil in the centre while incorporating crop residues.

The four authors reviewed under tillage operations outlined 3,11and 4 skill items respectively in tillage operations. The validation of these skill items gave a total of 20 skill items that were utilized by this study. The views and opinions of the authors whose work were reviewed guided the researcher in identifying skill items in tillage operations.

Soil Testing and Analysis

Soil testing is one of the practices necessary for effective conservation of the soil. Wikipedia (2008) defined soil testing as the analysis of a soil sample to determine the nutrient content, composition and other characteristics including contamination. It is a chemical method used in determining the nutrient supply on the soil. It therefore indicates the fertility of the soil, type and rate of fertilizer required and soil acidity and rates of lime required for correcting the acidity. Soil testing is usually carried out before planting especially where vegetables and food crops are grown; and every year in places where tree crops like citrus, cocoa and fruits are grown. Murrel (2000) said that soil testing is a powerful tool for deciding how best to manage nutrients. According to the author, soil testing was formally designed to provide a means of following trends over time but today it is used as a tool for diagnosis and prescription system and if properly carried out, forms the bases for successful long term soil and crop nutrient management plan. The author further stressed that without soil testing, nutrient application are a guess and there is no room for guessing in todayœs atmosphere of narrow margins and public concerns with the environment. As regards the skills in soil testing, soil samples collected in the field according to Olaitan and Lombin (1985) are to be analysed as soon as possible to avoid losing their natural characteristics and subsequent misleading results. The authors outlined the skills in soil testing and analysis based on the Cation Exchange, soil pH, soil water and drainage, Calcium Carbonate, Potassium, Magnesium and Nitrate contents among others.

A) Determination of Cation Exchange

With reference to cation exchange, the authors outlined four skills which were:

- Place filter papers in two funnels and fill them with acidic soil
- Leach the soil in one of the funnels with a 100% potassium nitrate (KNO_3) solution while leaching the second with ordinary water.
- Add few drops of soil indicator solution to both leachates
- Observe the pH of the leachates. The pH of the leachates from the soil which was treated with potassium nitrate will turn the indicator yellow or green, meaning that the soil is acidic

B) Determination of soil pH

To determine the soil pH, the authors outlined eight skills thus

- Fill a test tube to a depth of almost 1cm with the soil to be tested.
- Add the same quantity of barium sulphate.
- Fill the tube with distilled water 4 cm from the top of the tube.
- Shake the tube thoroughly.
- Allow the content to settle, and then add 8 ï 10 drops of universal soil indicator.
- Shake the tube again and allow the content to settle.
- Hold the test tube again at the pointed colour chart.
- Compare each colour of the chart with the colour of the suspension containing the indicator and note the pH of the colour which it matches exactly.

B) Measurement of acidity to determine lime requirement of the soil.

Olaitan and Lombin (1985) further stated that it is necessary to measure the acidity level of the soil to help determine the quantity of lime that the soil could utilize. To perform this function requires eight skills which are

- Place a small quantity of calcium carbonate on a glass.
- Half fill a test tube with soil indicator solution.
- Add a drop of acid and shake the tube thoroughly.
- Add a few drops of sodium hydroxide solution and mix again.
- Place a small quantity of soil or a piece of waxed paper and add drops of soil indicator solution until some of it runs out of the soil.
- Test all the samples of the soil that are available and
- record the pH of each.
- Use colour chart to relate the pH of the sample to the recommend application of lime per hectare.

C) Test for Phosphorus

With reference to phosphorus availability in the soil, the authors outlined the following skills for testing the presences of phosphorus thus:

- Pour $10cm^3$ of ammonium molybdate solution into a glass vial.
- Add 1g of soil and shake the vial vigorously for one minute.
- Filter the solution.
- Add a grain of dry powdered tin (ii) chloride solution to 5 cm^3 of the filtrate.

- Observe the intensity of the colour of molybdenum. The intensity of the blue molybdenum content indicates whether the soil has a high, medium or low phosphorous content.

H) Test for Potassium

The authors stated that in determination of the presence of potassium it requires the following skills:

- Pour 10 cm^3 of sodium cobalt nitrate solution into a glass vial.
- Add one level tea spoonful of air dried soil into the glass vail.
- shake the vial vigorously for a minute.
- Filter the solution.
- Use the pipette to add 2.5 cm^3 of anhydrous propyl 2OL to 5cm^3 of filtrate and thoroughly mix the two solutions together.
- After three minute compare the turbidity of the solution with a standard colour chart.

I) Test for Magnesium

With regard to the availability of Magnesium in the soil Olaitan et al outlined four skills which are:

- Put 1 cm^3 of soil extraction into a test tube.
- Add one drop of titan yellow solution and shake the tube vigorously.
- Add one drop of 5% sodium hydroxide solution and shake the tube again.

- Observe the colour. The colour ranging from light orange to peach red will be obtained. A yellow colour indicates presence of magnesium.

J) Test for Nitrates

Olaitan and Lombin (1985) identified three skills in the determination of Nitrogen in the soil which are:

- Place one drop of the soil extract or a spotting title and add four drops of the dispheny lamine solution.
- After two minute stir the mixture.
- Compare the colour with standard colour chart

Hartz (2007) said that soil test should be based on individual nutrient elements. The author identified general skills in collection of soil sample but did not state clearly the specific skills of testing individual elements. The identification of general skills and the explanations are made thus;

- Collect soil samples using a coring device that collects an equal amount of soil over the entire depth. Avoid the use of shovel as it collects the top soil bringing about over representation of elements and so exaggerates the fertility of the field.
- Sample top soil 6inches and sub soil 12inches deep
- Gather a composite of at least a dozen soil cores representing all areas of the field
- Sheep the samples immediately to laboratory or
- Air dry the sample below 120^{of} if not shipped immediately to the laboratory

- Test for individual soil nutrient elements

Test for Nitrogen

The author further stated that soil Nitrogen (N) exists in both mineral and inorganic forms which are available for plant uptake but when in complex form they become unavailable to the plants. It is also important to note that there are two mineral Nitrogen forms which are NO_3-N (Nitrate nitrogen) and NH_4-N (Ammonium Nitrogen) in the soil. According to the author, the NO_{3-}N usually predominates and it is often the only form reported that is easily absorbable by plants. This is because NO_3-N exists only in soluble form and is easily extractable from the soil by plant roots. It therefore means that the soil test results should unambiguously describe the concentration of NO_{3-}N present in such soil. Organic Nitrogen can be characterised in several ways. A ‘Kjeldahi’ digests dissolves soil organic matter containing Nitrogen in a strong acid solution and the results are reported as “Kjeldahi N” or “TKN”. Soil can also be heated in a furnace to combust organic matter with Nitrogen which is usually measured in the furnace exhaust; this is most often referred to as “total Nitrogen”. These measures of organic Nitrogen may be useful to rank the relative potential of soils to supply Nitrogen over time but do not give an indication of current Nitrogen availability. It should therefore be noted that the total Nitrogen by combustion will include mineral Nitrogen fraction of total the Nitrogen (usually < 5%) ; TKN does not include nitrogen in NO_3-N form. The following skills can be utilized when extracting Nitrogen from the soil.

- Identify the most common analytical approach to determine mineral Nitrogen concentration
- Use Potassium Chloride to extract the nitrogen element present. Or
- Digest soil organic matter in Kjeldahi solution or
- Heat the soil in furnace to combust organic matter
- Extract total relative potential of soil nitrogen
- Report the result as TKN or Total Nitrogen

Testing for Phosphorus (P)

Hartz (2007) stated that bicarbonate extraction test is the laboratory method most appropriate for phosphorus in soils with pH greater than 6.2. In this method, dry soil sample is extracted with a weak solution of Sodium bi-carbonate; the extracted solution is diluted or to a pH of 8.5 to prevent the extraction of P that would not be normally available in alkaline solution for plants. For soils with pH less than 6.2, the Bray extraction solution is most appropriate. The Bray extraction solution is mildly acidic and therefore similar to soil solution. Both the Bray technique extract only small available Phosphorus rather than quantitative measures of soil phosphorus content. The skills that can be employed for the extraction of phosphorus are

- Extract the dry soil samples with weak solution of sodium bicarbonate or Bray extraction solution as the case may be.
- dilute the extraction solution with alkaline solution to a pH of 8.5 to prevent the extraction of phosphorus that would not normally be available to plant in a given situation.

Testing for Potassium (K)

With reference to potassium determination, the author stated that the most common analytical technique for determining soil potassium availability is ammonium acetate extraction. In this method, *dry soil is extracted with an acetate solution*. The NH_4-N ions in the solution displaces potassium on soil Cation Exchange Capacity site For this reason, this procedure is often referred to as the Exchangeable potassium test. However, this technique can also extract potassium from fixation sites with the structural layers of some types of silt and clay particles. A soil derived from the vermiculite parent material and having high silt and clay content as much as 25% of exchangeable potassium can actually represent fixed potassium Since in some soils the total amount of fixed potassium can be much larger than the amount on exchangeable site, and since some of the fixed potassium may become available to plants after sometimes, the extractable potassium soil test should be considered to be an index of the relative soil potassium availability rather than soil potassium content. It is therefore necessary to use ammonium acetate to extract soil potassium from dry soil sample

Test for Calcium (Ca), Magnesium (Mg) and Sodium (Na)

The concentration of these cations can be measured in the same ammonium acetate extract used to determine potassium availability. Many laboratories report exchangeable Calcium, Magnesium and Sodium when determining potassium availability. Although this is a valid measure of Sodium, it does not accurately describe Calcium or Magnesium availability in alkaline soils containing tetra-oxo carbonate iv and tetra oxo- Magnate iv. The test that more accurately describes soil Calcium and Magnesium availability is saturated paste extraction. In this procedure, *dry soil is mixed with enough distilled water* to create slurry which is then *filtered under vacuum. Results are often reported* as “soluble or saturated paste” Calcium and Magnesium. saturated paste extraction is also the preferred method for evaluating soil salinity. Results from saturated paste are typically reported as either parts per million (ppm) or milli-equivalents (Meq) per litre of extract. The skills that could be employed in determining the presence of Calcium or Magnesium present in a soil sample are:

- Mix dry soil with enough distilled water to obtain a slurry
- Filter the slurry obtained under vacuum
- Report results as soluble or saturated paste in either parts per million or mill-equivalent per litre of extract.

Playsier in Nwankwo (2007) stated that in determining the presence of elements in soil sample it is necessary to collect the soil sample and select a dependable laboratory to carry out the test for these elements. The author therefore outlined 6 skills required in collecting the soil sample thus;

- Collect soil sample
- Crush the collected sample in a mortar
- Sieve the sample through a 2mm brass, stainless or plastic sieve

- Package the soil samples into container
- Store in a clean closed container
- Take to the laboratory for analysis.

The author did not state the skills required in determining each nutrient content of the soil as the skills ended in the taking the sample to the laboratory for analysis.

In the view of Ray, Torker and Amburgey (1997) determining the presence of elements in soil sample requires collecting the soil sample and selecting a reliable laboratory to carry out test for the presence of various elements. The authors therefore outlined 5 skills required in obtaining soil sample to include the following

- Obtain soil sample before planting
- Take samples from sides of constructed ridges/beds
- Mix samples collected from 8-10 locations within a field thoroughly
- Dry the sample
- Take the sample to the laboratory

In the opinion of Brady and Weil (1999) soil testing consist of three major phases which are collection of the soil sample, chemical analysis and interpreting phases. The authors advised sampling of the field annually or biannually so that the soil test levels can be tracked over the years to help determine maintenance or depletion levels of soil nutrients. The authors identified 9 skills in collection of soil sample as follows

- Obtain soil sampling and testing instructions from soil testing laboratory
- Divide the farm to be tested into portions
- Collect soil samples from each portion of the land

- Put the collected samples in a plastic container or polythene bag
- Air dry the sample
- Send the sample to the laboratory
- Analyse the sample
- Interpret the result
- Make recommendations for nutrient application based on the interpretation of the result.

Silvertooth (2001) believed that before analysing the nutrient content of a soil, a sample of the soil has to be collected and taken to the laboratory. The author therefore the author identified 12 skills in soil testing as follows:

- Consult some laboratories
- Select one that is near the area to be tested
- Discuss the soil problem with the consultant or manager of the chosen testing laboratory.
- Mark a relatively uniform field fig A (that is one that can be easily managed in a consistent manner)
- Mark field that has more than a distinct area fig B(that is one that has different areas that cannot be easily managed in a consistent manner)
- Collect soil samples with probe, auger or shovel at 6-12 inches.
- Collect 25 cores from each marked area
- Mix each of the 25 cores from each area together to give a common composite sample.
- Take 20-30 ounces (volume) or sample container-full
- Send to laboratory.

- Test for NPK, pH, CEC, Na levels or SAR (Sodium adsorption ratio)
- Collect the lab result with recommendation.

Synder (2001) also believed that before analysing the nutrient content, a sample of the soil has to be collected and taken to laboratory for analysis. The author outlined 14 skills for collecting the soil sample and they are

- Consult chosen laboratory for recommended sampling depth based on specific tillage systems and fertilizer application methods
- Use suitable soil augers or probe. Probe is preferred because intact cores can be obtained from a fairly accurate depth with precision
- Mark soil probe with a file or permanent ink to accurately gauge the sampling depth
- Collect soil samples during rainfall at similar moisture content and temperature
- Collect only the highest quality soil samples to represent fields, management zones, sampling grids or grid points
- Collect at a depth of 7-8inches deep or 0-6inches in no till fields
- Put the collected samples in a plastic buckets avoiding metal, galvanised or rubber buckets as they may contain zinc and other micro nutrients that could contaminate the sample and interfere with accurate micro nutrient analysis
- Mix the sample cores
- Take 2-5gramme (0.01 pound) to the laboratory for actual analysis
- Dry the sample
- Pulverise the dried sample
- Blend the sample

- Sieve the sample
- Transfer to shipping bags or boxes

Murrel (2000) stated the step by-step of collecting and testing the nutrient in a soil sample as follows;

- Adopt a regular soil testing program
- Review records of management and weather
- Mark the probe with permanent ink
- Collect representative samples taking more than one sample out of a field
- Collect samples from tillage depth of 6-7inches, making sure that the depth matches the calibration used for interpreting the soil test results
- Collect 5-8 cores from different places.

Board of Reagent Report (2008) identified 13 skills in soil testing. These are listed below

- Carry out soil testing any time of the year but fall is the best time
- Collect and fill out the soil information sheet form from the county extension office
- Obtain the implement for sampling from the extension officer (probe or auger, trowel or spade)
- Move to the site
- Scrape away the surface litter and
- insert the probe or auger into the soil to the plough depth or at least 6inches
- Take a minimum of 5 cores for every 5 acre section

- Mix the core soil samples in a clean container and place about 2cups(1pint) into a plastic bag
- Label the bag with your name, field/site/location and
- Record the sample number/field/site and sample location on a sketch
- Keep this for reference purposes
- Take the soil sample and information sheet to the soil sample county extension office or send the soil sample directly to testing laboratory
- Collect test result within 2-3weeks (this shows that in developed countries, the farmers are expected to just collect the sample and take to the extension office for testing. This is different in the developing courtiers and South-eastern Nigeria in particular where soil testing is only carried out in tertiary institutions for the purpose of teaching or for experimental purposes. Farmers neither carry out soil testing analysis nor collect the soil sample to take it to the laboratory for testing. This is because there seems not be privately owned laboratories for soil testing and analysis in the study area to enable them determine nutrient content of the soil before planting crops.

Wikipedia (2008) believed in collecting the soil sample and analysing it using soil test kit especially where there is non-availability of soil testing laboratory. In performing the above function, 15 skills could be utilized and they include:

- Clean the sampling implements/tools properly before sampling and remember to clean them between samples to avoid cross contamination.
- Check the tools and ensure that they are free from rust

- Wash the tools with distilled water to ensure that there is no addition of mineral or element from regular tap water or chemical that could change the composition of the soil.
- Take samples in fall (June) after harvesting. This is because the presence of various nutrients and other soil components vary during the year; so sampling time is important. Further more, taking the sample during fall helps get the results in time to help formulate fertilizer plan for the following growing season
- Take samples also in spring (March) this is a good way to identify the nutrients that survived dry season
- Take samples from tillage depth as this is where the majority of the nutrient elements are placed mechanically
- Take between 10-20 samples for every 40 acres. This is because soil characteristics can vary significantly from one spot to another even in small garden or field so taking samples from everywhere in the field is crucial to get the most accurate measurement of nutrient and other organisms.
- Mix soil from several locations to create an average or composite sample. Carry this operation judiciously as it can artificially dilute quantities or concentration of soil components
- Make a reference map for filling system to help keep knowledge of where each sample is taken and how many samples that were taken in the field
- Analyse as soon as possible (within 24hrs). This is because certain characteristics of soil change with time. If not then

- Frozen or air dry the sample to reduce change due to biological and chemical activities. Air dry properly if longer periods exist between sampling and testing
- Chose appropriate laboratory with experience workers for the test or
- Make use of do-it-yourself kits
- Test for major nutrients; minor nutrients, pH levels and physical properties of the soil
- Refer to previous statements included in the lab reports and include professional interpretation results and recommendations.

The nine authors reviewed under soil testing and analysis outlined 61, 6,5,9,12,14,6,13 and 15 skill items. The validation of these skill items gave a total of 59 skill items that were utilized by this study in collecting data from the respondents on soil testing and analysis. Therefore, the views and opinions of the authors whose works were reviewed guided the researcher in identifying skill items in soil testing and analysis.

Manure Preparation and Application

Manure refers to any material added to the soil to increase its fertility. Agbo (1999) defined manure as materials added to the soil to replace the deficient nutrients. In the view of the author manure only replaces nutrients that are lost by the soil but with reference to this study manure means anything whether plant or animal material that is added to the soil to increase its fertility.. Wikipedia (2008) grouped manure into organic and inorganic. Organic manure according to the author refers to organic matter used in soil management. These covers manure made from cattle dung and excreta of other animals, crop residues and green plants. In the view of the author, organic manure are time tested materials for improving the fertility and productivity of soils as it significantly improves soil physical properties, soil porosity, water holding capacity, infiltration rate and the hydraulic conductivity among others. The author classified organic manure into farmyard, compost and green manure.

Farmyard manure in the opinion of Agbo (1999) refers to animal dung or faeces and grasses used as litter and beddings for cattle, pig, poultry, sheep and goat. Wikipedia (2008) explained that farmyard manure when prepared and applied to the soil improves the soil tilt and aeration, increases water holding capacity of the soil and stimulates the activities of soil micro-organisms that make plant food elements in the soil readily available to the crops. Olaitan and Lombin (1985) identified skills in farmyard manure to include;

- Cut grasses from bush
- Dry properly
- Spread the grasses on the floor of the pen
- Allow the animals to stay and defecate on top of the grasses
- Collect the beddings
- Spread on the farm.
- Plough in if necessary.

Archer (1998) indicated that the animals need to be housed and the feeds and water provide for them in the pen. As they defecate and urinate on the beddings the grasses decay and are used as manures. The author then identified skills in farmyard manure to include:

- Cut grasses and shrubs

- Allow to dry if they will be used as beddings
- Spread on the floor of the pen
- Allow animals to deposit their faeces and urine on the beddings of grasses
- Collect the beddings with the grasses
- Spread on the farm or
- Place in a shade if not applied immediately
- Replace beddings with new ones (grasses)

Compost Manure

Compost refers to manure obtained through the process of reducing vegetable and animal wastes to a quickly utilizable condition for improving and maintaining soil fertility (Agriculture and Agri field 2008). The manure according to the author is produced by the action of micro-organisms on wastes which include leaves, roots and stubbles, crop residues, straw, hedge clippings, weeds, saw dust, kitchen wastes and human habitation wastes. These materials undergo intensive decomposition under medium high temperature of 55ęc ï 60ęc in heaps or pits with adequate moisture content of 50 ï 60%. The decomposition process the author concluded may take 3-6monthes at the end of which an amorphous brown to dark brown unified material is obtained. Medwyn (1998) said that compost manure enriches the soil, promotes the development of beneficial insect population, helps the soil retain moisture and aids in stabilizing the pH level of the soil. The author added that any plant and animal materials can be recycled into valuable compost such as crushed egg shell, cow and horse dun**g**, shred leaves among others. With regard to the skills in compositing, Food and Agricultural organisation (FAO), (1980) identified the following:

- Select appropriate site
- Dig trenches or pits of about 1m deep (the trenches should have slopping walls and a floor with a 90cm slope to prevent water logging.
- Fill the pit with organic residues and night soil.
- Add additional layers in alternate manner.
- Cover the pit with layers of refuse of 15-20cm.
- Plaster to drive away files
- Allow materials remain in the pit without turning and watering for 3months.

Olaitan and lombin (1985) indicated that compost manure can be prepared using either stack or pit method. The author said that in either case, the process of preparation is the same and the skills include the following:

- Select suitable site (a flat and well drained ground with short trees and shrubs)
- Map out seven plots/spaces
- label the plots/spaces as A,B,C,1, 2, 3 and 4
- Provide wall or fence round the corners.
- Fill the corners with compost materials
- Cut the compost materials with cutting implements (this is to make mixing easy and decomposition fast)
- Build up the heaps in plots 1,2,3 and 4 with the materials

- Spray urine, wood ash, animal dung or a head pan or bucket full of old compost on top of each heap (the aim is to introduce micro-organisms that will help in fast decomposition of the materials
- Sprinkle water on each 4 heaps
- Sprinkle hand full of soil
- Repeat the process of applying water after each layer until the required level of the compost is attained
- Drive a strong long stick (testing stick) through the top until it reaches the centre
- Take the stick out after the first day
- Feel the testing stick to know if it is hot, cold, damp, or moist (if it is hot and moist, it means that active decomposition is taking place but if it feels cold and damp/dry, it shows that there is no active decomposition)
- Turn the materials (removing layer by layer) from heap 1 and 2 into space A and materials in heap 3 and 4 into space B.
- Stack materials in the spaces from where the materials were removed i.e. 1, 2, 3 and 4 To continue another process
- Move the materials in heap óAôto óCôand those in óBôto óCô
- Store in a shade
- Cover the prepared compost to prevent the effect of sun or rain

Inckel, Smet, and Veldkamp (1994) said that the skills in compost preparations are:

- Collect leaves, grasses, chippings, kitchen scraps, wood shavings and other fast decomposing materials for composting
- Turn the piles to reduce excessive moisture during dry weather and

- Turn the pile during wet season to moisten the dry pile

Brady and Weil (1999) identified the skills in composting to include:

- Collect leaves, grasses, chippings, kitchen scraps, wood savings and other fast decomposing materials for compositing.
- Dig a pit of 1m deep.
- Mix the compost materials together.
- Apply the compost materials in layers.
- Add small amount of garden soil or old compost to each layer for easy decomposition.
- Turn the materials in the pits to reduce excessive moisture during dry weather and
- Turn the materials in the pit during wet season to moisten the dry pile.
- Choose a suitable site (the site should be very close to where the manure is to be applied).
- Create enough space for the heap (this is to enhance the turning over and examining of the heap for decomposition.
- Map out square spaces between 1m x1m and x3m.
- Collect fast decomposing organic materials.
- Place the organic materials in layers in the mapped spaces.
- Make individual layers (this should not be thicker than 10cm.
- Cover the top with a layer of leaves or cloth, jute or plastic (this is to prevent evaporation of moisture from the heap.
- Protect the heap from drying out during dry weather.
- Protect the heap from excess welting during rainy season.
- Dig trenches round the heap to facilitate run off of excess rainwater.

- Create air channels into the heap by putting sticks, bundles of straw or other firm materials upright in the heap.
- Put bundles or straw in the heap to help check the moisture level.
- Feel the straw after five minutes (if the straw feels clammy, it mean that the moisture level is good.
- Then test the heap temperature after five days of complete composting and after final turning.
- Take out the stick and feel immediately. (The stick is expected to be considerably warmer than the body temperature (60^{0C}-70^{0C}) if not warmer than the body temperature then.
- Check the materials for faulty aeration.

Agriculture and Agri-filed Canada report series (2007) stated that compost preparation can be carried out under aerobic and anaerobic conditions. The author therefore identified skills under each as follows.

Aerobic compost preparation

- Remove the used beddings, sweepings from cattle shed and some urine soaked earth from the stubble floor everyday.
- Mix with cattle dung and 2or3 handful of wood ash.
- Deposit on a well drained site to gradually build up a low pile or about 30-40cm in height,5cm in width with any convenient length.
- Ensure that the pile build up before the start of the rainy season. then after the first heavy rain.
- Turn the wetted material in a 1.2m strip of each side of the long heap into a 2.4m Wide strip in the middle; thus making the heap to be nearly 1m.

- Allow the heap to sink appreciably.
- Turn again (in about 3-4 weeks) to make a fresh heap. This ensures the mixing of outside material and inside ones.
- Turn again after a month depending on incident of rains.
- Turn finally in a cloudy or moderately rainy day.
- Rebuild within vacant part or original position.

Anaerobic compost preparation

- Dig pits of convenient sizes or 4.5m x 1.5x1m.
- Collect mixed farm residues each day.
- Spread each dayös collection in a thin layer.
- Sprinkle with a mixture of fresh cow Dung(4.5kg)
- Sprinkle ash 140-170g.Sprinkle water 18-22 litre.
- Compact the layers.
- Fill the pit with the raw materials.
- Stand materials 30-40cm above the edge of the pit.
- Plaster with a 2.5cm layer of a mixture of mud or cow dung.

Under soil conditions, decomposition is anaerobic and high temperature does not develop. During the decomposition, the insoluble Nitrogen compound gradually becomes soluble. Carbonaceous matter is broken down into carbon iv oxide (CO_2) and water (H_2O).The loss of aluminium (N1&4) is negligible because of high concentration of carbon iv oxide (CO_2). The plastered pit prevents the fly nuisance. The compacted moisture materials become compost in about 4-5 months without any further attention. The well made compost contains 0.8-1%N and have all good properties of farm yard manure.

The view and opinions of the authors whose works are reviewed above guided the researcher in developing skill items in composting as outlined in this study.

Green Manure

Green manure in the view of Army (1996) means planting a crop that is meant to be incorporated into the soil to increase its fertility. Wikipedia (2008) is of the opinion that it refers to crops grown for the express purpose of ploughing them under with the aim of increasing the soil fertility through the nutrient of organic matter returned to the soil. Adede (2001) said that green manure can be planted as a sole crop or be intercropped with cereals. The author then identified 11 skills when planting green manure as a sole crop. The skills are:

- Collect green manure crop seeds/ cuttings
- Prepare the seed beds. This is carried out by digging the soil and removing weeds
- Water the seed beds
- Plant the seeds or cuttings of the green manure crop spacing them closely so that they cover the ground quickly when they start growing
- Weed the plot regularly to reduce weeds and pests
- Cut the leaves and stems for fodder if necessary but not the entire plants
- Harvest the green manure crop (the pods)
- Allow to grow up to 2years before slashing them
- Slash the remaining stalk and leaves and if possible on the same day,

- Turn them into the soil
- Leave at least 7days before planting the next crop (this is to allow the stalks and leaves to decompose)

With reference to intercropping with cereals the author identified 13 skills as follows

- Choose legume specie that grows well in the area like hemp, and stylo among others.
- Inoculate the legume seeds if necessary
- Plant before heavy rains and 2 weeks after the cereals are planted
- Broadcast small seeded legumes
- Plant larger seeds in rows between the rows of cereals
- Weed the plots regularly to reduce weeds and pests
- Turn the legume into the soil just after it had flowered
- Cut the leaves and stems for fodder if necessary but not the entire plants
- Harvest the green manure crop (the pods)
- Allow to grow up to 2years before slashing them
- Slash the remaining stalk and leaves and if possible on the same day,
- Turn them into the soil
- Leave at least 7days before planting the next crop (this is to allow the stalks and leaves to decompose)

Army (1996) is of the opinion that the extension officer is the best position to know the type of grasses or legumes that perform efficiently in an area. So, the author then identified 7 skills in growing and applying green manure as follows

- Consult the extension officer for the best green manures in the area
- Plant in the fall after the herbs have been harvested or
- Plant as part of crop rotation during the growing season
- Mix the seeds with sand or soil
- Broadcast the seeds by hand in an even manner if on a small garden
- Rake the soil to cover them sufficiently
- Turn the green manure into the soil in the early spring when the soil is not warm or dry enough.

Howard and Yeshwant (2005) stated that it is better to grow crops in particular area, harvest the crop before planting grasses and legume crops that are for green manure. The authors then identified 5 skills in green manure preparation thus

- Plant leguminous crop after harvesting crop
- Irrigate the farm if ample rainfall is less than 5inches during the first forth-night after ploughing
- Cut the crop before the grand period of growth is completed that is just before flowering begins.
- Plough in the crop distributing evenly over the farm
- Allow 8 weeks to elapse before sowing the next crop.

The view and opinions of the authors whose works are reviewed above guided the researcher in developing skill items in green manure in this study.

Skills in fertilizer application

In the view of Agbo (1999) the following 6 skills are utilized in fertilizer application.

- Spread fertilizer uniformly over uncultivated land using hand or machine but if in a cultivated land with growing crops, perform the following skills.
- Protect plantsôstems or roots from being in contact with fertilizer
- Make an opening in ring form round the crop in heaps or mounds
- Make openings as bands if crops are planted in rows/ridges
- Spread fertilizer evenly in the ring or bands a few centimetre away from the crop
- Cover the applied fertilizer with soil.

Youdeowei, Ezedimma and Onazi (1999) identified 6 skills in fertilizer application. These are

- Plough the field/land
- Spread the fertilizer uniformly over the ploughed field/land
- Mix fertilizer with soil
- Apply the fertilizer within drills along with the seeds (when it is to be applied with the seeds)
- At about 3-4 weeks after planting crops, apply second dose of fertilizer by broadcasting on the soil surface close to the plant
- Make ring or band of 5cm below the seed or plant and 4cm away from the seed or plant

The view and opinions of the authors whose works were reviewed above guided the researcher in developing skill item in fertilizer application in this study.

Mulching

Mulching refers to dry vegetative materials used in covering the soil surfaces in order to help it retain water, reduce evaporation and erosion in addition to providing plant nutrients when the materials decompose. The materials used for mulching are called mulch. In the view of Cooper (1999), mulch refers to materials placed on the soil surfaces to help reduce the impact of raindrops. The materials the author further stated prevent weeds from growing in addition to improving the aesthetic value of the area. The author then outlined the skills in mulching as follows:

- Collect suitable mulching materials.
- Carry the materials to the site/farm
- Spread the materials on the beds or on top of the soil after tillage

Beauliew (2002) outlined 7 skills in mulching as

- Identify the appropriate mulch materials
- Rake leaves.
- Put them into a mulch bin. The bin serves as a holding tank
- Cut or shred the leaves using mulching lawn mower
- Spread the shredded mulch over the land or cultivated ridges
- Spread plastic mulch materials.
- Poke holes in the plastic mulch materials to provide access for the plants

Sustainable Agricultural Manual (nd) outlined 8 skills in mulching to include

- Collect/rake dry plant materials that do not rot quickly. Example maize or sorghum stalks, maize husks, wheat straw among others.
- Determine when to apply the material
- Carry the materials to the field
- Spread the materials on the soil surface with hand or rake before or after planting.
- Spread on the cultivated beds or ridges
- Spread around young crop plants
- Spread mulch materials during dry season and in rainy season in places where the soil is easily eroded by heavy rain.
- Maintain a layer of mulch material at 7-15cm (3-6 inches) deep all over bed, around the growing plant and more on the eroded places

Cooper (1999) identified 3 skills in mulching to include the following

- Collect suitable materials for mulching
- Carry the materials to the farm
- Spread the materials on top of beds or ridges after tillage

The authors reviewed under manure preparation and application outlined a total of 154 skill items. These skill items were validated to obtain a total of 62 skill items that were utilized by this study in manure preparation and application. Therefore, the views and opinions of the authors whose works were reviewed guided the researcher in identifying skill items in manure preparation and application.

Crop Rotation

Crop rotation in the view of Moeller (2007) is a method that uses the practice of planting different crops in a location in subsequent growing seasons. The author further stated that it is a farming practice which utilizes the different requirements and benefits of different plants so that soil fertility is improved, erosion controlled and pests and diseases decreased. This practice the author concluded requires planning and some knowledge of the type of crops to grow for an extended period of time to get the full benefit from the practice. Al-kaisi, Mark and Tidman (2004), said that crop rotation or cropping sequence is proven to be very effective in addressing concerns related to soil, water and environmental quality from long or short term perspective. In their view, it has been an age-old farming practice that has many agronomic, economic and environmental benefits as it can improve yield and profitability over time. Moeller (2007) identified 10 skills in crop rotation as follows

- Make a long range rotation plan by determining the goals in view
- Create a planting schedule
- Implement the plan by planting specific crops which will help in the realization of the goal
- Follow the planting schedule by planting the plants chosen in order of sequence
- Take notice of the benefit or problems experienced using the plan
- Modify the order to minimize the loss. This may include adding another neutral plant between the two previous crops that offset the condition causing decreased.

- Work with neighbouring growers to derive the full benefit of the rotation plan.
- Use the crop adjustment as realized benefit from the plan
- Be consistent for consistent result
- Keep records so that gain or losses in production can be observed. The record should indicate crop type, yield and weather along with the cost of soil amendments, fertilizer, pH, chemicals, pesticides and herbicides.

Wikipedia (2009) identified 8 skills in crop rotation and they include;

- Make a list of crops (vegetables) to grow in the farm (garden)
- Group these crops by plant family. Example of common plant families in case of vegetables include: the Brassicas (cabbage, broccoli, kale, cauliflower, mustard greens), Legumes (peas, beans, fava beans), Alliums (garlic, onions, shallots, chives), Solanaceous crops (tomatoes, peppers, eggplants, potatoes, tomato) and Cucurbits (melons, winter and summer squash, cucumbers, zucchini, pumpkins).
- Draw a map of the beds, ridges or mounds on a graph paper and make several copies.
- Use the map to plan where to plant each crop in the farm (garden). To simplify the crop rotation plan, it is best to grow plants from the same family together.
- note crops (vegetables) grown and where on the map.
- label each crop with the year, because it will be referred to in least three to five years later.

- Rotate each plant family to a new spot in the farm (garden). Crop rotation works best on a 3- to 5-year sequenceð meaning that if a Solanaceous crop is planted in one spot in 2012, they would not be planted there again until 2016 at the earliest. Rotating crops helps break pest and disease cycles, gives an opportunity to balance the nutrients in the soil. For instance, heavy-feeding crops like squash and tomatoes draw a lot of nutrients (especially nitrogen) from the soil. But legumes (peas and beans) actually add nitrogen to the soil. So, a good crop rotation strategy is to plant heavy-feeding crops in a spot that legumes were grown because the soil is richer in nitrogen. The soil can also recharge by rotating legumes into a spot that heavy feeders were grown.
- refer back to the map from the previous growing season(s) when beginning planning for the following year rotation.

Maluniu (2009) said that crop rotation is a farming practice which utilises the different requirements and benefits of different plants so that soil fertility is improved, erosion controlled, and pest and diseases are decreased. This practice requires planning and some knowledge of the type of crop to grow for an extended period of time to get the full benefit from it. The author then outlined 19 skills in crop rotation as

- Study crop rotation requirements.
- Select appropriate crop varieties.
- Rotate grains with solid seed and row crops. Example plant wheat, season 1, Legumes, season 2, Oil seed crops (corn, sunflowers,) season 3 wheat season 4, Legumes, season 5 and so on).
- Include a fallow in the rotation.

- Make a long range rotation plan bearing in mind the goals hoped to be achieved by implementing crop rotation-
- Plant specific crops which will help realize the goals.
- Create a planting schedule to facilitate action on the plan.
- Implement the rotation plan in the order chosen.
- Take records of the benefits experienced, or problems that occur using the rotation plan.
- Modify the order of the crop selection if there is any loss in productivity to minimize further loss. This might mean adding another neutral crop plant between the two previous crops that could offset the condition which causes the decrease in the production that was previously noted.
- Work with neighbouring growers to increase the benefits of the rotation.
- Use crop adjustment as the benefits of the rotation plan is realized
- Choose a place to store the surplus if the rotation strategy increases the yield of the crops.
- reduce the space dedicated to plant crop if loss is continually incurred
- Look at other farmers in their operations to see where they have success with crop rotation.
- Be consistent for consistent results.
- Keep informed of new seeds which are available in the region.
- Keep records so that gains (or losses) in production can be observed.
- Take precautions to protect the stored seed from insects and other organisms which may destroy them.

The three authors reviewed under crop rotation outlined 10, 8 and 19 items which gave a total of 37 skill items in crop rotation. These skill items were validated to obtain a total of 13 skill items that were utilized by this study in crop rotation. Therefore, the views and opinions of the authors whose works were reviewed guided the researcher in identifying skill items in crop rotation.

Skills in soil erosion prevention and control

Erosion is the carrying away of soil particles from its original place to another position. In the opinion of Akamigbo (1986), it is the movement of soil from higher area to a lower one. To the author, soil erosion occurs as a result of man disturbance to the vegetative cover of the soil through clearing, burning and other farming practices as well as through establishment of residential buildings, industries/factories markets, road construction and other development projects that make life pleasurable. Soil erosion can be prevented from occurring at all and it can also be controlled from further occurrence in places where it has started.

Soil erosion prevention in the opinion of Olaitan (2005) means anticipatory measures geared towards avoiding the occurrence or existence of any type of soil erosion. Prevention of soil erosion can be a major problem in a garden, planted bed or on a farm of any type. eHow (2009) noted that the guiding principle of preventing erosion is to avoid altering natural landscapes and processes as much as possible. The author then advised that preventing soil erosion is the responsibility of everybody. As noted by Wendy (2008), prevention of soil erosion is one of the ways of conserving the soil and this according to Feed (2009) can be carried out by adopting Best Management Practices (BMP). The BMP as indicated by the author embraces physical, chemical, structural or managerial practices that prevent or reduce erosion. The methods can be the simplest and most effective measures that help retain sediments on soil surfaces. Olaitan (2005) then identified 9 skills in soil erosion prevention as follows.

- Build short-ridge structures across the furrow between ridges in the farm (these are called cross bars).
- Make ridges across the slope.
- Plant grasses on the land that is likely to be eroded.
- Break the slope into series of flat-surfaces called terraces.
- build walls to cut across slopes to prevent rill and landslide.
- Establish crops in strips at right angles to the direction of water flow.
- Break the soil clods moderately in order to avoid excessive damages to soil granules.
- Plant young tree seedlings in areas likely to be eroded in future.
- Prepare ridges in spiral forms to restrict rapid movement of water in the farm.

eHow (2009) believe in establishing vegetation on soil surfaces especially in arid regions as the roots hold the soil particles while the leaves reduce the impact of rain drops. The author outlined 7 skills required in preventing soil erosion.

These are

- Plant trees, shrubs and other plants. The roots of these plants help to hold soil in place on the ground preventing them from being easily blown away by wind and or washed away by rain.
- Create windbreaks. Windbreaks made out of trees, such as evergreen trees or bushes help prevent erosion by preventing wind from blowing across the land.
- Grow cover crops on farm land. When land is not being used (during off seasons). Cover crops especially legume (beans) can help prevent soil erosion due to wind and rain.
- Apply mulch to retain moisture and also help prevent soil erosion. Topsoil is not likely to be washed or blown away when it is covered by mulch materials.
- Construct surface runoff barriers, such as edging made of bricks or stones. This can help prevent soil erosion by minimizing runoff. If runoff is minimized, soil is less likely to be carried away.
- Use contour farming when farming on sloped areas. This conservation technique is to follow the actual topography of a slope or the natural lay of the land when planting crops.
- Adopt/try terrace farming and gardening to decrease groundwater runoff by creating nearly level layers of crops on hillside.

Feed (2009) stated that skills in soil erosion prevention include the following

- establish rough soil surface during tillage.
- Reduce runoff velocity and allow for infiltration by zero tillage.
- Trap soil sediments by grassing steep slopes.

- Establish vegetative cover on the soil surfaces.
- Stabilize exposed soil with vegetation and mulching materials.
- Grow plants that are indigenous to the area. It can be interesting to make something grow outside of its usual domain, these plants can reduce the speed of run-off.

Wendy (2008) outline 11 skills as preventive measures that can help conserve soil if properly utilized

- Grow plants that are indigenous to the area.
- plant trees and shrubs. These can provide shelter for the soil, while the roots will help to prevent excess water from washing it away.
- Keep the soil moist by covering with damp piles of mulch.
- plant and maintain enough strong, healthy growing vegetation as this will bind the soil together and protect its surface being carried by wind or water.
- practice a tillage method that does not make the soil over fine. This is because a good tillage method optimizes the biological and physical condition of soil.
- construct physical structures made of earth, stone or other organic materials that can aid in protecting soil against uncontrolled runoff erosion. With a little bit of design, it can also retain and direct water in areas where it is needed most. The best structure will depend on climate and the need to either discharge or retain runoff; the size garden or farm; the texture and depth of the soil.
- construct wind barrier at the boundaries of a farm, this will help stop the wind from blowing soil away.

- Plant patches of high grass and allow the grass to grow to at least three inches to promote retention of water in the soil.
- spread an organic mulch. This helps in the maintenance of soil temperature and minimizes erosion.
- Plant cover crops that will assist in the protection of soil, like rye or clover. They protect the soil by thickly covering the ground restricting weed growth and reducing runoff.
- Irrigate/water plants early in the morning, when evaporation is low. Watering in harsh sunlight can dry out soil while in the late evening; it can cause growth of fungus.

With reference to erosion control, Olaitan (2005) explained that it is an act of restraining different types of speeds of running water, wind and mining erosion from having threatening effects on the soil. To the author, erosion control measures are carried out to stop further occurrences of detaching and transporting of soil particles. About.com (2009) then reported that erosion control measures are adopted when erosion already exists with the aim to reduce or totally stop its effect. Stone (1996) stated that controlling soil erosion helps to sustain or improve crop yields, reduce drainage costs, retain nutrients and chemicals where applied, reduce hazards when working on eroding soil, and help improve water quality that enters the soil. The author is of the opinion that the management of soil for water and wind erosion control is based on sensible certain conservation practices, the majority of which are recognized components of good soil, crop, and water management. To the author, effective erosion control embraces the ability to maintain good soil structure, protect the soil surface by adequate crop and residue cover, and use special structural erosion control practices where necessary. The author further explained that these factors often control both water and wind erosion; but warned that it is necessary to bear in mind that not all erosion control practices fit into every farm management scheme; although each erosion problem can be remedied by choosing one or more of the remedial practices appropriate to the problem. In view of controlling soil erosion, Schwab, Fangmeier, Elliot and Fervert (1993) identified 10 skills erosion control as

- Plough on the contour.
- Till the soil to produce rough-clod-dry surface
- Place plant residues on the surface to obtain maximum roughness.
- Construct small ridges to direction of wind.
- Plant on the contour.
- Put checks in furrows.
- Establish grasses that have the ability to live long withstand wind especially on sandy soils.
- Plant tress to act as shelter belts for wind erosion control.
- Mulch with suitable materials.
- Build level terraces.

Brady and Weil (1999) identified 8 skills that can be employed in soil erosion control thus;

- Plant permanent vegetations, usually trees and shrubs on the contour to slow down runoff, trap sediments and eventually build up natures that eventually build up the soil washed soil surfaces.

- Fill in gullies with sand.
- Shape gullies for smooth water flows.
- Sow grasses to serve as water ways.
- Construct check dams about 0.5m high at intervals of 4-9m depending on the slope.
- Plant perennial vegetations on exposed road cuts to eliminate soil loss.
- Provide cross channels (shallow ditches or water channel) every 25 to100 m to prevent excessive accumulation of water
- Plant windbreaks and tenacious grasses

Olaitan (2005) outlined 5 skills that can be utilized as erosion control measures. They are:

- Make bunds between two strips surface.
- Construct deep pathways for diverting running water and channel them into exit pipes or tunnels.
- Make barriers along the slope with sand bags and logs of wood.
- Build tunnels in form of large exit pipes or joined ringed concrete.
- Make concrete walls.

Deere (2005) identified 6 skills in erosion control. They are

- Place blankets and mats tightly and securely on affected area
- Construct large cement pavers into a retaining wall to prevent the water from moving inwards
- Use large boulder type rocks or concrete pavers on shorelines
- Place residue covers on soil surfaces. Residue covers are most successful and cost effective sources of demolishing erosion. This is because the residue covers provide protective shelf for the soil surface

reducing impact of raindrops, water or ice in addition to preventing deposits of soil and so diverts running water in other directions away from the soil and into drains

- Apply a simple layer of mulch.
- Place grass onto the eroded areas where it will grow over, covering the surface and providing temporary control measures.

About.com (2009) outlined 5 skills in erosion control as:

- Build retaining walls of mortar-less stones
- Plant vine ground covers
- Apply mulch materials to prevent and control erosion.
- Build dry-creek beds on hillsides
- Plant shrub on hills.

The authors reviewed under soil erosion prevention and control outlined a total of 67 skill items. These skill items were validated to obtain a total of 43 skill items that were utilized by this study in soil erosion prevention and control. Therefore, the opinions and statements of the authors whose works were reviewed above guided the researcher in identifying skill items in soil erosion prevention and control.

Skills in Irrigation

Irrigation is the artificial application of water to the soil to supplement rainfall. In the view of Wikipedia (2009) it is an artificial application of water to the soil for assisting in growing crops during the period of scanty or absence of rainfall. According to Clark (2008) the primary objective of irrigation is to provide water to crop to meet the evapo-transpiration demands in the absence of rainfall. Additionally, irrigation helps to suppress weed growing with the crops in the fields. The author also said that, the goal of irrigation is to supply the entire field uniformly with water, so that each plant has the amount of water it needs, and the soil nutrient dissolved for the use by the plants.

The water levels from the irrigation source are usually controlled by dikes. This is often seen in terraced rice fields (rice paddies), where the method is used to flood or control the level of water in each distinct field. In some cases, the water is pumped, or lifted by human or animal power.

Wikipedia (2009) said that there are different types of irrigation techniques which can either be surface or sub-surface. Each technique differs in the context of how the water obtained from the source is distributed within the field. In surface irrigation systems the author noted, water moves over and across the land by gravitational flow in order to wet it and to infiltrate into the soil. Surface irrigation can be subdivided into furrow, border-strip or basin irrigation. It is often called flood irrigation when the irrigation results in flooding or near flooding of the cultivated land. The author explained further that in surface irrigation, buckets or watering can are also used especially in developing countries. These provide low quantity of water below the requirements of crops and need high labour inputs. Irrigation using watering cans is found mainly in semi-urban around large cities in developing countries. Besides the common manual watering by bucket or watering can, an automated, natural version also exist. This system (with certain crops) helps to save expenses as it does not consume any electricity and only little water is used (unlike sprinklers). However, it may only be used with certain crops (probably mostly larger crops) that do not need much quantity of water for their growth.

In sub-surface irrigation, water is distributed under low pressure through a piped network, in a pre-determined pattern, and applied as a small discharge to each plant. Drip irrigation, spray or micro-sprinkler irrigation and bubbler irrigation belong to this category of irrigation methods. Drip irrigation, also known as trickle irrigation, functions as its name suggests. Water is delivered at or near the root zone of plants, drop by drop. This method can be the most water-efficient method of irrigation, if managed properly, since evaporation and runoff are minimized. In modern agriculture, drip irrigation is often combined with plastic mulch, further reducing evaporation, and is also the means of delivering fertilizer.

Deep percolation, where water moves below the root zone, can occur if a drip system is operated for too long a duration or if the delivery rate is too high. Drip irrigation methods range from very high-tech and computerized to low-tech and labour-intensive. Lower water pressures are usually needed than for most other types of systems, with the exception of low energy centre pivot systems and surface irrigation systems, and the system can be designed for uniformity throughout a field or for precise water delivery to individual plants in a landscape containing a mixture of plant species. Although it is difficult to regulate pressure on steep slopes, pressure emitters are available that can be used to spray in such places, so the field does not have to be level. High-tech solutions involve precisely calibrated emitters located along lines of tubes that extend from a computerized set of valves. Both pressure regulation and filtration to remove particles are fitted. The tubes are usually black (or buried under soil or mulch) to prevent the growth of algae and to protect the polyethylene from degradation due to ultraviolet light. But drip irrigation can also be as low-tech as a porous clay vessel sunk into the soil and occasionally filled from a hose or bucket. Sub-surface drip irrigation has been used successfully on lawns, but it is more expensive than a more traditional sprinkler system.

Sub-surface irrigation is also used in commercial greenhouse production, usually for potted plants. Water is delivered from below, absorbed upwards, and the excess collected for recycling. Typically, water and nutrients flows through a trough for a short period of time, 10-20 minutes, and is then pumped back into a holding tank for reuse. Sub-surface irrigation in greenhouses requires fairly sophisticated, expensive equipment and management techniques. The advantages are water and nutrient conservation, and labour-saving through lowered system maintenance and automation. It is similar in principle and action to sub-surface drip irrigation.

Sometimes seepage irrigation is used. This is a method of artificially raising the water table to allow the soil to be moistened from below the plants' root zone. Often those systems are located on permanent grasslands in lowlands or river valleys and combined with drainage infrastructure. A system of pumping stations, canals, weirs and gates allows it to increase or decrease the water level in a network of ditches and thereby control the water table.

With reference to sources of water for irrigation it can be groundwater sourced from springs or wells, rivers, lakes or reservoirs or non-conventional sources like treated wastewater, desalinated water or drainage water. A special form of irrigation using surface water is spate irrigation, also called floodwater harvesting. In this case, (spate) water is diverted to dry river beds (wadi's) using a network of dams, and channels and spread over large areas. The moisture stored in the soil will be used thereafter to grow crops. Spate irrigation areas are located in semi-arid or arid, mountainous regions. In the opinion of Clark (2008), an irrigation system typically includes a pump, various pipes, valves and water emission or discharging devices such as sprinklers or drip emitters. Most commercial and residential irrigation systems are "in ground" systems, which means that everything is buried in the ground. With the pipes, sprinklers, and irrigation valves being hidden, it makes for a cleaner, more presentable landscape without garden hoses or other items having to be moved around manually.

The beginning of a sprinkler system is the water source. This is usually a tap into an existing (city) water line or a pump that pulls water out of a well or a pond. The water travels through pipes from the water source through the valves to the sprinklers. The pipes from the water source up to the irrigation valves are called "mainlines", and the lines from the valves to the sprinklers are called "lateral lines". Most pipes used in irrigation systems today is PVC plastic pressure pipes due to their ease of installation and resistance to corrosion. After the water source, the water usually travels through a check valve. This prevents water in the irrigation lines from being pulled back into and contaminating the clean water supply.

Most Irrigation systems are divided into zones. A zone refers to a single Irrigation valve and one or a group of sprinklers that are connected by pipes. Each zone has a solenoid valve on it that is controlled via wire by an Irrigation Controller. The Irrigation Controller is either a mechanical or electrical device that signals a zone to turn on at a specific time and keeps it on for a specified amount of time. "Smart Controller" is a recent term used to describe a controller that is capable of adjusting the watering time by itself in response to current environmental conditions. The smart controller determines current conditions by means of historic weather data for the local area, When a zone comes on, the water flows through the lateral lines and ultimately ends up at the irrigation sprinkler heads. Most sprinklers have pipe thread inlets on the bottom of them which allows a fitting pipe to be attached. The sprinklers are usually installed with the top of the head flush with the ground surface. When the water is pressurized, the head will pop up out of the ground and water the desired area until the valve closes and shuts off that zone. Once there is no more water pressure in the lateral line, the sprinkler head will retract into the ground.

Some problems are associated with irrigation; such problems include competition for surface water, depletion of underground water, salinity and pollution among others. Under-ground irrigation gives poor salinity control as it leads to increased soil salinity consequent build up of toxic salts on soil surface in areas with high evaporation. This requires either leaching to remove these salts and a method of drainage to carry the salts away or use of mulch to minimize evaporation of water from the soil surface. Over-irrigation due to poor distribution may lead to water pollution.

There is need for proper irrigation schedule, this in the opinion of Stryker (2009), is necessary because the largest loss of plant materials on new landscape projects is the direct result of improper irrigation scheduling. The most common irrigation scheduling problem is not too little water, or even too much water, it is watering too frequently. Many of the common turf grass and landscape shrub diseases are made worse by, or even may be as a result of too much watering. Plant roots need a combination of both air and water to survive. Some plants, like rice, can grow in an area that swampy while other crops will die if the roots are wet for long. Thus, the following skills were outlined by Wikipedia (2009) for ensuring proper irrigation of the soil.

- Examine the plants to be irrigated.
- Adjust the control clock on at least weekly basis to conform with current weather conditions, although with monthly adjustments plants can be healthy.
- Check to see if the soil is wet. Avoid watering if the soil is still wet and on hot afternoons.
- Saturate the soil with water if dry. The soil should be completely saturated (the technical term is that the soil has reached field capacity) to a uniform depth of at least 6 inches. The primary feeder roots for most plants will be growing throughout the top 6 inches. These feeder roots are

so small that they are not even noticeable in the soil. The plant's lower roots are primarily to physically support the plant, although these lower roots can sometimes take up water if they need to.

Tichenor (2002) outline the skills in irrigation as follows:

- Cycle the Sprinklers.

If irrigating is carried out using sprinklers, the water will probably start to run off into the gutter, or into a low spot, before the soil is wet to a 6 inch depth. This is because the sprinklers put out more water in a given amount of time than the soil can absorb. In technical terms the precipitation rate of the sprinklers is greater than the infiltration rate of the soil. So as soon as the water starts to run-off, just turn off the sprinklers! Wait an hour or so for the water to soak in, and then run the sprinklers again until run-off once again occurs. Continue this run-stop-wait-run cycle until the soil is saturated to a 6 inch depth. This process is referred to as cycling the sprinklers. Almost all sprinkler systems need to be cycled for proper irrigation. Technically in large areas the run-off may not be noticed because the water doesn't run into a gutter or over a sidewalk, but runs off to the lowest area in the lawn. It's still critically important to prevent the run-off. With drip systems the goal of saturating the soil 6 inches deep in the entire planter is the same, but a different approach is necessary to achieve the goal. Drip emitters slowly trickle water into the soil at the location of each emitter. Because the water comes out of the emitter so slowly it easily soaks into the soil, making saturation of the soil to a 6 inch depth easy. The problem with a drip system is saturating the soil throughout the entire plant area, not just the soil directly under the emitter. To saturate the entire plant area, the water has to move outward in the soil from the emitter locations.

- force water to move at least 36 inches in each direction away from the emitter through a combination of positive displacement and capillary action in sandy soils. To achieve the positive displacement part of this action it is necessary to avoid cycling the drip system.
- Run the drip system as long as possible at a time.
- Create small beams if necessary to control run-off.

In some clay soils there may be need to cycle the drip system like sprinkler system to avoid run-off, but try to keep it down to just one repeat cycle if possible.

- add more emitters and space them at least 36 inches apart to achieve the required goal of wetting more area for the roots to grow in.
- Check with water provider to collect or provide a list of irrigation auditors in the area.
- carefully examine and test the irrigation system.
- create a report detailing the condition of the system, including a list of recommendations for repairs and improvements.
- provide an irrigation schedule showing how often or how frequently water should be applied during each month of the year.
- get quotes from landscapers for performing the repairs and improvements to be carried out.

Web (2009) outlined the irrigation skills to include the following

- Adjust the irrigation controller (timer) run time for seasonal changes in weather once a month.

- Put a weekly or monthly reminder for the adjustment of time. Greater savings is associated with weekly time adjustments, but monthly time adjustment provides the most return in water savings for the amount of money and time invested.
- Run the irrigation system in the morning hours, especially if sprinklers are used. This is because less water is lost to evaporation when the temperature is cooler and in most areas the wind does not blow much in the morning hours. Watering in the evenings can lead to disease problems because the water settles on the plants all night, especially in humid climates.
- program the irrigation timer so that it waters in 2-3 short cycles rather than a single long period .

In the opinion of Tichenor (2002), irrigation requires 10 skills. These are

- Write out the plan or hire a private company to write the plan.
- Select appropriate irrigation methods and alternatives for the plan. Make sure to consider the impacts the alternatives will have in whole farm water management
- Contact permitting agencies to see if the area required permit before installation of irrigation system.
- Purchase the correct equipment for the irrigation project that best fits needs and Best Management Practices (BMP)
- Check for leakages or any other problem within the system.
- Make Corrections and repairs if necessary
- manually start the irrigation system on the assigned watering days.
- cycle the controller through each irrigation zone.

- Detect or identify dry areas. Dry patches are a sign that sprinklers are spaced too far apart, that the water pressure is low, that sprinkler patterns may be blocked by overgrown grass or shrubs. Sprinklers should throw water 80 to 100 percent of the distance to adjacent sprinklers; sprinklers may need to be added or moved.

2. Adjust the Irrigation Controller for compliance and efficiency by setting the controller to the current date and time, watering days complying with the local watering restrictions. Set the controller for each zone to apply 3/4 inch of water per irrigation cycle, which will moisten the soil to about 8 to 9 inches deep and encourage deeper rooting. To determine how many minutes each zone should run to apply 3/4 inch of water, calibrate the system. Every irrigation system and irrigation zone is unique and should be calibrated. Calibrating the Irrigation System involves setting the irrigation controller to apply 3/4 inch of water in each zone during every irrigation cycle and this is carried out through the following:

a) On an allowed watering day, the author suggested randomly placing 10 sprinkler gauges throughout the area watered in zone one. The author also indicated that empty cans may be used if sprinkler gauges are not available.

b) The author further said that when in zone one, it is necessary to time how long it takes to get an average depth of 3/4 inch of water in gauges. This is because if there are large differences in water depths among the gauges, corrections should be made before continuing so that water is applied uniformly throughout the zone. The author concluded that all zones do not have to be calibrated in one session. He therefore suggested the following

- Set the controller for the time to begin irrigation.
- Water between 4 and 7 a.m. to reduce evaporation and plant disease.

To find the start time, add together the run times from each zone and subtract from the total

- Water the crop as needed to avoid overwatering and to encourage roots to grow deeper.
- Return the controller to the "off" setting after watering.

Lynette (2008) said that drip irrigation not only save water, it also reduces the amount of time spent by only watering the plant. Other advantages according to the author include reduction in the installation costs. The author identified the skills to include the following;

- Gather accurate site data. Site data encompasses information such as water source(s), soil type and climate. It is also important to note whether areas are densely or sparsely planted because different planting schemes dictate different design approaches.
- Determine plant water requirements by calculating the precise amount of water needed by each type of plant within the irrigation site. This will help to figure out the most effective irrigation methods and types of emitters required for different groups of plants. To calculate each plant's water requirements, it needs to take into account several factors such as plant species, climate and planting density.
- Irrigate the "base plant." Base plants are those plants within the irrigation area that require least water.

- Calculate system run time. As stated in Step 3, system run time is dictated by the irrigation needs of the base plant, meaning that flow rates to other plants must be adjusted for adequate hydration during that same amount of time.
- determine the maximum system run time (the length of time the system can run before it begins to waste water.) This time depends on the flow rates of the emitters and the allowable depletion of the soil. From there, the irrigation interval can also be determined.
- Irrigate "non-base plants." To do this there is need to calculate the number of emission devices required for each plant by dividing the daily water requirement for each remaining plant by the system run time calculated in Step 4. This tells the minimum flow rate required for each plant and allows for the selection of the emission devices necessary to meet or exceed the flow rate.
- Calculate system hydraulics. This step is imperative to ensure that there is sufficient flow and water pressure to irrigate all parts of the landscape. These factors are influenced by changes in elevation and friction between water and system components. Calculating the system hydraulics enables one determine the maximum allowable pressure loss, which, in turn, indicates the maximum length of drip line laterals. The author indicated that the following steps are required in the calculation:
- Locate irrigation meter.
- Remove cover to irrigation meter.
- Inspect inside the box for wildlife such as snakes or spiders.

- Wearing protective gloves, reach into irrigation meter box and flip up the dial cover to expose the meter. Be careful not to disconnect any wires or damage any part of the meter equipment.
- Properly measure the required water.
- Locate irrigation system control box.
- Set timer for five minutes.
- Manually turn on timer.
- Inspect sprinkler heads in zone for leaks while first zone is running to make sure they are running properly. That is, watch for gushing water,
- Turn off the system. After five minutes
- Calculate the water usage for each zone. To calculate water usage for Zone 1, take the initial reading and subtract it from the reading taken at x^{th}

Seymour and Wade (nd) Identified 7 skills that can be utilized in irrigation. These are

- Carry out proper planning and design
- carry out Soil analysis and improvements.
- Carry out appropriate plant selection.
- Determine practical turf areas.
- install efficient irrigation.

The authors reviewed under irrigation outlined 10,4,11,16 and 5 skill items. These skill items were validated to obtain a total of 6 skill items that were utilized by this study for collection of data in irrigation. Therefore, the opinions and statements of the authors whose works were reviewed above guided the researcher in identifying skill items in irrigation.

Theoretical Framework of the Study

Theory in the view of Beachamp in Olaitan (2003) is a set of related statements that are logically arranged so as to give functional meaning to a series of events. The author further explained that the set of related statements may take the form of descriptive or functional definitions, hypotheses, principles, prepositions, generalizations, laws or theorems. Hornby (2006) stated that a theory refers to the principles on which a particular subject is based. In the opinion of Redmond (2008) a theory means an assumption, accepted principles and rules or procedures based on limited information or knowledge devised to analyse, predict or otherwise explain the nature or behaviour of a specified set of phenomena. The author concluded that it involves abstract reasoning. With reference to this study, a theory refers to a set of principles that are logically arranged so as to give functional meaning to the teaching of soil conservation. Theoretical framework on the other hand helps to ask questions, interpret information, set goals and select strategies for achieving goals (Cookey, 1990). It therefore provided a base that helps a study achieve its goals. The theoretical framework of this study is based on the theory of teaching, principles of soil conservation and need assessment theory

Theory of Teaching

This study adopted Gagne's theory of instruction of 1988. According to this theory, *instructors determine the objectives of instruction which are stated in performance terms.* Determination of objectives as indicated by the author is carried out during planning of instruction. Wikipedia (2010) stated that planning is a basis for successful teaching. The author further stated that planning involves statement of objectives, means of attaining them, materials required and the procedure for evaluating the stated objectives. Wilen in McLaughlin (2008) observed that planning is an essential part of instructional delivery since it is during this stage that the objectives are stated and selection of appropriate varieties of methods and techniques that would help achieve the stated objectives are described. The author further stated that during instructional planning, teachers focus on significant parts of the content, account for prior-knowledge of learners and activities that would motivate them during teaching. Kearsely (1994) stated that Gagne's theory of instruction with reference to instructional planning provides better structure for the lesson and acts as road map to follow to help deliver the lesson in a more holistic way. According to Gagne, these objectives are stated in performance terms. This might have necessitated Kearsely (1994) to state that for cognitive abilities to be learned, there must be a chance to practice learned tasks while learning attitudes require exposing learners to role model. Learning theory of instruction by Gagne on the statement of objectives in performance terms guided the researcher in structuring planning skills suitable for teaching soil conservation practices.

Gagne's theory of instruction also contended that learning tasks for intellectual skills can be organised in a hierarchy according to complexity while for motor skills, complex behaviours are composed of simpler behaviours arranged in a hierarchical structure and that these simple *behaviours must be mastered before the complex ones can be performed*. The author is of the opinion that students should be able to learn more complex tasks as a result of their previous experience. That is, basic concepts must be understood first before moving to higher level concepts. Dick and Carey (1996) influenced by Gagne's theory stated that when analysing sub-skills, the designers must ask what the students already know how to do as pre-requisite skills to help them learn subordinate skills. Based on the need for hierarchical arrangement of instruction, Gagne categorized educational objectives into five domains. These domains are verbal information, intellectual skills, cognitive strategies, motor skills and attitudes. Bearing in mind the hierarchical arrangement of instruction based in five domains, Olaitan and Ali (1997) adopted classification of educational objectives using Bloom's taxonomy of cognitive domain which classified objectives into the following: knowledge, comprehension, application, analysis, synthesis and evaluation. Knowledge is the lowest level while evaluation is the highest level of cognitive domain. Further, Simpson in Olaitan (2003) also classified educational objectives in the psychomotor domain into seven levels which includes perception, set, guided response, mechanism, complex overt response, adaptation and origination. Perception is the lowest level while origination is the highest. All these classification follows Gagne's theory of hierarchical arrangement indicating that simple tasks or behaviours are learned before complex ones. This theory of hierarchical arrangement based on complexity guided the researcher in arranging the skills in instruction and soil conservation hierarchically based on their complexity. That is even the minute skill is identified, listed for the teachers to study, indicate whether such minute skill is required and the extent they can perform such skill before the complex ones.

Gagneô theory of instruction further stated that there are nine events of instruction which refers to a set of external activities that support internal learning processes. The author indicated that these nine events activate internal processes that are needed for effective learning and that all lessons must include these nine sequences of events. These events includes

1. *Gaining attention*- this event determines the extent and nature of reception of stimulation during learning process. To gain learnersô attention, a teacher has to employ many techniques. The teacher could use probing questions or motivation. Keller (1988) stated that gaining attention ties directly with the concept of motivation. The author then developed model of motivation. The model is called ARCS which stands for attention, relevance, confidence and satisfaction. This model indicated that people are motivated to engage in an activity if it is perceived to be linked to the satisfaction of personal needs, and if there is a positive expectancy for success. According to the author, these conditions must be met in order for people to become and remain motivated to learn.

2. *Inform learners of the objectives*; learners need to be informed of the kind of performance that they are expected to display to indicate if they have learned what they were supposed to learn. In some cases, it may not be necessary to specifically inform learners of the objective because they already know. However, in many cases it is necessary to inform the

learners what they are expected to learn in order to clarify what they should be attempting to learn. It also helps them avoid undue stress resulting from thinking that they have to know everything relating to a topic. Therefore, it is best to let the learners know in advance what they are expected to learn.

3. *Stimulating recall of pre-requisite learning*. According to cognitive information processing theory by Gagne, most new learning depends on connections made to prior learning. For examples, certain concepts and rules must have been previously learned in order to learn new higher-order rules. When new learning is about to occur, relevant prior information could be made internally accessible so that it can be made part of the learning events. This accessibility is assured by having the old information recalled just prior to presenting the new information and this can be carried out by through recall questions. This line of questioning recalls previously learned information and leads to a new learning. In this way, learners see the relationship between what they have already learned and what they will be learning, thereby creating relevance to the entire learning process.

4. *Presenting the stimulus material:* This event according to Gagne means the presentation of new information to the learners for example, if learners must learn a series of facts then those facts must be communicated to them; If they are to learn a motor skill the skill must be demonstrated. It is proper to present the required stimuli as part of the instructional events. Stimulus presentation emphasizes features that encourage learners to select what the teacher wants them to learn. This

can be carried out by the teacher using pictures with arrows or circles to indicate the important information.

5. *Providing Learning Guidance*: Learning guidance usually takes the form of communication between teacher and learners in which the teacher helps guide them. The sole purpose of guidance is to aid the learners in the process of learning, and to move them from one state of mind to another. This involves suggesting a line of thought that will presumably lead to the desired outcome. The amount of guidance given by the teacher depends on the type of learning desired and sometimes it varies according to the kinds of learners as some require less guidance, while others require a great deal of it and can become frustrated when such guidance is not present.

6. *Eliciting Performance* (practice): This event allows the learner to communicate to the instructor whether or not they can perform the skills taught. This is carried out by providing the learners with practice exercises. Usually, the initial practice may involve using the same example with which the learners were taught followed by more examples that differ from the original. All practiced items must match the performances and conditions indicated within the objectives.

7. *Providing Feedb*ack:: Learners require practice exercises and feedback about their performance. Feedback can be verbal, written, computerized or other forms. Regardless of the form chosen, feedback informs learners about the degree of correctness in their performance so that they may improve on subsequent attempts. The teacher has to provide feedback soon after performance.

8. *Assessing performance*: In Gagneọs events, the teacher elicits performance from the learners to determine if the desired learning has occurred. Students are assessed to determine whether the instruction has met the designed objectives and also to know whether each student has achieved the desired objectives. Most often this result in some sort of grade assigned to each studentọs performance.

9. *Enhancing Retention and Transfer*: It is important to figure out ways to increase the chances that the skills taught are properly demonstrated by the learners outside the learning environment. This according to the author is because learning is situation specific. The best way to aid in retention and transfer is to provide meaningful context in which to present the lesson. If skills to be learned represent skills used in the real world, it is necessary to establish a classroom learning environment that approximates the real world as much as possible. This justifies one of the theories of vocational education which stated that the environment in which the learner is trained must be a replica of the environment where he is to work after graduation.

Gagneọs theory of instruction with reference to nine events guided the researcher in identifying skills in instruction and soil conservation practices because these skills are to be demonstrated by the learners outside the learning environment while carrying out soil conservation practices after graduating from the colleges. The study was also guided by soil conservation principles

Principles of Soil Conservation

Soil Conservation is governed by certain principles as explained by Allen and Leoner in Osinem (2005). These principles stated as follows

Every piece of land has one or more uses for which it is best adapted. This means that any piece of land has a valuable use. Butter (1955) said that land is divided into classes based on their best uses. These classes in the view of the author are land suitable for cultivation which is of 4 classes (i, ii, iii, and iv) and land not suitable for cultivation which is of another 4 classes (v, vi, vii and viii). The author explained these classes thus:

Class i- this land has little or no limitation in use. It may consist of a field that is nearly level; deeply fertile, free from gravel or stones, possesses no hazard from wind or water erosion, and has the rainfall and growing season ample for all the crops to be successfully grown; not flooded during rainy season and with no drainage problem. Any major change in one of these factors may change the land from class i to another class. Class i land needs good farming practices including rotation of crops, necessary fertilizers and any other practices that can maintain a high level of production.

Class ii- this land is a little sloppy and requires a few easily applied practices to maintain. The slope may be steeper than class i, the soil shallower, the erosion more active. Class ii land may produce yields as good as class i but the extra-practices needed are for long time protection from erosion and soil damage. It needs the same general crop rotation as class i but the soil building crop may be left a year or longer. The extra-practices to apply would be designed to conserve moisture and prevent soil loss on field. These practices may include contour cultivation, use of crop residues, cross slope seeding of grain and legumes among others.

Class iii- this land has hazards or limitations that need careful attention if crops are to be grown on it. It is steeper than class i or ii soils, the slopes may be 15% or more in some areas, with rich soil that has been eroded until the top soil almost disappeared. This land may require manure crops, commercial fertilizers and a combination of strip cropping and terracing in order to maintain a good level of production. Sandy soils on are placed in this class. Many shallow soils on drained lands that may be somewhat improved by surface drains or tile are generally included in class iii. Lands in class i-iii can be used for cultivation of crops in rotation if certain minor conservation practices are utilised while class iv land can be used for cultivation of crops over wide intervals but need to be kept in close growing crops such as pasture or hay most often. The author concluded that land not suitable for cultivation in classes v-vii are generally grazed by livestock or used in growing trees; while class viii land may be covered by sparse stands of timber or grass or used for storage of crops and for camping, hunting or fishing. In the opinion of Parson (1961) land is divided into 4 categories and the numerous classes within each compete for different uses. Among the primary uses, cultivation of crops the author said takes first; pasture second while forest retires to the areas poorly suited to either of the two and residential takes the remaining. The author concluded that as the land is continuously used; inherent fertility loses result, necessitating certain soil management practices to resuscitate the nutrient status. West African Examination

Council in its marking scheme (2004) classified land into two based on their uses. These are agricultural and non-agricultural uses of land. Agricultural uses of land include lands for crop and animal production, fishery, wildlife conservation and forestry while non agricultural uses of land are those for mining, construction of buildings, bridges, roads and sport centres. Anthoni (2000) warned that everywhere in the world where people change natural ecosystem into agricultural uses or non agricultural uses, the land degrades; the visible part being eroded especially where the soil particles leave the land. The principle indicated careful management of any piece of land despite its class to ensure its consistent use. This study utilized the knowledge of the land classes in the identification of skills in crop rotation, fertilizer application and erosion prevention and control among others.

Most soils even though virgin need some 'doctoring' to make them productive. That is, all soils including those that have never been under cultivation require maintenance of their fertility to ensure high level of production. Adeleke and Leong (1978) supporting this principle stated that soil additives like manure or fertilizers are required to maintain the fertility of the soil. The authors are of the opinion that when cow-dung, poultry droppings, green manure, farm wastes, compost and other decayed vegetation are applied in suitable quantities, crop yield is increased; chemical fertilizers and liming are also required to improve the nutrient status of the soil and to make soil mineral nutrients easily accessible to plants. The authors concluded that the farming techniques employed to maintain the soil include crop rotation, irrigation, afforestation, cover cropping and fallowing. Sarojini, Sheila and Charles (1984) enumerated ways through which soil fertility can be maintained (doctored) as practicing shifting cultivation, application of manure and chemical fertilizers and the use of well planned system of crop rotation. Olaitan and Lombin (1985) explained that in the soil, there is a well established nutrient cycle which ensures that a balance is maintained between soil nutrients removed and nutrients returned. In this cycle observed the authors, plants extract the nutrient they need for their growth and development from the soil and when plants shed their leaves or die and decompose, the nutrients are returned to the soil. In this way, nutrients are recycled from the soil to the plants and back to the soil so that no nutrient is ever lost; but the author observed that intensive cultivation and cropping upset the nutrient cycle as nutrients used up by the plants are not returned to the soil; therefore nutrient cycle is broken and nutrient depletion takes effect creating the need for doctoring. Uri, Atwood and Sanabria (2004) said that lost nutrients can be replenished (doctored) through shifting cultivation, land rotation, crop rotation, mixed cropping, cover cropping, addition of manure, liming and use of artificial fertilizers. Agricultural and Agri-field Canada (AAFC) Report series (2007) outlined the ways of returning soil lost nutrients to include addition of manure, reduced tillage, rotating crops, growing legumes and trees, restricting the density of animals, rotational grazing, mulching and terracing among others, Crook (2007) affirmed that the practices include mulching heavily with hay, construction of channels to create access for water and planting of cover crops and trees. This principle justifies the adoption of crop rotation, use of organic and inorganic manures, planting of cover crops, liming among others to maintain different soil types for better crop production. This study therefore, utilized the contributions of these authors to identify the skills required in cover cropping, tillage operation, compost, green and farmyard manure preparations.

Organic matter is needed in ever increasing amount in all soils. That is, soil requires addition of manure to make it productive. Brady and Weil (1999) stated that soil organic matter is a complex and varied mixture of organic substances. It provides much of the Cation Exchange and water-holding capacity of soils and certain components of soil organic matter are largely responsible for the formation of plant nutrients and act as slow-release nutrient storehouse, especially for nitrogen. Furthermore, organic matter supplies energy and body-building constituents for most of the micro organisms. According to the authors, in addition to enhancing plant growth through the just mentioned effects (Cation Exchange & water holding capacity), certain organic compounds found in soils have direct growth stimulating effects on plants. In the view of Uri et al (2004), organic matter covers the ground protecting it from erosion, allowing water to seep in while providing required plant nutrients for vigorous crop growth. Carter (2005) said that soils used for growing crops must have plant nutrients and organic matter added in order to maintain the fertility of the soil. The author further stated that, soil that is well cared for will continuously produce good yield but will become exhausted after a few years leading to yield drop if not properly cared for through application of manure. In the opinion of Crook (2007) application of organic matter significantly increases levels of organic carbon and nitrogen, and the formation of water stable aggregates thereby conserving soil for better yield. This principle justifies the use of organic manure as a source of organic matter to soil conservation. This study in view of this principle identified skills required in preparation and application of organic manure to the soil as a means of conserving the soil to last longer for the better yield of crops and its sustenance for the coming generation.

Beating raindrops strike bare soil until flowing mud bleeds the life from the land; and the steeper the slope the greater the speed of flowing water. That is, raindrops detach soil particles from their positions and the intensity of detachment and transportation increases as slopes become steeper. Schwab, Fangmeser, Elliot and Frevert (1993)said that water erosion is accelerated by farming and construction activities, and to reduce the striking effect of raindrops on the soil, the following must be provided; interception of rainfall by the use of absorbent materials thus cushioning the striking effect of raindrops and subsequent surface runoff through restriction of soil movement; it also leads to reduction of erosion by decreasing surface velocity; improvement of aggregation and porosity of the soil by roots and residues; increasing biological activity in the soil and storage capacity of the soil. Uri et al (2004) said that erosion is likely to be more severe on steep slopes where there are rainfalls and the vegetation is scarce. The authors are of the opinion that for any form of land use to be sustainable, production must be combined with planting of trees, as trees cushion the effect of raindrops on soil surface, reduce the amount of rain splash erosion and while the roots bind the soil particles intercepting flow of water running off the surface. Crook (2007) stated that rain splash erosion occurs when raindrops fall on unprotected ground, splashing away soil particles and digs a crater. The author further stated that many agricultural soils are easily eroded and the problem is more severe on certain type of soils, on steep slopes, where there is intense rainfall and where the vegetation is removed. The author advocates conservation of soil water as this makes more water available to crops and increases crop yield. Based on this principle, this study identified skills required in mulching, as a means of reducing the impact of raindrops on the soil surfaces and carrying soil particles down the steep slopes.

Clear water enters a soil about ten times faster than muddy water. This means that infiltration rate is faster when the water is clearer than when the water is dirty. Parson (1961) explained that as raindrops splashes, flowing water carries soil particles and the soil pores become clogged with the muddy fluid hindering infiltration. Continuous pounding actions of the raindrops on the bare surfaces and the sealing off of pore spaces by raindrops make it difficult for muddy water to infiltrate into the soil. The author therefore recommends mulching of the soil surfaces to reduce detachment of soil particles and increase infiltration rate of clean water. Schwab, et al (1993) said that an intense rain exceeds the infiltration capacity by a greater margin than does a gentle rain. According to the authors, an intense rain or storm may decrease the infiltration rate because of its destructive action on the soil structure at the surface. Consequently, the water on the soil surface became muddy reducing further the infiltration rate. Presence of vegetative cover on the soil surfaces concluded the author, has fewer tendencies to destroy soil structure and make infiltration rate of water difficult. That is vegetative cover prevents destruction of soil structure and increases infiltration rate. This principle necessitated identification of skills in mulching and cover-cropping by this study.

Soil requires at least 45cm^3 of water in order to provide adequate moisture for growing crops. This principle indicates the need for water in plant growth and production. Russell (1988) said that the amount of water held by a soil depends on the amount held per unit volume of soil and on the depth of soil from which plants can extract their water. The author indicated that all the water in the root zone held at a suction less than the permanent wilting suction is readily available to crops. This quantity of available water which soil can hold is defined as the water held between the field capacity and the permanent wilting point; and it is equally available to the crop for its growth. The author further said that water as an essential nutrient is needed in much larger quantities by plants than any other nutrient element, as large proportion of other nutrient elements are absorbed by plants and retained, the outstanding characteristics of water is its continuous one way flow from the soil through the roots up the stems into the leaf surface where it is evaporated by diffusing into the air through the stomata by the process of transpiration. This means that water is continuously lost from the soil through the plants by the process of evapo-transpiration and as well through the soil surfaces by evaporation process. Therefore, there is need for continuous supply of water to the soil and the use of other management practices to enhance infiltration capacity of the soil and make water continuously available for plant use. In the view of Franzen (1997), moisture is the single most limiting factor to crop yield. The author further stated that soil holds moisture mostly on the basis of texture although plantsô available water can be modified by soil organic matter content as the soil particle aggregate increases the capacity of the soil to water infiltration. In the opinion of Brady et al (1999), once the rain or irrigation has ceased, filtered water into the largest soil pores drain downwards rapidly in response to the hydraulic gradient. After 1-3 days, the rapid downward movement becomes negligible as a matric-force play a greater role in the movement of the remaining water. In this condition, water has moved out of macro pores and the space being replaced by air; the water available to the plant is supplied from the micro pores. It is necessary therefore, to maintain the soil water at field capacity because at this point the soil is holding the maximum amount of water useful to plants. Franzen (1997) advocates a tillage technique that can conserve moisture and increase infiltration capacity of the soil for better yield in addition to artificial application of water (irrigation) and mulching during drought to replace and reduce moisture loses from the soil. The conservation principle by Allen in Osinem (2005) guided the researcher in selecting skill items in soil conservation practices that were used by this study to determine the improvement needs of teachers.

Need Assessment Theory

Need assessment theory as propounded by Rouda and Kussy (1995) is a systematic exploration of the way things are and the way they should be. In the view of Archer, Cripe and McCaslin (2009), Need Assessment means a process of identifying gaps that exist in something. These gaps according the authors are discrepancies between what should be and what the current condition is. Sometimes, the gap between "what is" and "what should be" establishes the objectives for re-training programs. Rouda and Kuzzy (1995) stated that need assessment is usually associated with organisation and or individualsô performance; that, it is important to invest in an assessment of needs to make sure that there is wise investment in training of individual in an organization. Archer, Cripe and McCaslin (2009) advocated that needs assessment helps to select the strategy a program might use to solve an identified problem. Sometimes needs assessment information is used for designing or modifying an instructional program for example, unsatisfactory academic performance of teachers. Conducting needs assessment helps in generation of new ideas and alternatives for dealing with needs. It also provides an opportunity for job enrichment. Needs assessment can help identify similar personnel, facilities, equipment and funds in other organizations and agencies to help improve those with deficiencies.

Rouda and Kuzzy (1995) identified four steps that are followed when conducting need assessment. These steps are

a) Perform a gap analysis to identify current skills, knowledge and abilities.

b) Identify priorities and importance of possible activities.

c) Identify causes of performance problems and or opportunities.

d) Identify possible solution and growth opportunities.

The first step is to check the actual performance of people against existing standards or to set new standard. Rossett and Sheldon (2001) said that in needs assessment, the first thing to do is to carry out performance analysis (job performance analysis) This according to the author is to determine the need gap; the goal is to discover the present level of performance and the performance that is actually required in addition to finding out the ówhyô that is, what is causing the gap. This shows that job performance needs relates to present situation. The authors stated further that job performance analysis is the most important need as it links the performer with the organisation. The author emphasised that when analysing job performance, there is need to look at the entire spectrum that surrounds the job, processes, environment and actual performance versus required or expected performance. Rouda and Kussy (1995) said that there are two parts to checking the actual against existing standard and they include:

- *Current situation*: determine the current state of skills, knowledge and abilities.
- *Desired or necessary situation*: identify the desired or necessary job tasks / standard as well as the knowledge, skills and abilities needed to accomplish them successfully.

The authors warned that it is important to identify the critical tasks necessary and not just observe the current practice; and after, the actual need is distinguish from perceived needs. The difference (gap) between the current performance and desired performance will help identify the need, purpose and objectives. Rossett and Sheldon (2001) advised that in order to diagnose needs properly, the analyst must check the process level and measure the performance of the job holders. The first step produces a large list of needs required while the second identifies the most important needs in descending order. Rouda and Kussy (1995) explained that the list of needs should be examined in level of their requirement, determine if the identified needs are real and worthy of addressing in terms of cost-effectiveness, legal mandates, executive pressure and population among others. This may be why Rossett and Sheldon (2001) stated that after the assessment, it is necessary to analyse the findings and make plans for any needed performance interventions.

The third step according to Rouda and Kussy (1999) is to identify specific problem areas or opportunities. That is, to find out the performance requirement by asking two major questions

- Are the people concerned doing their jobs effectively?
- Do they know how to do their jobs?

To answer these questions as observed by the authors, it requires detailed investigation and analysis of the people in question, their jobs and the organisation in both current situation and in preparation for the future. Answering these question leads to the fourth step which is identify possible solution and growth opportunities. In the view of the authors, if the people are doing their jobs effectively, there is no need for intervention; but if people are not doing their job effectively training or re-training may be the solution. The authors then advocated the use of a combination of the following techniques of needs assessment to get a true picture of what is required. These techniques are

- Direct observation of the workers.
- Consultation with persons in the key positions and with specific knowledge. (adopted by this study by asking experts to validation the instrument).
- Review of relevant literature. (this study reviewed literature to identify the required skills in instruction and soil conservation practices).
- Use of questionnaire. (This study used structured questionnaire.
- Interviews/psycho-productive test items.
- Use of focus groups discussion.
- Use of records and report studies.
- Work samples.

The authors concluded that the data collected by the use of a combination of the above techniques are utilized for proposing solutions. They then stated that it is important to:

- Use the data to make necessary points: that is there is need to avoid confronting the managers since conclusion will follow from the need assessment activities carried out.
- Provide feedback to everyone who was solicited for information if every one of them is to be proposed for intervention needs.

Phillips and Phillips (2002) referred to intervention needs as training. To determine what type of performance intervention or training that will bridge the performance gap, the authors stated that it is good to determine what the performer needs to know and how to evaluate any learning requirements in order for the performance intervention to be successful. This is because it is one thing to determine the learning needs (knowledge, skills, altitudes and meta-cognitive) but is quite another thing to ensure that those requirements actually take place. Rossett and Sheldon (2001) summarised things required in need assessment thus:

- Look at the system.
- Identify a need.
- Build an evaluation using measurement instrument that identifies the objectives required.
- Select intervention and
- Build content and context that will bridge the gap between the needs and the objectives.

Archer, Cripe and McCaslin (2009) outlined the procedure listed below for planning and designing a needs assessment. This study identified with the procedure making use of questionnaire in number 5. The procedures include:

1) Determine the purpose for conducting the needs assessment. Among these purposes are: generating awareness, satisfying a mandate, aiding in decision-making or promoting action.

2) Define the goals and objectives for the needs assessment.

3) State things necessary to find out about individuals who are being assessed. That is the type of information required, is it demographic, awareness, attitudinal, knowledge, skills or behavioural? With reference to this study it requires knowledge and skills.

4) Who will be the target audience? (in this study they were teachers of Agriculture)

5) Select the approach for collecting the required information and whether the information exists. One common method is to gather data by the use of questionnaire. Valuable information might also be collected by interviews and observation of conditions and situations from a potential source. Other useful techniques include the use of focus groups, public hearings or forums. One or a combination of approaches might be utilized. This study used questionnaire.

6) Design the instrumentation and procedures.

7) "Make the instrumentation design simple." This is because complicated instruments discourage response. Additionally, short instruments are less expensive to produce, distribute, collect and analyze.

8) Prepare a draft of the instrument, check it against the original proposal(s), goals and objectives to make sure non-essential information has not been included.

9) Check if it needs to be reviewed by experts

10) Prepare an estimated time line and budget for the needs assessment.

11) Conduct a pilot test of the instrumentation and procedures (which could be carried out by giving few copies of the questionnaire to a group of respondents). Many mistakes can be identified and eliminated by trying them with a small group.

12) Collect the information limiting the collection time to six weeks as this will help develop a sense of urgency and keep the needs assessment targeted.

13) Analyze the data and information. If there is a large response, try to have access to a computer to conduct the statistical analyses as there are also software packages to analyze qualitative data.

14) Prepare a report of the findings. Make it as user-friendly as possible. It is probably better to divide the report into several brief documents than a too long one. Consider using figures to help communicate important points.

15) Evaluate efforts by taking time after the needs assessment has been completed to judge its merit and worth. What worked well? What problems were encountered?

The authors advised that certain consideration should be given while planning and designing needs assessment. They include the fact that

- People differ on how they prefer to receive information. Prepare multiple reports using a variety of media.
- People rarely read reports cover to cover. Make needs assessment report readable, including an executive summary. Keep a logical sequence in mind, use an outline and language that is easily understandable. Start with the most important information.
- Do not be afraid to list or identify the limitations and alternative explanations. This should increase the credibility of processes.
- Include oral reports as well as written documents. Remember an oral report requires the quick engagement of the audience with key points of interest. They allow for interaction, which could serve to generate new ideas and insights.

- During oral, report only that which is important making sure that the audience knows why the needs assessment was completed, what is now known that was not known before and how the new information will help achieve the objective of needs assessment.

With reference to needs assessment in Agriculture, Joerger (2002) stated that one proven method of identifying agricultural education pre-service and in-service needs assessments utilizes a descriptive survey based on the Borich Needs Assessment Model. The author further stated that most researchers use the Borich Needs Assessment Model to evaluate the ñperceived level of importance or requiredò and ñperceived level of performance or competenceò of teachers regarding their professional competencies. The model has the following steps:

1 Determines the purpose for carrying out the assessment.

2 Find out the group of workers or personnel to be assessed

3. Identify the specific tasks and skills in each task which each worker needs to perform

4. Validate the skill items by using experts in the field.

5. Use the validated items to collect data from the workers by asking each worker to rate each skill items required and the extent he can perform each skill item in each of the tasks.

6. Analyse the data and determine the difference between the required and performance level.

7. Present the report by indicting that the workers need or do not need improvement.

This study identified with needs assessment theory propounded by Rouda and Kussy (1995) making use of all the authorsô steps and the steps identified by Archer cripe and McCaslin and the seven steps in Borich Need Assessment Model to determine the skills required in instruction and soil conservation practices and the level to which each teacher of Agriculture could perform each skill items.

Review of Empirical Studies

Akinseinde (1993) carried out a study on Professional in-service needs of Technical Teachers in secondary schools in Delta and Edo States. Four research questions and six null hypotheses guided the study. The study adopted survey research design that made use of structured questionnaire to collect data from 283 technical teachers from technical colleges and secondary schools in the study area. Mean was used to answer the research questions while t-test, Analysis of variance and Scheffeĝs test were used to test the hypotheses. The study revealed that 35 competencies were required by technical teachers in Delta and Edo States. The study also revealed that teachers needed improvement in planning, delivery and evaluating instruction. The study above relates to this present study as it provided a base that helped to validate the findings of this study on areas teachers of Agricultural Education need improvement in instruction (objective number three).

Jan, Nico and Wobbe, (1997) carried out a study on ôDeveloping Science Teachers' Pedagogical Content Knowledgeö ôThis article discusses the concept of pedagogical content knowledge (PCK) within the context of science teaching. First, an attempt was made to define these concepts within the tradition of research on teachers' craft knowledge and to identify possible purposes of research on PCK. From this point of view, recent research on science teaching was investigated. This investigation identified teaching experience as the major source of PCK, whereas adequate subject-matter knowledge appears to be a prerequisite. This study relates to the present study as it focused on the need for teachersö mastery of the subject matter for effective teaching. So when there is deficiency in the required skills of the subject matter, there is need for improvement which is the focus of this study in objectives numbers 1-4.

Bryan and Namyong (1997) carried out a study focused on the ôassessment of the in-service needs of beginning teachers of agriculture The purpose of the study was to identify and prioritize the in-service needs of beginning teachers of agriculture in the state of Missouri. The target populations for the study consisted of beginning agriculture teachers in Missouri State during the 1994-95 academic year (N=37) and members of the Joint State Staff in Agricultural Education, which included teacher-educators and state supervisor (N=16). Census populations were used. The Borich needs assessment model was used to assess the perceived level of importance and competence of beginning teachers regarding 50 professional competencies. A quadrant analysis utilizing discrepancy scores from beginning teachers and the Joint State Staff for each of the 50 professional competencies was also performed. From the results of the Borich needs assessment model, I2 competencies were identified as having a greater need for in-service education. As a result of the quadrant analysis model, 16 competencies were identified as having a greater need for in-service education. In general, the in-service needs identified using the Borich needs assessment model corresponded with the in-service needs identified by the quadrant analysis model. It was then concluded that when identifying the in-service needs of beginning teachers of agriculture, using either the Borich model or the quadrant analysis model are acceptable approaches that yield similar results. It is recommended that the findings of this study be taken into account as teacher educators in Missouri plan and develop in-service courses for beginning teachers. In-service should focus on enhancing instruction and program development and administration. The specific in-service needs with the highest ranking should be given priority when planning and developing in-service programs for beginning teachers. In addition, this study should be replicated in other states to determine if the in-service needs of beginning teachers are consistent. Historically, in-service programs have been conducted to assist agriculture teachers, especially beginning teachers of Agriculture, in learning the knowledge and skills necessary to perform their teaching roles and many of these in-service programs have been developed based on research that identified the in-service-needs of teachers. The study by Bryan and Namyong relates to the present study as it recommended a study on in-service need of teachers in other states using Borich Assessment Model. The present study therefore utilized the model for the collection of data from the teachers in order to determine the improvement they need in instruction and soil conservation practices (objective number 3 and 4).

A similar study was conducted by Feral (2003) on the topic ôdo science teachers' demographics affect their in-service needs? In this study, science teachers' in-service needs were determined and the relationships between the teachers' demographic variables and their in-service needs were examined. The data for the research was gathered by conducting a survey in Istanbul, Turkey in Fall 2001 and Spring 2002 Semesters. The subjects consisted of the science teachers in grades nine through eleven from 75 high schools, which were selected by using stratified random sampling from a total of 369 high schools in Istanbul. As an instrument, the Turkish translation of the modified version of Science Teacher Inventory of Need (STIN-2) was used. STIN-2 is composed of 16 demographic items related with teachers and schools and 54 need items collected under seven categories. The results showed that science teachers' priority in-service needs were mostly from the Category 4, "delivering science instruction", and from the Category 6, "administering science instructional facilities". It was also found that teachers' demographic variables had significant effects on some of their in-service needs. The authorôs findings helped to validate the findings of this study on the instructional skills where teachers of Agricultural Education need improvement (objective number 3).

Uga (2006) carried out a study on work-skill improvement needs of farmers on rice production in Ebonyi state. The study identified 1) work-skill needed by farmers for success in rice production, 2) improvement needs of rice farmers in nursery establishment 3) improvement needs of rice farmers in field management, 4) improvement needs of rice farmers in harvesting and winnowing, 5) improvement needs of rice farmers in processing and storage and 6) improvement needs of rice farmers in marketing. Six research questions were raised while six null hypotheses were formulated for the study. A structured questionnaire was used to collect data from138 respondents consisting of 91 rice farmers and 57 extension agents. The data were analysed using mean, standard deviation and improvement required index (IRI) to answer the research questions while t-test statistic was used to test the null hypotheses. The major findings of the study revealed that 9 work-skill items were required in nursery establishment, 40 work-skill items in field establishment, 11 out of 19 work-skill items in harvesting, threshing and winnowing, 43 out of 58 work-skills items in processing and storage and 8 out of 9 work-skill items in marketing. The author then recommended that the identified work-skill cluster and their corresponding competency skill items in rice production be packaged into programme by the government and integrated into skill centres for the purpose of training and re-training farmers for the improved rice production. The study by Uga identified skills needed in rice production and the areas where farmers needed improvement for effective rice production. It relates to the present study as the study also identified the skills required in instruction and soil conservation in addition to determining the areas where teachers of Agricultural Education need improvement for effective teaching of students in Colleges of Education in the study areas (objectives 1-4 and hypotheses 1 & 2)

In a study carried out by Onyemachi (2004) on Management skills required by teachers for improvement in operating woodwork laboratory in Technical Colleges in Abia and Enugu States of Nigeria. Five research questions were developed and answered while five null hypotheses were formulated and tested at 0.05 level of significance. A Structured questionnaire items generated from the literature reviewed for the study was used to collect data from 201 respondents made up of 119 experienced and 82 non-experienced woodwork teachers in Technical Colleges in Abia and Enugu States. The structured questionnaire was validated by three experts. Cronbach alpha was used to determine the internal consistency of the items. The data collected were analysed using mean, standard deviation and improvement need index (INI) to answer the research questions and t-test for testing the null hypotheses. The major findings of the study revealed that all the four management skill areas (planning, organizing, co-ordinating and evaluating instruction) were required by woodwork teachers in operating woodwork laboratory. The study further revealed that woodwork teachers required improvement in 9 skills in planning, 12 in organizing, 8 in co- coordinating and 9 in evaluating instruction. The result of the null hypothesis testing showed that there was no significant difference in the mean ratings of the responses of experienced and non-experienced teachers on the skills required by the woodwork teachers in planning, organizing, coordinating and evaluating instruction for operating woodwork laboratory in Technical Colleges in Abia and Enugu States. The study by Onyemach relates to this study with reference to objectives numbers 1 and 3 that is, instructional skills required and areas of the identified skills where teachers of Agricultural Education need improvement for effective planning, implementing and evaluating instruction. However the study by the author focused on the planning, implementing and evaluating instruction in operating woodwork laboratory while the present study focused on skills required and improvement needs of teachers in planning, implementing and evaluating instruction in soil conservation.

Another study was conducted by Lilia, Kamisah, Subahan and Meerah (2006) on what Malaysian science teachers need to improve their science instruction. The research specifically studied the perceived needs of secondary school science teachers in Malaysia for effective in-service programmes. The study adopted a cross-sectional survey to ascertain the perceived needs of 1,690 practicing secondary school science teachers, characterized by gender, school location, and area of specialization. The main instrument used was a questionnaire. The validity and reliability of the instrument were systematically established through relevant test procedures. The questionnaire sought feedback on the eight dimensions of science teachers' needs: (1) generic pedagogical knowledge and skills, (2) knowledge and skills in Science subjects, (3) managing and delivering science instruction, (4) diagnosing and evaluating students (5) planning science instruction, (6) administering science instructional facilities and equipment (7) integration of multimedia technology and (8) the use of

English language in science instruction. Data were descriptively analyzed, by the use of a series of chi square analysis. Results of the descriptive analysis demonstrated that the most prevalent needs of the Malaysian secondary school science teachers are the integration of multimedia and the use of English in science instruction and science teachers needed in-service in pedagogical and technical skills in science for updating their knowledge for effective teaching of science. When measures of association were gauged between the science teachers' needs and the independent variables, it was found that significant associations exist. The associations were apparent between most of the dimensions of science teachers' needs and school location. The authorӳ findings helped to validate the findings of this study on the instructional and soil conservation skills where teachers of Agricultural Education need improvement (objective number 3 and 4).

Miller (2006), carried out a study on professional improvement need of metal work teachers on Colleges of Education in South Western Nigeria. Five research questions were developed and answered while five null hypotheses were formulated and tested at 0.05 level of significance and 28 degrees of freedom. Structured questionnaire generated from the literature reviewed for the study was used to collect data from the respondents. The structured questionnaire was validated by three experts. Cronbach alpha was used to determine the internal consistency of the items. The questionnaire was administered on 35 respondents out of which 30 was retrieved and analyzed using mean, standard deviation and improvement need index (INI) to answer the research questions and t-test statistic to analyse the null hypotheses. The findings of the study revealed that metalwork teachers need improvement in instructional planning = 14 items, instructional implementation = 11 items, evaluation of instruction 7 items while others include sheet metal = 26 items, machine shop practice = 45 items, foundry and forgery = 19 items, welding & fabrication = 8 items. It was therefore found out that out of 130 skill items identified by the study; metalwork teachers need improvement in 128 of them. On the hypotheses, the study revealed that there was no significant difference in the mean ratings of the responses of metalwork teachers on the professional skill areas on which metalwork teachers needed improvement for better performance of teaching job in Colleges of Education in South Western Nigeria. It was therefore recommended that the identified professional skill areas on which metalwork teachers needed improvement with their corresponding items be packaged into re-training programme for the teachers by college administrators, government agencies for the purpose of effective teaching in metalwork in Colleges of Education. The authors study helped to validate the findings of this study on instructional and soil conservation skills required and areas of the identified skills where teachers of Agricultural Education need improvement for effective teaching of students in Colleges of Education in the study areas (objectives 1-4) .

In a study carried out by Nwankwo (2007) on requisite skills in soil conservation required for equipping secondary school graduates for profitable crop production in Abia state, seven research questions were developed and answered while seven null hypothesis were formulated and tested at 0.05 level of significance and 518 degrees of freedom. A structured questioned item generated from the literature reviewed and were used to collect date from 520 respondents made up of 243 teachers and Agriculture and 277 Extension agents. 520 copes of the questionnaire were distributed, retrieved and analysed using mean and standard deviation to answer research question and t-test statistic was used to test the null hypotheses. The findings of the study revealed that secondary school graduates in Abia state required requisite skills in the following areas of soil science. Tillage ï 13 skill items, soil testing and Analysis = 62 item, soil erosion prevention and control= 18 shell item, Manuring = 48items crop rotation = 37 items and afforestation = 17 items. It was also found at there was a significant different in the mean ratings of the responses of teachers and extension agents on the 209 requisite skill items in soil conservation identified by the study for equipping secondary school graduates for profitable crop production. The authors study helped to validate the findings of this study soil conservation skills required and areas of the identified skills where teachers need improvement for effective teaching of students in Colleges of Education in the study areas (objectives 2 and4) .

Azunku (2008) carried out a study on soil conservation skills require by students of Agriculture in Colleges of Education for effective teaching in South-eastern Nigeria. The Seven research questions were developed and answered in consonance with the purpose of the study. Seven null hypotheses were formulated and tested at the probability of 0.05 level of significance. A structured questionnaire was developed from the related literature reviewed for the study. The questionnaire was face validated by five experts. The questionnaire was tested for reliability using Cronbach alpha method and the result showed a coefficient of 0.92. Two hundred and eighty-eight copies of the questionnaire were administered on 288 respondents and were retrieved. The data were analysed using the weighted mean and standard deviation to answer research questions and t ï test statistics to test the null hypothesis. The finding of the study showed those seven soil conservation clusters listed below were required by students of agriculture in the Colleges of Education for effective teaching. They were modules: Aï tillage with 11 skill items, B ï Soil testing and analysis with 40 skill items, C-manuring with 57 skill items, D-soil erosion prevention and control with 39 skill items, E-drainage with 11 skill items, F crop rotation with 32 skill items and G-forestation with 38 skill items. The result of the hypotheses tested revealed that there was no significance difference in the mean ratings of the two groups of respondents on the 228 skill items. It was therefore recommended that the seven clusters with their 228 corresponding skill items identified by the study be packaged and integrated into the curriculum of Agricultural Education by the NCCE. The authors study indicated that soil conservation practices are not in the Agricultural Education Curriculum of Colleges of Education but this study identified soil conservation in different soil component of the curriculum and in addition determined the areas of where teachers need improvement. However, the study helped to validate the findings of this study on soil conservation skills required by teachers for effective teaching of students in Colleges of Education in the study areas (objectives 2) .

Another study was carried out by Mohammed (2007) on Entrepreneurial skills required by secondary school graduates for success in rice production enterprise in Kwara State. Three research questions were developed and answered by the study while three hypotheses were formulated and tested at the probability of 0.05 level of significance. Three sets of questionnaire items developed from the literature review for the study was used to collect data from 250 respondents. Each questionnaire item had a four response option of highly needed=4, averagely needed=3, slightly needed=2 and not needed=1. The questionnaire was face validated by three experts. Reliability of the three sets of questionnaire was determined through split half technique and alpha method which yielded coefficients of 0.92, 0.89 and 0.90. Mean and standard deviation were used to answer the research questions while t-test statistic was used to test the null hypotheses. The findings of the study revealed that seven cluster with 113 skills in rice processing and two cluster with 25 skills in rice marketing were required. The null hypotheses tested revealed that there was no significant difference in the mean ratings of the responses of professional rice growers (rice processors, and rice marketers) and teachers of Agriculture in the entrepreneurial skill cluster with their corresponding skill items required by secondary school graduates for success in rice growing, processing and marketing enterprises. The null hypothesis of no significance difference was accepted for the entire cluster and their corresponding skill items.

The authors recommended that the identified entrepreneurship cluster and their corresponding skill items packaged into a re-training programme and integrated into Stateô skill acquisition centres by Kwara state government for training interested secondary school graduates for employment in rice production enterprise. The authors study helped to validate the findings of this study on soil conservation skills required by teachers for effective teaching of students in Colleges of Education in the study areas (objectives 2) .

In a study carried out by Onderi, and Croll, (2008) on ôin-service training needs of Head teachers and Teacher Perspectives in the Gucha District of Kenya. The paper considered various aspects of in-service education, including views on the effectiveness of in-service, teacher and head teacher priorities in determining in-service needs and the constraints on providing in-service courses. These issues were examined though an empirical study of a population of 139 made up of 30 secondary head teachers and 109 teachers in a district of Kenya. The results showed a strong felt need for in-service provision together with a firm belief in the efficacy of in-service in raising pupil achievement. Head teachers had a stronger belief in the need for in-service for their teachers than did teachers themselves.

Kiumars, Amir and Ali, (2008) carried out a study on what can a Borich Needs Assessment Model tell us about in-service training needs of Faculty in a College of Agriculture in Iran? The purpose of the study was to determine current in-service needs of agricultural faculties at Razi University in Kermanshah province in Iran. A descriptive research methodology design was used to conduct the study. The target population of the study consisted of all agricultural faculties in College of Agriculture at Razi University. Based on the Borich Need Assessment Model, a Delphi techniques was used to develop 19 competencies needed to assess needs of faculty members (N=108). The perceived level of importance and perceived level of competence of the 19 competencies of the faculty members were measured. Overall in-service needs were analyzed and ranked using Mean Weighted Discrepancy Scores (MWDS). The top five competencies in need by agricultural faculties included integrating sustainability issues into agricultural curriculum (7.75); teaching students problem-solving and decision-making skills (7.22); teaching students to think critically and creatively (6.54); understanding learning styles (5.86); managing student behaviour problems (5.23). The result of this study has practical implications for the Human Resource Development (HRD) programs in Razi University. HRD programs should study how the top in-service areas can be addressed in training workshops. Further, needs assessment studies need to be implemented using the Borich model across agricultural colleges in Iran in order to build a baseline of research data when designing training workshop. The study helped in the model adopted in collection of data to help in objectives 3 and 4

A study was carried out by Dibio (2008) on the requisite skills required by teachers of agriculture for improving the teaching of yam production to secondary school students in Enugu state. Six research questions were developed and answered by the study while five null hypotheses were formulated and tested at probability $<$ 0.05 level of significance and 196 degree. Relevant literature was reviewed to guide the study. The study adopted a survey research design that made use of structured questionnaire to obtain information from the respondent. A structured questionnaire of 80 skill cluster items was developed and administered on the respondents to collect data. The population for the study was 597 made up of 298 male 299 female teachers of agriculture. Random sampling technique (balloting) was used to select a sample of 200 made up of 100 male and 100 female teachers of agriculture. Three experts face validated the questionnaire items. The reliability was determined using Cronbach alpha method to obtain a coefficient of 0.78. The questionnaire was administered on 200 respondent and all the copies of the questionnaire were retrieved. The data collected were analysed using weighty mean, standard deviation and Improvement Required Index (IRI) to answer the research questions and t ï test statistic to test the null hypotheses at 0.05 level of significance. The findings of the study revealed that 27 requisite skill items in professional or teaching methods and techniques were required by Teachers of Agriculture for effective teaching of yam production. The result of the hypothesis revealed that there was no significant difference in the mean ratings of the two groups of respondents on 69 out of 80 requisite skill items required by teachers of Agriculture for effective teaching of yam production but there was a significant difference in 11 out of the 80 requisite skill items. The study therefore recommended that the identified skill items be utilized in improving the teachers for better performance of their job. The authors study helped to validate the findings of this study on instructional and soil conservation skills required by teachers of Agricultural Education and the areas of the identified skills where they need improvement for effective teaching of students in Colleges of Education in the study areas (objectives 1-4).

Another study was carried out by Abu (2009) on competency improvement needs of farmers in soil conservation practices in Kogi state. Seven research questions were developed and answered in line with what the study sought to find out. Six null hypotheses were formulated and tested at the probability of 0.05level of significance and 532 degrees of freedom. The study made use of survey research design. Questionnaire was developed from the literature reviewed and used for collecting data for the study. The questionnaire items were face validated by three experts and tested for reliability using Cronbach alpha method with a coefficient of 0.91. The questionnaire was used to collect data from 540 respondents made up of 330 registered crop farmers and 210 Agricultural extension agents. The data collected were analysed using weighted mean, standard deviation and Improvement Need Index (INI). t-test statistic was used to test the null hypotheses. The findings of the study indicated that six cluster and 316 corresponding competencies were needed by farmers for soil conservation practices, It was also found out that farmers needed improvement in the cluster listed below with their corresponding competencies in soil conservation practices. Tillage= 14 skill items, soil testing and analysis =82 items, soil erosion prevention and control= 194 items, Manuring = 57 items, crop rotation = 16 items and afforestation = 53 items. The null hypotheses tested indicated that there was a significant different in the mean ratings of the responses of extension agents crop farmers on the 214 out of 316 needed by farmers for soil conservation practices. It was therefore recommended that the six cluster and their corresponding competency items identified by the study be packaged into training programme for acquisition centres in Kogi state for training and re-training of farmers in soil conservation practices. The authors study helped to validate the findings of this study on instructional and soil conservation skills required by teachers of Agricultural Education and the areas of the identified skills where they need for effective teaching of students in Colleges of Education in the study areas (objectives 1-4).

In a study carried out by Ukonze and olaitan (2009)) on competencies needed by teachers of Agricultural science for effective computer application in Agriculture in secondary schools in Enugu State. Three research questions were developed and answered while two null hypotheses were formulated and tested at 0.05 level of significance and 105 degrees of freedom. Structured questionnaire items generated from the literature reviewed for the study was used to collect data from a sample of 107 respondents which comprised of 54 final year students of computer education, 18 computer experts and 35 teachers of agricultural science. The structured questionnaire items were face validated by three Lecturers from Computer Education unit of University of Nigeria, Nsukka. Cronbach alpha reliability method was used to determine the internal consistency of the items and a coefficient of 0.85 was obtained. Mean was used to answer research questions while t-test statistic was used to test the null hypothesis. The findings of the study revealed that 26 keyboarding and 70 internet competencies were required by teachers of Agricultural science for effective computer application into agriculture. The hypothesis tested revealed that there was no significant difference in the mean ratings of the responses of respondents (teachers of Agriculture and final year computer students on the competencies required by teachers of Agricultural science for internet usage. It was therefore recommended that the competencies identified by the study be made available for equipping teacher of Agricultural science with the required competencies to enable them apply these competencies in Agriculture. The author's study helped to validate the findings of this study on instructional and soil conservation skills required by teachers for effective teaching of students in Colleges of Education in the study areas (objectives 1 and 2).

A study was carried out by Olaitan, Eze and Ogbonnaya (2009) on Entrepreneurial competencies required by secondary school graduates for entry into oil palm processing enterprise in South-eastern states of Nigeria made up of Abia, Anambra, Ebony, Enugu and Imo States. Three research questions were developed and answered by the study while three null hypotheses were formulated and tested at the probability of 0.05 level of significance. Survey and function of industry designs were adopted by the study. The sample for the study was 459 teachers of Agricultural science in senior secondary schools and 182 registered oil palm processors. A 45 competency structured questionnaire items developed from the literature review for the study was used to collect data from the respondents. Each questionnaire item had a four response option of highly needed=4, averagely needed=3, slightly needed=2 and not needed=1. The questionnaire was face validated by three experts. Reliability of the questionnaire was determined through split half techniques and alpha method which yielded a coefficient of 0.84. 459 copies were distributed all were retrieved and analysed using mean and standard deviation while t-test statistic was used to test the null hypotheses. The result of the study revealed that 11competencies were required in planning, 16 in processing and 18 in marketing palm oil. The authors recommended that the identified competencies be packaged into a re-training programme for empowering interested secondary school graduates for employment in oil palm processing enterprise. The authorsô study helped to validate the findings of this study on instructional and soil conservation skills required by teachers for effective teaching of students in Colleges of Education in the study areas (objectives 1 and 2).

A study was carried out by Ifeanyieze and Olaitan (2009) on the requisite skills required for capacity building of teachers of agriculture for effective teaching of yam production in Colleges of Education in South-eastern Nigeria. The study adopted research design that made use of structured questionnaire to collect data from the respondents. The population for the study was eighty-nine teachers of agriculture from eight Colleges of Education in South-eastern Nigeria. An eighty (80) item structured questionnaire was developed for the study. Three experts face validated the questionnaire items. Cronbach alpha method was adopted for determining the internal consistency of the items and a coefficient of 0.79 was obtained. Eighty-nine copies of the questionnaire were administered on the respondents through five research assistants. All the eighty-nine copies of the questionnaire were retrieved and analysed. Weighted mean and Improvement Required Index (IRI) were used in analysing the data. The study found out that the teachers of agriculture were deficient in certain skills; 9 skills in each of pre-planting and planting operations; 16 skills in post planting operations 13 in processing and storage and 18 in delivering in instruction. It was therefore recommended that the identified requisite skills be packaged and utilized for capacity building of teachers of agriculture in the areas identified. The authorsô study helped to validate the findings of this study on instructional and soil conservation skills required by teachers and areas of the identified skills where they need improvement for effective teaching of students in Colleges of Education in the study areas as it adopted the methodoly of this study to help provide answers to objectives 1 - 4.

Summary of the Related Literature Reviewed

The related literature reviewed by this study was in the following areas: the conceptual framework of the study in form of a schemer covered such concepts as colleges of education, agricultural education programme, skill, teachers and others. This guided the researcher to obtain different frameworks for the study. Literature reviewed on approaches to the identification of skills helped to direct the researcher in identifying different tasks in instruction and soil conservation practices and so facilitated the arrangement of the items in clusters for simpler and easier discussion and understanding. The theoretical framework of the study which centred on the theory of teaching, principles of soil conservation and need assessment theory provided a guide for the researcher on the direction of the study. The literature reviewed on empirical study guided the researcher in selecting the design adopted by the study and also provided information that was utilized in the discussion of the findings. The literature reviewed on the instructional and technical skills helped the researcher to develop questionnaire items for collecting data in order to identify the skills required in instruction and soil conservation practices. These items further helped the researcher to obtain information on skills possessed by teachers of agricultural education programme. The difference between the required skills and the skills possessed by these teachers provided the gap. This gap refers to the shortfall existing in the performance of teachers while teaching soil conservation component of the Agricultural Education Curriculum which this study intended to bridge. This study therefore provided the areas of deficiencies of the teachers in teaching soil conservation practices to their students.

CHAPTER III

METHODOLOGY

This chapter described and presented the procedures used in carrying out the study. The procedure was as follows: design of the study, area of the study, population for the study, instrument for data collection, validation of the instrument, reliability of the instrument, method of data collection and method of data analysis.

Design of the Study

The study adopted descriptive survey research design, using Borich need assessment model. Survey design according to Ali (2006), means a descriptive study that makes use of a population or sample to document, describe and explain what is in existence on the present status of a phenomena being investigated. The author further stated that in survey studies, views and facts about things or individuals are collected through questionnaire, observation or interview which are analysed and used for answering research questions. Descriptive survey design was used by this study to collect data from the respondents (Lecturers and teachers of Agricultural Education) on the skills required in instruction and soil conservation practices. The rational for adopting descriptive survey was that the Lecturers and teachers of Agricultural Education programme were located at different educational institutions situated in five states of South-eastern Nigeria. It was therefore appropriate to use questionnaire to elicit information from these respondents in their different institutions on the professional and technical skills required for effective teaching of soil conservation.

Borich Need Assessment Model was utilized only in collecting data from teachers of Agricultural Education in Collage of Education. Borich Need Assessment Model according to Byran and Namyoung (1997) is the act of conducting educational needs by utilising self-evaluative procedure that relies on teachersô judgement about their own performance. The authors further stated that the assumption underlining the use of the model is that the performer (teacher) can best judge his own performance when explicitly told to do so, and can make an objective judgement. Teachers were asked to rate their own performance in teaching and soil conservation practices in line with Borich Need Assessment Model.

Area of the Study

The study was carried out in South-eastern states of Nigeria, made up of: Abia, Anambra, Ebonyi, Enugu and Imo states. Many people in the study area engage in agricultural production (farmers) that involves interaction with the soil. The area also lies between the zones of tropical to deciduous forest with moderate to heavy rainfall.

Agricultural activities of farmers, urban expansion, heavy rainfall and sandy-loam soil make the soil in the area to be susceptible to land degradation and consequently subjecting the environment to marginal soils which necessitates constant soil conservation practices. There are many Universities and Colleges of Education in this area where teachers of Agriculture teach soil conservation. These Universities include Abia State University, Ebonyi State University, Enugu State University of Science and Technology, Evan Enwerem University, Imo State, University of Agriculture Umudike and University of Nigeria, Nsukka; Colleges of Education include; College of Education, Arochukwu, College of Education Nsugbe, College of Education (Technical), Umunze, College of Education Ikwo, Enugu State College of Education (Technical), Enugu, Federal College of Education, Eha-Amufu and Alvan Ikoku Federal College of Education, Imo state.

Population for the Study

The population for this study was 109, made up of 20 lecturers of agricultural Education in the Universities and 89 teachers of agricultural Education in Colleges of Education from South-eastern Nigeria. (See Appendix A pg 280). Lecturers of Agricultural Education in Universities have been trained in instruction and soil conservation practices. They also teach soil conservation practices to student demonstrating possessed instructional skills. These Lecturers were therefore considered competent to supply dependable responses on instructional and soil conservation skills required for effective teaching of students. Furthermore, lecturers of Agricultural Education in Colleges of Education (who are teachers in this study) were trained in the Universities to teach Agricultural Education. Due to their experience they were judged competent in responding to questionnaire items on the instructional and soil conservation skills required for teaching students and in which of these skill areas they need improvement. The population of Lecturers and teachers was small and all were used for the study. Therefore, there was no sampling.

Instrument for Data Collection

The instrument for data collection was structured questionnaire. The structured questionnaire items in the instrument were developed from the related literature reviewed for the study. The questionnaire comprised of parts, 1 and 2. Part 1 was used to collect information on the personal data of the respondents relating to name of school, qualification among others; while part 2 consisted of two sections A and B.

Section A.; **Instructional Skills Questionnaire.** This was made up of three cluster skill items in instruction specifically covering planning (13 items), implementing (14 items), and evaluating instruction (12 items).

Section B. **Technical Skills Questionnaire**- This was made up of six cluster skill items in soil conservation from the following components; tillage practices (20 items), soil testing and analysis (59 items), manure preparation and application (62 items), crop rotation (13 items), soil erosion prevention and control (43 items) and irrigation (6 items).

Each questionnaire item had two categories of required and performance. The required category had 4 point response options of

Response Option			**Real limit**
Highly Required	(HR)	=	3.50 - 4.00
Averagely Required	(AR)	=	2.50 - 3.49
Slightly Required	(SR)	=	1.50 - 2.49
Not Required	(NR)	=	0. 00 - 1.49

The Performance category also had 4 point response options of:

Response Option			**Real limit**
High Performance	(HP)	=	3.50 - 4.00
Average Performance	(AP)	=	2.50 - 3.49
Low Performance	(LP)	=	1.50 - 2.49
No Performance	(NP)	=	0. 00 - 1.49

Validation of the Instrument

The instrument was subjected to face validation by five experts (Lecturers) from University of Nigeria, Nsukka who are highly knowledgeable in teaching of soil conservation practices. Three lecturers in the Agricultural Education unit of Vocational Teacher Education Department of the University validated the entire items in the questionnaire while two lecturers from the Department of Soil Science, Faculty of Agriculture in the same University were restricted to the technical skills sections of the instrument. The reason for the restriction was based on the fact that the soil science lecturers were not trained in the act of teaching agriculture in schools, that is, the lecturers did not pass through professional training in Agricultural Education and so would find it difficult in validating skill items in instructional area. Each of the validates was directed to the area to be validated and was requested to help correct any ambiguous or unclear statement, wrong information with reference to any item and delete or make suggestion of any missing skill that was required. The corrections and suggestions of the validates were used to improve the instrument for the collection of data. The request for the validation of the instrument is in Appendix B

Reliability of the Instrument

To determine the internal consistency of the instrument, 10 copies of the questionnaire were administered to teachers of Agricultural Education at the Institute of Ecumenical Studies, Enugu, a College of Education which was not part of the population. After collecting the distributed 10 copies of the questionnaire, Cronbach alpha method was utilised in determining the internal consistency of the skill items and coefficients 0.83 and 0.97 were obtained for instructional and technical areas of the questionnaire respectively. Detailed analysis using computer software of SPSS version 6.0 is shown in Appendix C pg 282

Method of Data Collection

One hundred and nine (109) copies of the questionnaire were administered on the respondents in South-eastern Nigeria with the help of five research assistants. These research assistants were selected based on their familiarity with the study area. They were instructed by the researcher prior to the assignment on how to distribute and collect the copies of the questionnaire. They were further directed to request the Lecturers of Agricultural Education in the Universities to check (ã) the required response category option only while the Teachers of Agricultural Education in Colleges of Education were to check (ã) both the required and performance category options of the questionnaire. Thus, the Teachers of Agricultural Education in Colleges of Education were to checked (ã) the skill items that were required in the two sections of instructional and technical areas and also to check (ã) how they could perform each skill item in each case.

The research assistants were given three weeks to distribute and collect the copies of the questionnaire while the researcher went round during the fourth week to collect the retrieved copies of the instrument from the research assistants at the agreed points. Out of 109 copies of the questionnaire distributed, 102 copies were retrieved and analysed giving a return rate of 93.6 percent.

Method of Data Analysis

The data collected were analysed using weighted mean, standard deviation and Improvement Need Index (INI) to answer the research questions, while t-test statistic was used to test the null hypotheses at 0.05 level of significance and 100 degrees of freedom. Weighted mean was utilised in answering research questions one (1) and two (2) while standard deviation was used to determine the closeness or otherwise of the opinion of respondents from the mean and from one another. Each of the items in research questions 1 and 2 had 4 point response option of

Response Option				***Real limit***
1)	Highly Required	(HR)	=	3.50 - 4.00
2)	Averagely Required	(AR)	=	1.50 - 3.49
3)	Slightly Required	(SR)	=	1.50 - 2.49
4)	Not Required	(NR)	=	0. 00 - 1.49

Any item with a mean value within the real limit as indicated in 1^{st}, 2^{nd} and 3rd response options above was interpreted accordingly (highly, averagely or slightly required), while any item with a mean value within the real limit of 0.00 - 1 .49 was regarded as not required

Any item with a standard deviation of 1.96 and below showed that the respondents were not too far from the mean and from one another in their responses; while any item with a standard deviation above 1.96 showed that the respondents were too far from the mean and from one another in their responses. Ali (2006) stated that if the standard deviation is low that is, within 1.96 in a two tailed test, it means that the respondents are the true representative of the population; therefore their opinions will be close to the mean and to one another

Improvement Need Index (INI) was used to answer research questions 3 and 4. The Index has a scale of 4, 3, 2 and 1 (Olaitan and Ndomi, 2001). The performance gap value (PG) obtained was compared with the index to indicate whether improvement was needed or not. That is: In taking decision on the improvement needed by teachers of

Agriculture in research questions 3 and 4. The gap was determined and the result compared with the index to know whether there is need for improvement or not. To determine the gap, the following activities were carried out.

i. The weighted mean of each item under the required category was calculated $\overline{X}_R$)

ii) The weighted mean of each item under the performance category was also calculated ($\overline{X}_P$). To obtain the weighted mean under this, each of the items under performance category was assigned 4 point response options of:

Response Option			**Real limit**
High Performance	(HP)	=	3.50 - 4.00
Average Performance	(AP)	=	1.50 - 3.49
Low Performance	(SP)	=	1.50 - 2.49
No Performance	(NP)	=	0. 00 - 1.49

iii) The difference between the mean of required and mean of performance was determined. ($\overline{X}_R$ -$\overline{X}_P$) and this gave the performance gap value (PG) that indicated whether improvement was needed or not and stated as follows

1. Where the difference was Zero (($\overline{X}_R$ï $\overline{X}_P$ = 0), it indicated that teachers did not need improvement on the item because the level at which the item was required was equal to the level to which teachers could perform the item.

However, for INI to be equal to zero, any of these conditions must occur.

Highly required = High performance

Averagely required = Average performance

Slightly required = Low performance

Not required = No performance

2. Where the difference was positive ($\overline{X}_R$ ï $\overline{X}_P$ = +), it indicated that teachers need improvement on the item because the level at which the item was required was greater than the level at which teachers could perform the item.
3. Where the difference was negative ($\overline{X}_R$ ï $\overline{X}_P$ = ---), it indicated that teachers did not need improvement on the item because the level at which teachers could perform the item was greater than the level at which the item was required. That is, teachers could perform the skill to the level at which it was required and even above.

The researcherõs expectation in performance was that every teacher should perform to optimum which is 4 in the index. Therefore the performance mean value was subtracted from the required mean value and the difference compared with the index (4,3,2,1) in order to determine the level of improvement needed by teachers in each item.

t ï test statistic was used to test the two null hypotheses (1 and 2) at 0.05 level of significance and 100 degrees of freedom. The null hypothesis of no significant difference was accepted for any item whose t-calculated value was equal to or less than the t-table value and rejected for any item whose t-calculated value was greater than the t-table value of 1.98.

CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA

The data collected for the study were analysed and presented in this chapter. The analysis and presentation were organized based on research questions and hypotheses of the study.

Research Question 1

What are the instructional skills required by teachers of Agricultural Education for effective teaching of soil conservation in Colleges of Education in South-eastern Nigeria?

The data for answering research question one were presented in Table 1.

Table 1

Mean Ratings of Lecturers and Teachers on Instructional Skills Required for Effective Teaching of Soil Conservation in Colleges of Education South-eastern Nigeria.

N= 102

Cluster	cluster Statement	$\bar{X}$	SD	Remarks
A	Planning for Instruction (13 skill items)	3.45	0.77	A R

B	Implementing Instruction (14 skill items	3.38	0.94	,,
C	Evaluating Instruction (12 skill items)	3.27	0.89	,,

Data in Table 1 revealed that the three clusters (A, B and C) had mean $(\bar{x})$ values of 3.45, 3.38 and 3.27. The mean value of each cluster was within the real limit of 2.50 ï 3.49, indicating that all the three clusters were averagely required by teachers of Agricultural Education for effective teaching of soil conser 176 ges of Education in South-eastern Nigeria. The standard deviations (SD) of the three clusters were 0.77, 0.89 and 0.94. These values were less than 1.96, indicating that the respondents were not too far from the mean or from one another in their responses on the instructional skill required by teachers of Agricultural Education for effective teaching of soil conservation in Colleges of Education in South-eastern Nigeria.

The three clusters had 39 corresponding skill items (planning 13, implementing 14 and evaluating 12). Ten out of the 39 skill items had their mean values ranged from 3.51 ï 3.67 which were within the real limit of 3.50 ï 4.00 (see pg 172), indicating that the 10 skill items were highly required by teachers of Agriculture for effective teaching in the colleges. The table in appendix E pg 284 revealed that the remaining 29 skill items had mean values that ranged from 2.88 to 3.48. The mean value of each of the 29 skill items was within the real limit of 2.50 ï 3.49, indicating that all the 29 instructional skill items were averagely required by teachers of Agricultural Education for effective teaching of soil conservation in Colleges of Education. The standard deviations of the 39 corresponding instructional skill items ranged from 0.61 to 1.02, indicating that the respondents were not too far from the mean or from one another in their responses. (See Appendix E pg 284-286). The t-test analysis was further carried out to compare the mean responses of lecturers and teachers on the instructional skills required for effective teaching of students in the colleges. The summary of the analysis was presented thus.

Hypothesis 1

There is no significant difference in the mean ratings of the responses of Lecturers and Teachers of Agricultural Education on the instructional skills required for effective teaching of soil conservation in Colleges of Education in South-eastern Nigeria.

The data for testing hypothesis one were presented in Table 2.

Table 2

t-test Analysis of the Mean Ratings of Lectures and Teachers on the Instructional Skills Required for Effective Teaching of Soil Conservation in Colleges of Education in South-eastern Nigeria.

N=102
(17 Lecturers & 85 Teachers)

Cluster	Cluster statement	t-calculated	t-table	Remarks
A	Planning instruction (13 skill items)	1.32	1.98	Not significant
B	Implementing instruction (14 skill items)	1.00	1.98	,,
C	Evaluating instruction (12 skill items)	0.58	1.98	,,

Data in Table 2 revealed that the t-calculated values of the three clusters were 1.32, 1.00 and 0.58. These values were less than their t-table values of 1.98 at 0.05 level of significance and 100 degrees of freedom; indicating that there was no significant difference in the mean ratings of the responses of lecturers and teachers on instructional skills required by teachers for effective teaching of soil conservation in colleges of Education in South-eastern Nigeria. Therefore the null hypothesis of no significant difference was accepted for all the three clusters..

The three clusters had 39 corresponding skill items; 35 out of the 39 items had their t-calculated values ranges from 0.05 to 1.85. These values were less than their t-table value of 1.98 and 100 degrees of freedom; indicating that there was no significant difference in the mean ratings of the responses of teachers and lecturers on the 35 items in instructional skills required for effective teaching of soil conservation in colleges of Education in South-eastern Nigeria. The remaining four items had their t-calculated values ranged from 2.08 to 2.45 which were above their t-table value of 1.98; indicating that there was significant difference in the mean ratings of the responses of lecturers and teachers on the 4 items in instructional skills required by teachers for effective teaching of soil conservation in colleges of Education in South-eastern Nigeria. The null hypothesis of no significant difference was upheld for the 35 items but rejected for the 4 items in instruction. Specifically, the analysis of the data for each of the three clusters in instruction was as follows:

Cluster A-planning instruction had 13 corresponding skill items out of which nine (9) had their t-calculated values ranged from 0.25 to 1.85

which were less than their t- table value of 1.98 (see Appendix F pg 287); indicating that there was no significant difference in the mean ratings of the responses of teachers and lecturers in 9 skill items required by teachers for effective teaching of soil conservation in colleges of Education in South-eastern Nigeria. The remaining 4 skill items (no 1, 3, 8, and 9) had t-calculated values of 2.20, 2.42, 2.08 and 2.29 which were greater than their t-table value of 1.98; indicating that there was significant difference in the mean ratings of the responses of lecturers and teachers on the 4 items. The null hypothesis of no significant difference was accepted for the 9 items but rejected for the 4 items in planning instruction. The implication of this is that the professional differences and experience of the respondent did not significantly influence their opinions on 9 items but on 4 skill items required in planning instruction for effective teaching in Colleges of Education.

Cluster B- implementing instruction had 14 corresponding skill items. All the 14 items had their t-calculated values ranged from 0.21 to 1.46 (see Appendix F pg 288-289). These values were less than their t-table values of 1.98; indicating that there was no significant difference in the mean ratings of the responses of teachers and lecturers in all the 14 items. The null hypothesis of no significant difference was accepted for all the 14 items. This implied that the professional differences and experiences of the respondent did not significantly influence their opinions on all the 14 skill items required in implementing instruction for effective teaching in Colleges of Education

Cluster C. evaluating instruction had 12 corresponding skill items; all of which had their t-calculated values ranged from 0.00 to 1.74 which were less than their t-table value of 1.98, indicating that there was no significant difference in the mean ratings of the responses of lecturers and teachers on all the 12 items. The null hypothesis of no significant difference was accepted for the entire 12 skill items. This showed that the professional differences and experiences of the respondents did not significantly influence their opinions on all the 12 skill items required in evaluating instruction for effective teaching in Colleges of Education

Research Question 2

What are the soil conservation skills required by teachers of Agricultural Education for effective teaching of students in Colleges of Education in South-eastern Nigeria?

The data for answering research question two were presented in Table 3.

Table 3

Mean Ratings of the Responses of Lecturers and Teachers on Soil Conservation Skills Required for Effective Teaching of Students in Colleges of Education in South-eastern Nigeria?

N= 102

Cluster	**Cluster Statement**	$\bar{X}$	**SD**	**Remarks**
A	Tillage operation (20 skill items)	3.21	0.9	AR
B	Soil testing and Analysis (59 skill items)	3.51	0.74	HR
C	Manure Preparation & Application (62 skill items)	3.15	0.68	AR

D	Crop rotation (13 skill items)	3.30	0.73	,,
E	Crop erosion prevention and control (43 skill items)	3.37	0.82	,,
F	Irrigation (6 skill items)	3.18	0.90	,,

Data in Table 3 revealed that the mean $(\bar{x})$ value of one out of the six (6) clusters (A - F) was 3.51. The mean value was within the real limit of 3.50-4.00, indicating that the cluster was highly required by teachers of Agriculture for effective teaching of soil conservation. The remaining five clusters had mean values that ranged from 3.15 ï 3.37 which were within the real limit of 2.50 ï 3.49; indicating that the five clusters were averagely required by teachers of Agricultural Education for effective teaching of soil conservation in Colleges of Education in South-eastern Nigeria. The standard deviations (SD) of the 6 clusters ranged from 0.68 to 0.91. These values were less than 1.96, indicating that the respondents were not too far from the mean or from one another in their responses.

The six clusters had 203 corresponding skill items (see Appendix G pg 291-204). The mean values of 91 out of the 203 corresponding skill items ranged from 3.50-3.79 which were within the real limit of 3.50 - 4.00 (see page 172), indicating that the 91 skill items were highly required by teachers of Agriculture for effective teaching of soil conservation. The remaining 112 skill items had mean values that ranged from 2.80 - 3.49, which were within the real limit of 2.50-3.49 (see page 172), indicating that the 112 skill items were averagely required by teachers of Agricultural Education for effective teaching of students in Colleges of Education. The standard deviations of the 203 corresponding skill items in soil conservation ranged from 0.53 to 1.24 (see Appendix G pg 291-304). These values were below 1.96, indicating that the respondents were not too far from the mean or from one another in their responses on soil conservation skills required by teachers of Agriculture for effective teaching of students in the colleges of Education. The t-test analysis was further carried out to compare the mean responses of lecturers and teachers on the soil conservation skills required for effective teaching of students in the colleges. The summary of the analysis was presented thus.

Hypothesis 2

There is no significant difference in the mean ratings of the responses of Lecturers and Teachers on the soil conservation skills required by for effective teaching of students in Colleges of Education in South-eastern Nigeria.

The data for testing hypothesis two were presented in Table 4

Table 4

t-test Analysis of Mean Ratings of Lecturers and Teachers on the soil conservation Skills Required for Effective Teaching of Students in Colleges of Education South-eastern Nigeria.

N=102
(17 Lecturers & 85 Teachers)

Cluster	Clusters of Soil Conservation skills	t-calculated	t-table	Remarks
A	Tillage operation (20 skill items)	1.25	1.98	Not significant
B	Soil testing and analysis (59 skill items)	1.23	,,	,,

C	Manure preparation and application (48 skill items)	0.55	,,	,,
D	Crop rotation (13 skill items)	1.03	,,	,,
E	Soil erosion prevention and control (43 skill items)	1.10	,,	,,
F	Irrigation (6 skill items)	1.12	,,	,,

Data in Table 4 revealed that the t-calculated values of the six clusters ranged from 0.55 to 1.31. These values were less than their t-table value of 1.98 at 0.05 level of significance and 100 degrees of freedom; indicating that there was no significant difference in the mean ratings of the responses of teachers and lecturers in all the 6 skill clusters. Therefore the null hypothesis of no significant difference was accepted for all the six clusters.

The six clusters had 203 corresponding skill items. 176 out of the 203 items had their t-calculated values ranges from 0.00 to 1.98. These values were within their t-table value of 1.98 and 100 degree of freedom; indicating that there was no significant difference in the mean ratings of the responses of teachers and lecturers in the 176 items. The remaining 27 items had their t-calculated values ranged from 2.06 to 4.18 which were above their t-table value of 1.98, indicating that there was significant difference in the mean ratings of the responses of teachers and lecturers on the 27 items. The null hypothesis of no significant difference were upheld for the 176 items but rejected for the 27 items in soil conservation. Specifically, the analysis of the data for each of the six clusters in soil conservation was as follows:

Cluster A-Tillage had 20 skill items out of which 16 had their t-calculated values ranged from 0.12 to 1.83. These values were less than their t-table value of 1.98 (see Appendix H pg 304-320), indicating that there was no significant difference in the mean ratings of the responses of teachers and lecturers in the 16 items. The remaining four (4) items (number 5, 6, 7, and 12 had t-calculated values of 2.45, 2.23, 2.35 and 2.09 respectively. These values were greater than the t-table value of 1.98; indicating that there was significant difference in the mean ratings of the responses of teachers and lecturers on the 4 items. The null hypothesis of no significant difference was accepted for the 16 items but rejected for the four (4) items in tillage operations. The implication of this is that the professional differences and experiences of the respondent did not significantly influence their opinions on 16 items but on 4 items on skills in tillage operation required for effective teaching of soil conservation in Colleges of Education

Cluster B- soil testing and analysis had 59 corresponding skill items out of which, 49 had their t-calculated values ranged from 0.04 to 1.92 (see Appendix H pg 305-310). These values were less than their t-table values of 1.98, indicating that there was no significant difference in the mean ratings of the responses of teachers and lecturers on the 49 items. The remaining ten (10) items had their t-calculated values ranged from 2.06 to 4.18 (numbers 29, 30, 58, 64, 67, 71, 73, 75, 77 and 78). These values were greater than their t-table value of 1.98, indicating that there was significant difference in the mean ratings of the responses of teachers and lecturers on the 10 items. The null hypothesis of no significant difference was accepted for the 49 items but rejected for the ten (10) items. The implication of this is that the professional differences and experiences of the respondent did not significantly influence their opinions on 49 items but on 10 items on skills in soil testing and analysis required for effective teaching of soil conservation in Colleges of Education.

Cluster C- manure preparation and application had 62 skill items out of which, 54 had their t-calculated values ranged from 0.00 to 1.98 (see Appendix H pg 310-315). These values were less than their t-table value of 1.98, indicating that there was no significant difference in the mean ratings of the responses of lecturers and teachers on the 54 items. The remaining eight (8) items had their t-calculated values ranged from 2.32 to 3.35 (numbers 80, 81, 82, 85, 87, 95, 116, and 119). These values were greater than their t-table value of 1.98, indicating that there was significant difference in the mean ratings of the responses of lecturers and teachers on the 8 items. The null hypothesis of no significant difference was upheld for the 54 items but ejected for the eight (8) items. The implication of this is that the professional differences and experiences of the respondent did not significantly influence their opinions on 54 items but on 8 items on skills in manure preparation and application required for effective teaching of soil conservation in Colleges of Education

Cluster D-crop rotation had 13 corresponding skill items out of which, 12 had their t-calculated values ranged from 0.06 to 1.91 (see Appendix H pg 315-316). These values were less than their t-table values of 1.98, indicating that there was no significant difference in the mean ratings of the responses of teachers and lecturers in the 12 items. The remaining one (1) skill item had its t-calculated value as 2.19 (number 145). The value was greater than its t-table value of 1.98, indicating that there was significant difference in the mean ratings of the responses of teachers and lecturers in the item. The null hypothesis of no significant difference was accepted for the 12 items but rejected for the one item. The implication of this is that the professional differences and experiences of the respondent did not significantly influence their opinions on 12 items but on one of the skills in crop rotation required for effective teaching of soil conservation in Colleges of Education

Cluster E- soil erosion prevention and control had 43 corresponding skill items out of which, 39 had their t-calculated values ranged from 0.04 to 1.90 (see Appendix H pg 316-319). These values were less than their t-table value of 1.98, indicating that there was no significant difference in the mean ratings of the responses of teachers and lecturers in the 39 items. The remaining four (4) skill items had their t-calculated values ranged from 2.08 to 2.81 (numbers 162, 170, 173, and 180). These values were greater than their t-table values of 1.98, indicating that there was significant difference in the mean ratings of the responses of teachers and lecturers in the 4 items. The null hypothesis of no significant difference was accepted for the 39 items but rejected for the four (4) items. The implication of this is that the professional differences and experiences of the respondent did not significantly influence their opinions on 39 items but on 4 items on skills in soil erosion prevention and control required for effective teaching of soil conservation in Colleges of Education.

Cluster F-irrigation had six (6) skill items all of which had their t-calculated values ranged from 0.04 to 1.95 (see Appendix H pg 320). These values were less than their t-table value of 1.98, indicating that there was no significant difference in the mean ratings of the responses of teachers and lecturers in all the 6 items. The null hypothesis of no significant difference was upheld for all the six (6) skill items in irrigation. The implication of this is that the professional differences and experiences of the respondent did not significantly influence their opinions on all the 6 items in irrigation required for effective teaching of soil conservation in Colleges of Education

Research Question 3

What are the instructional skills where teachers of Agricultural Education need improvement for effective teaching in Colleges of Education in South Eastern Nigeria?

The data for answering research question three were presented in Table 5.

Table 5

Performance Gap Analysis of Mean Ratings of Teachers of Agriculture on Instructional skills required for effective Teaching in Colleges of Education in South-eastern Nigeria.

N = 85

Cluster	Cluster Statement	$\bar{X}_R$	$\bar{X}_p$	PG	Remarks

				$(\bar{x}_{R}-\bar{x}_{P})$	
A	Planning instruction	3.37	1.89	1.48	Improvement needed
B	Implementing instruction	3.34	1.97	1.37	Improvement needed
C	Evaluating instruction	3.17	1.89	1.28	Improvement needed

The data presented in Table 5 revealed that the three clusters (A, B, C) had performance gap values of 1.58, 1.37 and 1.28 and were positive. The values indicated that teachers of Agricultural Education need improvement in planning, implementing and evaluating instruction for effective teaching of soil conservation in Colleges of Education.

The three clusters had 39 corresponding skill items, 38 out of the 39 items in instruction had their performance gap values ranged from 0.58 to 1.63 and were positive, indicating that teachers of Agriculture need improvement in the 38 skill items in instruction. One of the items no 27 had a performance gap value of 0.00, indicating that teachers of Agriculture did not need improvement in the item because the level at which the item was required was equal to the level at which the teachers could perform the item. Specifically, the analysis of the data for each cluster was presented as follows:

Cluster A-planning instruction had 13 corresponding skill items all of which had their performance gap values ranged from 1.25 to 1.73 and were positive (see Appendix I pg 321). These values indicated that teachers of Agricultural Education need improvement in all the 13 skills items in planning instruction for effective teaching of soil conservation in Colleges of Education.

Cluster B - implementing instruction had fourteen (14) skill items out of which thirteen (13) had their performance gap values ranged from 1.17 to1.63 and were positive (see Appendix i pg 322). These values indicated that teachers of Agricultural Education need improvement in 13 out of 14 skills items in implementing instruction for effective teaching of soil conservation in Colleges of Education. However, one of the skill items (no 27 = *which is modify the lesson based on students reply to the questions)* had a performance gap value of 0.00, indicating that teachers Agricultural Education did not need improvement in the item because the level at which the item was required was equal to the level at which teachers could perform it. (See page 174 no 1). Generally teachers of Agriculture need improvement in 14 skill items in implementing instruction that make up the three clusters but with less emphasis on the item number ό7ôthat had negative performance gap value which was an integral part of the three clusters where its complete isolation is hardly necessary.

Cluster C- evaluating instruction had twelve (12) skill items whose performance gap values ranged from 0. 85 to 1.53 and were positive (see Appendix I pg 323).. These values indicated that teachers of Agricultural Education need improvement in all the twelve (12) skill items in evaluation for effective teaching of soil conservation in Colleges of Education in South-eastern Nigeria.

Research Question 4

What are the soil conservation skills where teachers of Agricultural Education need improvement for effective teaching of students in Colleges of Education in South-eastern Nigeria?

The data for answering research question four were presented in Table 6

Table 6

Performance Gap Analysis of Mean Ratings of the Teachers of Agriculture on Soil Conservation Skills required for Effective Teaching of Students in Colleges of Education. N = 85

Cluster	Cluster Statement	$\bar{X}_R$	$\bar{X}_p$	PG $(\bar{X}_R-\bar{X}_P)$	Remarks
A	Tillage operation (20 skill items)	3.44	1.78	1.66	Improvement Needed
B	Soil testing and analysis (59 skill items)	3.46	2.92	0.54	,,
C	Manure preparation and application (48 skill items)	3.43	2.92	0.51	,,
D	Crop rotation (13 skill items)	3.41	2.05	1.36	,,
E	Soil erosion prevention and control (43 skill items)	3.40	2.09	1.31	,,
F	Irrigation (6 skill items)	3.13	2.61	0.52	,,

Data in Table 6 revealed that the performance gap values of all the six clusters (A-F) were 1.66, 0.54, 0.51, 1.36, 1.31 and 0.52. These values were positive, indicating that teachers of Agricultural Education need improvement in the six clusters for effective teaching of soil conservation in College of Education.

The six clusters had 203 corresponding skill items, 152 out of the 203 skill items in soil conservation had their performance gap values ranged from 0.03 to 1.92 and were positive, indicating that teachers of Agricultural Education need improvement in the 152 skill items in soil conservation. Forty-eight out of the 203 had their performance values ranged from ï 0.65 to ï 0.01 and were negative, indicating that teachers of Agricultural Education did not need improvement in the 48 skill cluster items in soil conservation The remaining three skill items numbers 51, 77 and 158 had performance gap value of 0.00 each, which indicated that teachers of Agricultural Education did not need improvement in the items because the level at which each of the items was required was equal to the level at which the teachers could perform each of them. Specifically, the analysis of the data for each of the six clusters was as follows:

Cluster A - tillage operations had 20 corresponding skill items. All the 20 skill items had their performance gap values ranged from 1.43 to 1.92 and were positive (see Appendix J pg 324)., indicating that teachers of Agricultural Education need improvement in the entire 20 skill items in tillage operation for effective teaching of soil conservation in Colleges of Education in South-eastern Nigeria.

Cluster B- soil testing and Analysis had 59 skill items (see Appendix J pg 325-328), 42 out of the 59 items had their performance gap values ranged from 0.03 to 1.90 and were positive. However, 15 out of the 59 skill items in soil testing and analysis had their performance gap values ranged from -0.43 to ï 0.01 and were negative. These negative values indicated that teachers of Agricultural Education did not need improvement in the 15 skill cluster items in soil testing and analysis because the level at which the items were required was less than the level at which teacher could perform the items (see page 174 no 3). The remaining two of the items (no 51= s*hake the tube again and allow the content to settle and no 77 = place one drop of the soil extract in a spitting tittle and add four drops of dispheny lamine solution)* had performance gap value of 0.00 each which was neutral, indicating that teachers of Agricultural Education did not need improvement in the two items because the level at which the items were required were equal to the level at which teachers could perform them. Generally, teachers of Agriculture need improvement in 59 skill items in soil testing and analysis that make up the 6 clusters with less emphasis on the 17 items which were integral part of the 6 clusters where their complete isolation is hardly necessary.

Cluster C - manure preparation and application had 62 skill items (see Appendix J pg 329-332), 46 out of the 62 items had their performance gap values ranged from 0.01 to 1.75 and were positive, indicating that teachers of Agricultural Education need improvement in the 46 skill items. The remaining 16 skill items in manure preparation and application had their performance gap values ranged from ï 0.51 to ï 0.03 and were negative. These negative values indicated that teachers of Agricultural Education did not need improvement in the sixteen (16) skill items because the level at which the teachers could perform the items was greater than the level at which the items were required (see page 174 no 3).

Generally, teachers of Agriculture Need Improvement in: 63 skill items in manure preparation and application that make up the 6 clusters with less emphasis on the 16 items that had negative performance gap values which were integral part of the clusters where their complete isolation is hardly necessary.

Cluster D- crop rotation had 13 skill items out of which eleven (11) had performance gap values of 1.45 to 1.78 and were positive. (see Appendix J pg 332- 333). The positive values indicated that teachers of Agricultural Education need improvement in the 11 skill items in crop rotation. The remaining two (2) items had performance gap values of -0.42 and 0.41 and were negative; indicating that teachers of Agricultural Education did not need improvement in the 2 items because the level at which teachers could perform the items was greater than the level at which the items were required. Generally teachers of Agriculture Need Improvement in the 13 skill items in crop rotation that make up the 6 clusters with less emphasis on the 2 items that had negative performance gap values which were integral part of the clusters where their complete isolation is hardly necessary.

Cluster E -soil erosion prevention and control had 43 skill items out of which 27 had their performance gap values ranged from 0.03 to 1. 78 and were positive (see Appendix J pg 333-336), indicating that teachers of Agricultural Education need improvement in the 27 skill items. Sixteen (16) of the 43 skill items in soil erosion prevention and control had their performance gap values ranged from ï 0.45 to ï 0 01. These values were negative, indicating that teachers of Agriculture did not need improvement in the 16 skill items because the level at which teachers could perform the items was greater than the level at which the items were required. Generally teachers of Agriculture Need Improvement in 43 skill items in soil erosion prevention and control that make up the 6 clusters with less emphasis on the 16 items that had negative performance gap values which were integral part of the clusters where their complete isolation is hardly necessary.

Cluster F- irrigation had six (6) skill items (see Appendix J pg 336). Five (5) out of the six (6) clusters had their performance gap values ranged from 0.07 to 0.30 and were positive (see Appendix J pg 347). One of the items (no 198 = *identify the irrigation method or types to adopt)* had a performance gap values of ï 0. 25 and was negative indicating that teachers of Agriculture did not need improvement in identifying the method or type of irrigation to adopt. Generally teachers of Agriculture Need Improvement in six skill items in irrigation that make up the 6 clusters with less emphasis on the one item that had negative performance gap value which was an integral part of the 6 clusters where its complete isolation is hardly necessary.

Finding of the Study

The following findings emerged from the study based on the research questions answered and the hypotheses tested.

Section 1. Instructional skills required by teachers of Agricultural Education for effective teaching of soil conservation in Colleges of Education in South-eastern Nigeria.

It was found out that all the three clusters with their 39 instructional skills identified by the study were required by teachers of Agricultural Education for effective teaching of soil conservation in Colleges of Education in South-eastern Nigeria. These items were listed below based on findings on each cluster

Cluster A-Planning Instruction

1. Conduct a need analysis on soil conservation
2. Consult curriculum standards on soil conservation practices
3. Determine the basic skills required in soil conservation practices
4. Determine the objective required in soil conservation practices
5. Identify skills that need to be scaffold (sequenced)
6. Break the soil conservation course into units or lesson topics
7. Develop objectives for each topic on soil conservation while writing the lesson plan
8. Identify materials/resources that are best suited for accomplishing each lesson topic.
9. Design class activities that may involve listening, speaking, reading writing and manipulating
10. Identify opportunities for learners to put the skills into practice outside learning environment.
11. Identify instructional strategies that include a variety of activities focusing on the objectives
12. Provide the materials that will help in the achievement of each topic in soil conservation.
13. Review the objectives periodically

Cluster B- Implementing instruction Skills

14. Inform students technically of the objectives of each lesson on soil conservation (expectation at the end of the lesson).

15. Provide students with clear statement of skills required in each topic of soil conservation lesson.

16. Provide students with clear statement of assessment requirements.

17. Introduce the topic to the students.

18. Give summary or revision of the previous lesson to link it with the dayǿs lesson.

19. For a new lesson), test the studentsô entry behaviour with generally stimulating questions that are familiar but in the direction of the lesson on soil conservation.

20. Present the subject content in soil conservation in a coherent manner.

21. Utilise different instructional strategies.

22. Introduce learning materials at appropriate time.

23. Ask questions to guide the learners

24. Give students opportunity to answer the questions on soil conservation practices.

25. Correct wrong answers where nobody could do so in the class.

26. Provide opportunities for individual consultations after the lesson.

27. Modify the lesson based on studentsô reply to questions.

Cluster C- Evaluating instruction

28. Determine the assessment procedures on each topic on soil conservation.

29. Decide how to judge the performance. on theory or practical in soil conservation practices.

30. Design the assessment focusing on the content that is most important for students to learn

31. Pose closure questions at the end of each dayôs lesson on soil conservation.

32. Provide cross-word puzzles or a more challenging worksheet to keep fast working students busy and advanced ones engaged.

33. Observe studentsô body language while carrying out activities on soil conservation.

34. Observe students frequently off-task behaviours in the classroom

35. Observe students in groups while discussing soil conservation practices.

36. Utilise a variety of formal, informal, formative and summative assessments methods

37. Assign grades to studentsô performance.

38. Use assessment results to evaluate studentsô interest in the content areas of soil conservation.

39. Give feedback (result) to students on their performances in soil conservation practices

Hypothesis 1

H_01. It was found out that there was no significant difference in the mean ratings of the responses of the two groups of respondents (17 lecturers and 85 teachers) on three clusters and 35 out of their 39 corresponding skill items in instruction (9 in planning, 14 in implementing and 12 in evaluating instruction) required by teachers of Agricultural Education for effective teaching of soil conservation in Colleges of Education in South-eastern Nigeria. The null hypothesis of no significant difference was therefore upheld for the three clusters and the 35 skill items in instruction. However there was significant difference in the mean ratings of the responses of the two groups of respondents on four (4) skill cluster items in instruction (4 in planning instruction) required by teachers of Agricultural Education for effective teaching of soil conservation in Colleges Education in South-eastern Nigeria. The null hypothesis of no significant difference was rejected for the six (6) skill cluster items in instruction. The implication of this is that the professional differences and experiences of the respondents did not significantly differ in their opinions on 35 skill items in instruction but significantly differed in 4.

Section 2. Soil Conservation skills required by teachers of Agricultural Education for effective teaching of students in Colleges of Education in South-eastern Nigeria

It was found out that all the 6 clusters with their 203 corresponding skill items in soil conservation identified by the study were required by teachers of Agricultural Education for effective teaching of students in

Colleges of Education in South-eastern Nigeria. These items were listed below based on findings on each cluster.

Cluster A-Tillage operations

1. Turn the soil with mouldboard-plough to bury surface materials.
2. Mix the soil with chisel plough.
3. Loosen the soil with hoe or shovel.
4. Stir the soil with hoe or shovel
5. Bury the weeds
6. Scrape the soil surface
7. Smoothen the crushed surface
8. Till the soil leaving straw and stubble on the soil surface to act as mulch materials.
9. Perform tillage at right angles to the prevailing winds
10. Follow the contour of the land in hilly landscape to intercept water during heavy rainfall
11. Break the soil with hoe or tillage equipment.
12. Twist and collect the soil with the hoe..
13. Raise the hoe with the soil
14. Invert the hoe to allow the soil drop while incorporating crop residues.
15. Construct flat beds or
16. Construct ridges and furrows

17. Make cross bars.

18. Break old ridges (where old ones exist) to build new ones on the furrows by inverting half of the soil from adjacent ridges on both left and right.

19. If wide beds are required, construct wide beds that can accommodate two rows of crop plants.

20. Mulch the constructed ridges or beds with crop residues

B) Soil Testing and Analysis

i) Soil sampling

21. Consult some laboratories that are good in soil testing and analysis

22. Select one that is near the area to be tested if any.

23. Discuss the soil problem with the consultant or manager of the chosen testing laboratory.

24. Obtain the implement for sampling from the extension officer (probe or auger, trowel or spade/shovel).

25. Move to the site that need testing.

26. Scrape away the surface litter.

27. Mark a relatively uniform field fig A (that is one that can be easily managed in a consistent manner).

28. Mark field that has more than a distinct area which cannot be easily managed in a consistent manner fig B.

29. Insert the probe, auger or shovel into the soil to the plough depth or at least 6inches.

30. Collect soil samples with probe, auger or shovel.

31. Collect 25 cores from each marked area.

32. Mix each of the 25 cores from each area together to give a common composite sample.

33. Take 20-30 ounces (volume).

34. Crush the collected sample in a mortar

35. Sieve the sample through a 2mm brass, stainless or plastic sieve.

36. Package the soil samples into container.

37. Store in a clean closed container.

38. Take to the laboratory for analysis.

39. Test for CEC, NPK Ma and pH.

40. Air-dry the sample below 120^{of} if not shipped immediately to the laboratory.

41. Collect lab result with recommendation.

ii) Determination of Cation Exchange capacity

42. Place filter papers in two funnels and fill them with the soil sample.

43. Leach the soil in one of the funnels with a 100% potassium nitrate (KNO_3) solution.

44. Add few drops of soil indicator solution to both leachates.

45. Observe the leachate.

iii) Determination of soil pH

46. Fill a test tube to a depth of almost 1cm with the soil to be tested.

47. Add the 1cm of barium sulphate.

48. Fill the tube with distilled water leaving a space of 4 cm from the top of the tube.

49. Shake the tube thoroughly.

50. Allow the content to settle, and then add 8 ï 10 drops of universal indicator.

51. Shake the tube again and allow the content to settle.

52. Hold the test tube again at the pointed colour chart.

53. Compare each colour of the chart with the colour of the suspension containing the indicator and note the pH of the colour which it matches exactly.

iv) Determination of lime requirement of the soil

54. Place a small quantity of calcium carbonate on a glass.

55. Half fill a test tube with soil indicator solution.

56. Add a drop of acid and shake the tube thoroughly.

57. Add a few drops of sodium hydroxide solution and shake again.

58. Place a small quantity of soil or a piece of waxed paper and add drops of soil indicator solution until some of it runs out of the soil.

59. Test all the samples of the soil which are available and

60. Record the pH of each of them.

61. Use colour chart to relate the pH of soil sample and recommend application of lime per hectare.

v) Test for Phosphorus

62. Pour 10cm^3 of ammonium molybdate solution into the glass vial.

63. Add 1g of soil and shake the vial vigorously for one minute.

64. Filter the solution.

65. Add a grain of dry powdered tin (ii) chloride solution to 5 cm^3 of the filtrate.

66. Observe the intensity of the colour of molybdenum.

vi) Test for Potassium

67. Pour 10 cm^3 of sodium cobalt nitrate solution into a glass vial.

68. Add one level tea spoon of air dried soil Shake the vial vigorously for a minute.

69. Filter the solution.

70. Use the pipette to add 2.5 cm^3 of anhydrous propyl2OL to 5cm^3 of filtrate and mix the two solutions together thoroughly

71. After three minutes compare the turbidity of the solution with a standard chart..

72. After three minute compare the turbidity of the solution with a standard chart.

vii) Test for Magnesium

73. Put 1 cm^3 of soil extraction into a test tube..

74. Add one drop of titan yellow solution and shake the tube vigorously.

75. Add one drop of 5% sodium hydroxide solution and shake the tube.

76. Observe the colour.

viii) Test for Nitrates

77. Place one drop of the soil extract on a spotting title and add four drops of the dispheny lamine solution.

78. After two minute stir the mixture..

79. Compare the colour with standard colour chart.

C- Manure Preparation and Application

i) Farm yard manure

80. House animals: goat, sheep, or poultry in appropriate pen.

81. Feed the chosen animal with grasses, legumes, water and other materials.

82. Collect animal dung and litter from the pen.

83. Heap the daily collected beddings together in a place.

84. Allow them to decay.

85. Apply to the soil using broadcasting or any other method.

ii) Compost manure

86. Select appropriate site for compost preparation.

87. Map out seven plots/spaces.

88. Label the plots/spaces as A,B,C,1, 2, 3 and 4

89. Dig trenches or pits of about 1m deep in each plot mapped..

90. Provide wall or fence round the corners.

91. Provide compost materials.

92. Cut the compost materials with cutlass.

93. Build up the heaps in plots 1,2,3 and 4 with the cut materials.

94. Spray urine, wood ash, animal dung or a head pan or bucketful of old compost on top of each layer.

95. Sprinkle water on each four heaps.

96. Sprinkle a handful of soil on each of the heaps.

97. Add other layers of compost materials in alternate manner.

98. Repeat the process of applying water after each layer until the required level of the compost is attained.

99. Drive a strong long stick (testing stick) through the top until it reaches the centre

100. Cover the pit with layers of refuse of 15-20cm.

101. Plaster/ cover to drive away files

102. Allow materials to sink.

103. Take the stick out after the first day.

104. Feel the testing stick to know if it is hot, cold, damp, or moist.

105. Turn the materials (removing layer by layer) from heap 1 and 2 into space A and materials in heap 3 and 4 into space B.

106. Stack materials in the spaces from where the materials were removed. 1,2,3 and 4 to continue another process

107. Move the materials in heap óAôto óCôand those in óBôto óCôafter a fortnight.

108. Provide a shade over the decayed compost.

109. Cover the prepared compost to prevent effect of sun or rain.

110. Apply using appropriate method like ring, band or broadcasting.

iii) Green manure

111. Collect green manure crop seeds/ cuttings

112. Prepare seed beds.

113. Broadcast small seeds of legumes on the prepared beds.

114. Plant seeds or cuttings; spacing them closely or

115. Plant larger seeds in rows between the rows of cereals.

116. Water the seed beds after planting

117. Weed the plot regularly to reduce pests.

118. Plough in the crop distributing evenly over the farm just after it had flowered.

119. Leave at least 7days before planting the next crop.

iv). Fertilizer application

120. Plough the field/land

121. Broadcast fertilizer uniformly over uncultivated land using hang or machine

122. Mix fertilizer with soil

123. Protect plantsôstems or roots from being in contact with fertilizer.

124. Make an opening in ring-form round the crop or bands if crops are planted in rows/ridges

125. Spread fertilizer evenly in the ring or bands a few centimetre away

126. At about 3-4 weeks after planting, apply second dose of fertilizer by placing on a ring close to the plant.

127. Cover the applied fertilizer with soil.

v) Mulching

128. Identify the appropriate mulch materials

129. Collect/rake dry plant materials that do not rot quickly

130. Put them into a mulch bin.

131. Cut or shred the leaves using mulching lawn mower

132. Determine when to apply the material,

133. Carry the materials to the field.

134. Spread the materials on the soil surface with hand or rake before or after planting crops.

135. Spread around young crop plants

136. Spread on the cultivated beds or ridges

137. Spread mulch materials during dry season

138. Spread mulch materials during rainy season in places where the soil is easily eroded.

139. Maintain a layer of mulch material at 7-15cm (3-6 inches) deep all over bed, around the growing plant and more on the eroded places

140. Spread plastic mulch materials.

141. Poke holes in the plastic mulch materials to provide access for the plants

D -Crop Rotation

It was found out that all the 13 skill items in crop rotation were required for effective teaching of soil conservation in Colleges of Education: these items were

142. Make a long range rotation plan by determining the goals in view

143. Make a list of crops to grow in the farm

144. Group them together by plant family.

145. Create a planting schedule

146. Draw a map of the beds, ridges or mounds on a graph paper and make several copies.

147. Use the map to plan where to plant each crop

148. Note crops that are to be grown and where on the map.

149. Label each crop with the year including a fallow in the rotation

150. Implement the plan by planting specific crops in the mapped spaces

151. Follow the planting schedule by planting the plants chosen in order of sequence.

152. Be consistent for consistent result

153. Keep records so that gains (or losses) in production can be observed.

154. Modify the order to minimize loss

E-Soil Erosion Prevention and Control

i) Soil Erosion Prevention

155. Spread organic mulch over uncultivated land.

156. Make ridges across the slope.

157. Make cross bars between ridges.

158. Plant grasses on the land that is likely to be eroded.

159. Break the slope into series of flat-surfaces called terraces.

160. Establish or plant crops in strips at right angles to the direction of water flow.

161. Break the soil clods moderately in order to avoid excessive damages to the soil granules.

162. Plant young tree seedlings in areas likely to be eroded in future.

163. Prepare ridges in spiral forms to restrict rapid movement of water in the farm.

164. Grow plants that are indigenous to the area

165. Plant and maintain enough strong, healthy growing vegetation like trees and shrubs.

166. Keep the soil moist by covering with damp piles of mulch.

167. Practice a tillage method that does not make the soil over fine.

168. Construct physical structures made of earth, stone or other materials.

169. Construct wind barrier at the boundaries of the farm,.

170. Plant patches of high grass and allow the grass to grow to at least three inches to promote retention of water in the soil.

171. Plant cover crops that will assist in covering the ground; reducing runoff.

172. Water plants early in the morning, when evaporation is low.

b) Soil Erosion Control

173. Plough on the contour.

174. Till the soil to produce rough clods

175. Place plant residues on the surface to obtain maximum rougHRess.

176. Construct small ridges to the direction of the wind/water

177. Plant crops on the contour.

178. Put checks in furrows.

179. Establish grasses that have the ability to live long and withstand wind/water movement.

180. Plant tress to act as shelter belts.

181. Build level terracing.

182. Fill in gullies with sand.

183. Shape gullies for smooth water flows.

184. Construct dams of 0.5m high at intervals of 4-9m depending on the slope.

185. Plant perennial vegetations on exposed road cuts to eliminate soil loss.

186. Provide cross channels (shallow ditches or water channel) every 25 to100 m to prevent excessive accumulation of water.

187. Plant windbreaks and tenacious grasses.

188. Make bunds between two strips.

189. Construct deep pathways for diverting running water and channelling them into exit pipes or tunnels.

190. Make barriers along the slope with sand bags and logs of wood.

191. Build tunnels in form of large exit pipes or joined ringed concrete.

192. Make concrete walls

193. Place blankets and mats tightly and securely on affected area

194. Construct large cement pavers into a retaining wall to prevent water from moving onwards.

195. Use large builder type rocks or concrete pavers on shore lines

196. Plant grass on the eroded areas where it will grow over covering the surfaces

197. Build dry check beds on hillsides.

J) Irrigation

198. Identify the irrigation method and type to adopt.

199. Determine plant water requirements.

200. Lay out the system.

201. Irrigate the "base plant." Using watering can or any other

202. Calculate the water usage for the crop.

203. Carry out appropriate maintenance practices of the equipment

Hypothesis 2

It was found out that there was no significant difference in the mean ratings of the two groups of respondents (17 lecturers and 85 teachers) on six clusters and 176 out of their 203 corresponding skill items in soil conservation items required by teachers of Agricultural Education for effective teaching of students in Colleges of Education in South-eastern Nigeria. The null hypothesis of no significant difference was therefore upheld for the six clusters and the 176 skill items in soil conservation. However there was significant difference in the mean ratings of the responses of the two groups of respondents on twenty-seven (27) skill items in soil conservation (4 in tillage, 10 in soil testing and analysis, 8 in manuring, 1 in crop rotation and 4 in soil erosion prevention and control) required by teachers of Agricultural Education for effective teaching of soil conservation in Colleges Education in South-eastern Nigeria. The null hypothesis of no significant difference was rejected for the twenty-seven (27) skill items in soil conservation. See Appendix xi. The implication of this showed that the professional differences and experiences of the respondent did not significantly differ in their opinions on 176 items but significantly differed on 27 items on soil conservation skills required for effective teaching of students in Colleges of Education in the study area.

Section 3. Instructional skills where teachers of Agricultural Education need improvement for effective teaching of soil conservation in Colleges of Education in South-eastern Nigeria

It was found out from the study that teachers of agricultural Education need improvement in the three clusters and 38 out of their 39 corresponding skill items in instruction for effective teaching of soil conservation in Colleges of Education in South-eastern Nigeria. The 6 clusters and their corresponding skill items in instruction were presented based on each cluster.

Cluster A- Planning Instruction

It was found out that teacher of Agricultural Education need improvement in all the 13 skill items identified in planning instruction for effective teaching of soil conservation in Colleges of Education: these items were

1. Conduct a need analysis in soil conservation.

2. Consult curriculum standards on soil conservation practices.
3. Determine the basic skills required in soil conservation practices.
4. Determine the objective required in soil conservation practices.
5. Identify skills that need to be scaffold (sequenced).5
6. Break the soil conservation course into units or lesson topics.
7. Develop objectives for each topic on soil conservation while writing the lesson plan.
8. Identify materials/resources that are best suited for accomplishing each lesson topic.
9. Design class activities that may involve listening, speaking, reading, writing and manipulating.
10. Identify opportunities for learners to put the skills into practice outside learning environment.
11. Identify instructional strategies that include a variety of activities focusing on the objectives.
12. Provide the materials that will help in the achievement of each topic in soil conservation.
13. Review objectives periodically.

Cluster B- Implementing Instruction

It was found out that teachers of Agricultural Education need improvement in 13 out of the 14 skill items identified in implementing instruction for effective teaching of soil conservation in Colleges of Education: these items were

14. Inform students technically of the objectives of each lesson on soil conservation (expectation at the end of the lesson)
15. Provide students with clear statement of skills required in each topic of soil conservation lesson.
16. Provide students with clear statement of assessment requirements.
17. Introduce the topic to the students.
18. Give summary or revision of the previous lesson to link it with the dayôs lesson.
19. For a new lesson), test the studentsô entry behaviour with generally stimulating questions that are familiar but in the direction of the lesson on soil conservation.
20. Present the subject content in soil conservation in a coherent manner.
21. Utilise different instructional strategies.
22. Introduce learning materials at appropriate time.
23. Ask questions to guide the learners.
24. Give students opportunity to answer the questions on soil conservation practices.
25. Correct wrong answers where nobody could do so in the class.
26. Provide opportunities for individual consultations after the lesson.

However, it was also found out that teachers of Agricultural Education did not need improvement in one (no 27) of the 14 skill items identified in implementing instruction for effective teaching of soil conservation in Colleges of Education: The item was

27. Modify the lesson based on studentsô reply to questions.

Cluster C- Evaluating instruction

It was found out that teacher of Agricultural Education need improvement in all the 12 skill items identified in evaluation instruction for effective teaching of soil conservation in Colleges of Education: These items were

28. Determine the assessment procedures on each topic on soil conservation.
29. Decide how to judge the performance. on theory or practical in soil conservation practices.
30. Design the assessment focusing on the content that is most important for students to learn.
31. Pose closure questions at the end of each dayô s lesson on soil conservation.
32. Provide cross-word puzzles or a more challenging worksheet to keep fast working students busy and advanced ones engaged.
33. Observe studentsô body language while carrying out activities on soil conservation.
34. Observe students frequently off-task behaviours in the classroom.
35. Observe students in groups while discussing soil conservation practices.
36. Utilise a variety of formal, informal. Formative and summative assessments methods.
37. Assign grades to studentsôperformance.

38. Use assessment results to evaluate studentsô interest in the content areas of agriculture.

39. Give feedback (result) to students on their performances in soil conservation practices.

Section 4. Soil Conservation skills where teachers of Agricultural Education need improvement for effective teaching of students in Colleges of Education in South-eastern Nigeria

It was found out from the study that teachers of agricultural Education need improvement in the six clusters and 152 out of their 203 corresponding skill items in soil conservation for effective teaching of students in Colleges of Education in South-eastern Nigeria. The six clusters and their corresponding skill items in soil conservation were presented based on each cluster.

Cluster A-Tillage operations

It was found out that teachers of Agricultural Education need improvement in all the 20 skill items identified in tillage operations for effective teaching of soil conservation in Colleges of Education: These items were

1. Turn the soil with mouldboard-plough to bury surface materials.
2. Mix the soil with chisel plough.
3. Loosen the soil with hoe shovel.
4. Stir the soil with hoe or shovel.

5. Bury the weeds.
6. Scrape the soil surface.
7. Smoothen the crushed surface.
8. Till the soil leaving straw and stubble on the soil surface.
9. Perform tillage at right angles to the prevailing winds.
10. Follow the contour of the land in hilly landscape to intercept water during heavy rainfall.
11. Break the soil with hoe or tillage equipment.
12. Twist and collect the soil with the hoe.
13. Raise the hoe with the soil.
14. Invert the hoe with soil while incorporating crop residues.
15. Construct flat beds.
16. Construct ridges and furrows.
17. Make cross bars.
18. Break old ridges (where old ridges exist)to build new ones on the furrows by inverting half of the soil from adjacent ridges on both left and right.
19. If beds are required, construct wide beds that can accommodate two rows of crop plants.
20. Mulch the constructed ridges or beds with crop residues.

Cluster B- Soil Testing and Analysis

It was found out that teachers of Agricultural Education need improvement in 42 out of 59 skill items identified in soil testing and analysis for effective teaching of soil conservation in Colleges of Education: these items were

i) Soil sampling

1. Consult some laboratories that are good in soil testing and analysis.
2. Select one that is near the area to be tested if any.
3. Discuss the soil problem with the consultant or manager of the chosen testing laboratory.
4. Obtain the implement for sampling from the extension officer (probe or auger, trowel or spade).
5. Move to the site that need testing.
6. Scrape away the surface litter.
7. Mark a relatively uniform field fig A (that is one that can be easily managed in a consistent manner).
8. Mark field that has more than a distinct area which cannot be easily managed in a consistent manner fig B.
9. Insert the probe or auger into the soil to the plough depth or at least 6inches.
10. Collect soil samples with probe, auger or shovel.
11. Collect 25 cores from each marked area.
12. Mix each of the 25 cores from each area together to give a common composite sample.
13. Take 20-30 ounces (volume).
14. Crush the collected sample in a mortar.
15. Sieve the sample through a 2mm brass, stainless or plastic sieve.
16. Package the soil samples into container.

17. Store in a clean closed container.

18. Take to the laboratory for analysis.

19. Test for CEC, NPK Ma and pH.

20. Air-dry the sample below 120^{of} if not shipped immediately to the laboratory.

21. Collect lab result with recommendation.

ii) Determination of Cation Exchange capacity

22. Place filter papers in two funnels and fill them with the soil sample.

23. Leach the soil in one of the funnels with a 100% potassium nitrate (KNO_3) solution.

24. Add few drops of soil indicator solution to both leachates.

25. Observe the leachate.

iii) Determination of soil pH

26. Fill a test tube to a depth of almost 1cm with the soil to be tested.

27. Add the 1cm of barium sulphate.

28. Fill the tube with distilled water leaving a space of 4 cm from the top of the tube.

29. Shake the tube thoroughly.

30. Allow the content to settle, and then add 8 ï 10 drops of universal indicator.

iv) Determination of lime requirement of the soil

31. Test all the samples of the soil which are available and

32. Record the pH of each of them.

v) Test for Phosphorus

33. Filter the solution.

34. Add a grain of dry powdered tin (ii) chloride solution to 5 cm^3 of the filtrate.

35. Observe the intensity of the colour of molybdenum.

vi) Test for Potassium

36. Add one level tea spoon of air dried soil

37. Shake the vial vigorously for a minute.

38. Filter the solution.

40. Use the pipette to add 2.5 cm^3 of anhydrous propyl2OL to 5cm^3 of filtrate and mix the two solutions together thoroughly.

41. After three minutes compare the turbidity of the solution with a standard chart.

vii) Test for Magnesium

Put 1 cm^3 of soil extraction into a test tube.

viii) Test for Nitrates

After two minutes stir the mixture.

However it was also found out that teachers of Agricultural Education did not need improvement in 17 out of the 59 skill cluster items identified in soil testing and analysis for effective teaching of soil conservation in Colleges of Education: these items were:

1. Shake the tube again and allow the content to settle.

2. Hold the test tube again at the pointed colour chart.

3. Compare each colour of the chart with the colour of the suspension containing the indicator and note the pH of the colour which it matches exactly.

4. Place a small quantity of calcium carbonate on a glass.

5. Half fill a test tube with soil indicator solution.

6. Add a drop of acid and shake the tube thoroughly.

7. Add a few drops of sodium hydroxide solution and shake again.

8. Place a small quantity of soil or a piece of waxed paper and add drops of soil indicator solution until some of it run out of the soil.

9. Use colour chart to relate the pH of soil sample and recommend application of lime per hectare.

10. Pour 10cm of mammon molybdate solution into a glass Vail

11. Add 1g of soil and shake vigorously fir 1 minuet

12. Pour 10 cm^3 of sodium cobalt nitrate solution into a glass vial.

13. Add one drop of titan yellow solution and shake the tube vigorously.

14. Add one drop of 5% sodium hydroxide solution and shake the tube.

15. Observe the colour.

16. Place one drop of the soil extract on a spotting title and add four drops of the dispheny lamine solution.

17. Compare the colour with standard colour chart.

Cluster C- Manure Preparation and Application

It was found out that, teachers of Agricultural Education need improvement in all the 46 out of 62 skill items identified in manure preparation and application for effective teaching of soil conservation in Colleges of Education: these items were

i) Farm yard manure

1. House animals: goat, sheep, or poultry in appropriate pen.

2. Collect animal dung and litter from the pen.

3. Heap the daily collected beddings together in a place.

4. Allow them to decay.

5. Apply to the soil using broadcasting method.

ii) Compost manure

6. Select appropriate site for compost preparation.

7. Map out seven plots/spaces.

8. Label the plots/spaces as A,B,C,1, 2, 3 and 4.

9. Dig trenches or pits of about 1m deep in each plot mapped.

10. Provide wall or fence round the corners.

11. Provide compost materials.

12. Cut the compost materials with cutlass.

13. Build up the heaps in plots 1,2,3 and 4 with the cut materials.

14. Spray urine, wood ash, animal dung or a head pan or bucketful of old compost on top of each layer.

15. Sprinkle water on each four heaps.

16. Sprinkle a handful of soil.

17. Add other layers of compost materials in alternate manner.

18. Repeat the process of applying water after each layer until the required level of the compost is attained.

19. Drive a strong long stick (testing stick) through the top until it reaches the centre.

20. Cover the pit with layers of refuse of 15-20cm.

21. Plaster/ cover to drive away files.

22. Allow materials to sink.

23. Take the stick out after the first day.

24. Feel the testing stick to know if it is hot, cold, damp, or moist.

25. Turn the materials (removing layer by layer) from heap 1 and 2 into space A and materials in heap 3 and 4 into space B.

26. Stack materials in the spaces from where the materials were removed. 1,2,3 and 4 to continue another process.

27. Move the materials in heap óAô to óCô and those in óBô to óCô after a fortnight.

28. Provide a shade over the decayed compost.

29. Cover the prepared compost to prevent effect of sun or rain.

30. Apply using appropriate method like ring, band or broadcasting.

iii) Green manure

31. Collect green manure crop seeds/ cuttings.

32. Broadcast small seeds of legumes.

33. Plant seeds or cuttings; spacing them closely

34. Plant larger seeds in rows between the rows of cereals.

35. Water the seed beds after planting.

36. Weed the plot regularly to reduce pests.

37. Plough in the crop distributing evenly over the farm just after it had flowered.

38. Leave at least 7days before planting the next crop.

39. Fertilizer application

40. Plough the field/land.

41. Broadcast fertilizer uniformly over uncultivated land using hang or machine.

42. Mix fertilizer with soil.

43. Spread fertilizer evenly in the ring or bands a few centimetres away.

Mulching

44. Carry the material to the field.

45. Maintain a layer of mulch material at 7-15cm (3-6 inches) deep all over bed, around the growing plant and more on the eroded places.

46. Spread plastic mulch materials.

47. Poke holes in the plastic mulch materials to provide access for the plants**.**

However it was also found out that teachers of Agricultural Education did not need improvement in 16 out of the 62 skill items identified in manure preparation and application for effective teaching of soil conservation in Colleges of Education: these items were:

1. Feed the animals with grasses, legumes, water and other materials.

2. Prepare seed beds.

3. Protect plantsôstems or roots from being in contact with fertilizer.

4. Make an opening in ring-form round the crop or bands if crops are planted in rows/ridges.

5. Cover the applied fertilizer with soil

6. At about 3-4 weeks after planting, apply second dose of fertilizer by placing on a ring close to the plant y from the crop.

7. Identify the appropriate mulch materials.

8. Collect/rake dry plant materials that do not rot quickly.

9. Put them into a mulch bin.

10. Cut or shred the leaves using mulching lawn mower.

11. Determine when to apply the material.

12. Spread the materials on the soil surface with hand or rake before or after planting.

13. Spread around young crop plants.

14. Spread on the cultivated beds or ridges.

15. Spread mulch materials during dry season.

16. Spread mulch materials during rainy season in places where the soil is easily eroded

Cluster D -Crop Rotation

It was found out that teachers of Agricultural Education need improvement in 11 out of 13 skill items identified in crop rotation for effective teaching of soil conservation in Colleges of Education: these items were

1. Group crops together by plant family.

2. Create a planting schedule.

3. Draw a map of the beds, ridges or mounds on a graph paper and make several copies.

4. Use the map to plan where to plant each crop.

5. Note crops that are to be grown and where on the map.

6. Label each crop with the year including a fallow in the rotation.

7. Implement the plan by planting specific crops in the mapped spaces.

8. Follow the planting schedule by planting the plants chosen in order of sequence.

9. Be consistent for consistent result.

10. Keep records so that gains (or losses) in production can be observed.

11. Modify the order to minimize the loss.

However it was also found out that teachers of Agricultural Education did not need improvement in 2 out of the 13 skill cluster items identified in crop rotation for effective teaching of soil conservation in Colleges of Education: these items were:

1. Make a long range rotation plan by determining the goals in view.

2. Make a list of crops to grow in the farm.

Cluster E-Soil Erosion Prevention and Control

It was found out that, teachers of Agricultural Education need improvement in 27 out of 43 skill items in soil erosion prevention and control for effective teaching of soil conservation in Colleges of Education: these items were

i) Soil Erosion Prevention.

1. Spread organic mulch over uncultivated land.

2. Make ridges across the slope.

3. Make cross bars between ridges.

4. Break the slope into series of flat-surfaces called terraces.

5. Establish or plant crops in strips at right angles to the direction of water flow.

6. Break the soil clods moderately in order to avoid excessive damages to granules.

7. Plant young tree seedlings in areas likely to be eroded in future.

8. Prepare ridges in spiral forms to restrict rapid movement of water in the farm.

9. Grow plants that are indigenous to the area.

10. Maintain enough strong, healthy growing vegetation like trees and shrubs.

11. Keep the soil moist by covering with damp piles of mulch.

12. Practice a tillage method that does not make the soil over fine.

13. Construct physical structures made of earth, stone or other materials.

14. Construct wind barrier at the boundaries of the farm.

15. Plant patches of high grass and allow the grass to grow to at least three inches to promote retention of water in the soil.

16. Plant cover crops that will assist in covering the ground; reducing runoff.

17. Water plants early in the morning, when evaporation is low.

b) Soil Erosion Control

18. Plough on the contour

19. apply a simple layer of mulch

20.Till the soil to produce rough clod.

21. Place plant residues on the surface to obtain maximum rougHRess.

22. Construct small ridges to direct rain/water.

23. Plant tress to act as shelter belts.

24. Fill gullies with sand.

25. Plant perennials vegetation on exposed road cuts to eliminate soil loss.

26. Make bunds between two strips surface.

27. Build tunnels in form of large exit pipes or joined ringed concrete.

However it was also found out that teachers of Agricultural Education did not need improvement in 16 out of the 43 skill items identified in soil erosion prevention and control for effective teaching of soil conservation in Colleges of Education: these items were:

1. Plant grasses on the land that is likely to be eroded.

2. Make concrete walls.

3. place blankets and mats tightly and securely on affected area.

4. construct large cement pavers into a retaining wall to prevent the water from moving inwards.

5. use large boulder type rocks or concrete pavers on shorelines

6. Plant crops on the contour.

7. put check on furrows

8. Establish grasses that have the ability to live long and withstand wind.

9. Build level terracing.

10. Shape gullies for smooth water flows.

11. Construct dams of 0.5m high at intervals of 4-9m depending on the slope.

12. Provide cross channels every 25 ï 100m to prevent excessive accumulation of water.

13. Plant windbreaks and tenacious grasses.

14. Construct deep pathways for diverting running water and channelling them into exit pipes or tunnels.

15. Make barriers along the slope with sand bags and logs of wood.

16. Plant grass on the eroded areas where it will grow over covering the surfaces

J) Irrigation

It was found out that teacher of Agricultural Education need improvement in five out of six skill items identified in irrigation for effective teaching of soil conservation in Colleges of Education: These items were

1. Determine plant water requirements.

2. Lay out the system.

3. Irrigate the "base plant." Using watering can or any other implement.

4. Calculate the water usage for the crop.

5. Carry out appropriate maintenance practices of the equipment.

However it was also found out that teachers of Agricultural Education did not need improvement in one of the six skill items identified in irrigation for effective teaching of soil conservation in Colleges of Education: these items were:

1. Identify the irrigation method and type to adopt.

Discussion of Findings

The discussion of finding of the study was organized based on the research question answered and hypotheses tested and presented thus:

1) Instructional skills required by teachers of Agricultural Education for effective teaching of soil conservation in Colleges of Education in South-eastern Nigeria.

It was found out from the study that the respondents agreed that the three instructional clusters and their 39 corresponding skill items were required by teachers of Agricultural Education for effective teaching of soil conservation in the Colleges of Education. The findings of the study on each of the three clusters were discussed as follows:

Planning Instruction

It was found out from the study that the respondents agreed that all the 13 skills items identified in planning instruction were required by teachers of Agricultural Education for effective teaching of soil conservation in Colleges of Education in South-eastern Nigeria. These skill items in planning include; consult the curriculum, determine basic skills required in soil conservation, identify skills that need to be taught sequentially, develop topics for each lesson in soil conservation, identify instructional strategies and others. The findings of the study in planning instruction were in agreement with the findings of McLaughlin (2008) who indicated that planning instruction involves consultation of curriculum standards, identification of the skills that need to be scaffold, identification and selection of materials that will help accomplish the unit objectives among others. The findings were also in agreement with the findings of Allen (2008) who said that planning activities include; designing class activities that may involve speaking, reading writing manipulating, identifying opportunities for learners to put the learnt skills into practice outside the teaching learning environment and selection of instructional strategies that include a variety of activities and others.

Implementing Instruction

It was found out from the study that the respondents agreed that the all the 14 skill items identified in implementing instruction were required by teachers of Agricultural Education for effective teaching of soil conservation in Colleges of Education. These skill items include; inform students technically of the objectives, provide them with clear statements of skills required, present each lesson in soil conservation coherently, provide opportunity for individual consultation after each lesson, modify the lesson based on students, reply to the questions and others.

The findings of this study in implementing instruction were in agreement with the findings of Richard and Gabrielle (2002) who said that skills in implementation of instruction include intimating students with the objectives, providing students with clear statement of skill outcome and clear statement of assessment requirements, presentation of the subject content in a coherent manner and at appropriate level in addition to focusing the learning experience on achieving the objectives set in the plan, providing appropriate assistance and support to individuals, providing opportunities for individual consultations after the lesson and modifying the lesson based on studentsôreply to questions. The findings were also in conformity with the findings of Renner, Greenwood and Scotch (1996) who said that skills in implementation of instruction include engaging students in discussion on the topic, and utilising instructional strategies to enable many different styles of learning among students. The findings of the study on implementation of instruction were also in line with the findings of Olaitan (2003) who indicated that implementing instruction involves introducing the lesson by giving a summary or revision of the previous lesson to link it with the days lesson, using stimulating questions that are familiar but in the direction of the lesson, delivering the new content step by step bearing in mind the logical arrangement of concepts in the lesson, guiding learnersô responses to questions and correcting wrong answers where nobody could do so in the class and among others

Evaluating Instruction

It was found out from the study that the respondents agreed that all the 12 skills items identified in evaluating instruction were required by teachers of Agricultural Education for effective teaching of soil conservation in the colleges. These skills include; determine the assessment procedure, decide on how to judge students performance in theory or practice in soil conservation practices, pose closure questions at the end of each lesson on soil conservation, observe students body language, utilize varieties of assessment methods and others. The findings of this study in evaluation of instruction were in agreement with the findings of Stiggens (2007) that evaluation require such skills as observe the body language and behaviours off-task, in the classroom, or in group discussions, pose closure questions to students at the end of each dayĝs lesson, providing additional activities to keep students involved on task and providing cross-word puzzles and others. The findings of the study were also in conformity with The findings of Guabatz in Terry (2008) stated, that in evaluation, teachers required such skills as using start up activities/questions, assigning no official grades to studentsô responses and modifying the lesson to reflect studentsô abilities for assessment of students after delivering instruction.

Generally, the finding of the study in instructional skills in three clusters A, B, and C were in conformity with the findings of Onyemachi (2004) in a study on management skills required by teachers for improvement in operating woodwork laboratory where it was found out that all the management skill areas in planning, organising and evaluating instruction were required by teachers for effective operation of woodwork laboratories. The findings of the study in instruction were also in conformity with the findings of Dibio (2008) in a study on the requisite skills required by teachers of Agriculture for improving the teaching of yam production in secondary schools in Enugu State; where it was found out that 27 requisite skills in professional area were required by teachers of Agriculture foe effective teaching of yam production. These requisite skills identified by the author include develop instructional objective, break course into learning units, engage students in varieties of activities, ask students clear questions and others. The findings of the study were also in line with observation of Shank and Terril (1995) that a teacher can be described as a planner of content, deliverer of instruction and evaluator of instruction.

The opinions, statements, observations and findings of the authors in instructional skills required for effective teaching gave credence to the findings of this study on instructional skills required by teachers of Agricultural Education for effective teaching of soil conservation in Colleges of Education.

Ho_1 The findings of the study on null hypothesis one revealed that there was no significant difference in the mean ratings of the responses of the two groups of respondents (Lecturers and teachers) on 3 clusters and 35 out of their 39 skill items in instructional skills required by teachers of Agricultural Education for effective teaching of soil conservation in Colleges of Education in South-eastern Nigeria. These include 9 items in planning, 14 in implementing and 12 in evaluating instruction. The implication of this was that the professional competency and experiences of the two groups of respondents did not influence their responses on the 35 instructional skills required by teachers of Agricultural Education for effective teaching of soil conservation. However there was no significant difference in the mean ratings of the responses of the two groups of respondents (Lecturers and teachers) on 4 out of 39 skill cluster items in instructional skills required by teachers of Agricultural Education for effective teaching of soil conservation in Colleges of Education in South-eastern Nigeria. These include 4 items in planning instruction. The implication of this was that the professional competency and experiences of the two groups of respondents influenced their responses on the 4 skills in instruction required by teachers of Agricultural Education for effective teaching of soil conservation.

Generally the findings of the study on hypothesis one were in line with the findings of Onyemachi (2004) in a study on Management skills required by teachers for improvement in operating woodwork laboratory in Technical Colleges in Abia and Enugu States of Nigeria; where it was found out that there was no significance in the mean ratings of the responses of experienced and non-experienced teachers on the skills required by the woodwork teachers in planning, organizing, coordinating and evaluating instruction for operating woodwork laboratory in Technical Colleges. The findings of the study on hypothesis were also in line with the findings of Dibio (2008) in a study on requisite skills required by teachers of Agriculture for improving the teaching of yam production in secondary schools in Enugu state, where it was found out that there was no significant difference in the mean ratings of the two groups of respondents on 69 out of 80 but there was a significant difference in 11 out of 80 items in skills required by teachers of Agriculture for effective teaching of yam production.

The findings of the authors on hypotheses gave credence to the findings of this study on hypothesis one on the instructional skills required by Teachers of Agricultural Education for effective teaching of their students in Colleges of Education.

2) Soil Conservation Skills Required By Teachers of Agricultural Education for Effective Teaching of Students in Colleges of Education in South-eastern Nigeria.

It was found out from the study that the respondents agreed that all the six clusters and their 203 corresponding skill items in soil conservation were required by teachers of Agriculture for effective teaching of soil conservation in Colleges of Education in South-eastern Nigeria. Specifically each of the six cluster was discussed as follows:

Tillage Operations

It was found out from the study that the respondents agreed that all the 20 skills items identified in tillage operations were required by teachers of Agriculture for effective teaching of soil conservation in the Colleges of Education. These skills include scrap the soil surface, loosen the soil with hoe, stir the soil with hoe or shovel, bury weeds, twist and collect soil with hoe, raise the hoe with the soil, invert the hoe to allow the soil pour in a spot to form heap, ridge or mound and others. The findings of the study on tillage operations were in agreement with The findings of Troeh, Hobbs and Donahue (1993) who said that skills in tillage operation include; burying weeds, scraping soil surface, smoothening the crushed surface, manipulating (tilling) the soil leaving straw and stubble on the soil surface, constructing beds, mounds or ridges, making cross bars, breaking the old ridges to build new ones on the furrows (in a farm where old ridges exist,) by inverting half of the soil from adjacent ridges on both left and right, and mulching the constructed beds, mounds or ridges with crop residues among others. The findings of the study in tillage were also in conformity with the findings of Franzen (1997) that tillage operation involves performing tillage at right angles to the prevailing winds, following the contour of the land in hilly landscapes to intercept water on the event of heavy rainfall and others. The findings of the study further agreed with the findings of Brady and Weil (1999) that skills in tillage include using hand, hoe or mechanical drawn implement to stir the soil, breaking the soil into lumps, twisting and collecting the soil, inverting the soil while incorporating crop residues.

Soil Testing and Analysis

It was found out from the study that the respondents agreed that the all the 59 skill items identified in soil testing and analysis were required by teachers of Agricultural Education for effective teaching of soil conservation in the Colleges of Education. These skills includes the following; collection of soil sample, consulting soil testing laboratories, selection of the laboratory that is near the area to be tested, discussing the soil problem with the consultant or manager of the chosen testing laboratory, acquiring the required tool or implement to use, moving to the site, marking the area appropriately, collecting soil samples with probe, auger or shovel at 6-12 inches, sending to laboratory and determining the CEC pH, lime requirement, presence of Phosphorus, Potassium, magnesium and Nitrates, collecting result to and making recommendations based on the result of the analysis.

The findings of this study in soil testing and analysis were in agreement with the findings of Olaitan and Lombin (1985) that soil testing and analysis involves collection of soil sample and determination of Cation Exchange, soil pH, phosphorus, potassium, magnesium and Nitrates among other elements. The authors outlined the skills based on each test as follows:

Determination of Cation Exchange Capacity (CEC)

Place filter papers in two funnels and fill them with acidic soil, leach the soil in one of the funnels with a 100% potassium nitrate (KNO_3) solution, add few drops of soil indicator solution to both leachates and observe the pH of the leachate.

Determination of soil pH

Fill a test tube to a depth of almost 1cm with the soil to be tested, add the same quantity of barium sulphate, fill the tube with distilled water to 4cm from the top of the tube, shake the tube thoroughly, allow the content to settle, then add 8 ï 10 drops of universal soil indicator, shake the tube again and allow the content to settle, hold the test tube again at the pointed colour chart, compare each colour of the chart with the colour of the suspension containing the indicator and note the pH of the colour which it matches exactly.

F) Lime requirement of the soil

Place a small quantity of calcium carbonate on a glass, half fill a test tube with soil indicator solution, add a drop of acid and shake the tube thoroughly, add a few drop of sodium hydroxide solution and mix again, place a small quantity of soil or a piece of waxed paper and add drops of soil indicator solution until some of it runs out of the soil, test all the sample of the soil which are available, record the pH of each of them and se colour chart to relate the pH of soil sample of recommend application of lime per hectare.

G) Test for Phosphorus

Pour $10cm^3$ of ammonium molybdate solution into the glass vial, add 1g of soil and shake the vial vigorously for one minute, filter the solution, add a grain of dry powdered tin(ii) chloride solution to 5 cm^3 of the filtrate and observe the intensity of the colour of molybdenum as the intensity of the blue molybdenum content indicates whether the soil has a high, medium or low phosphorous content.

H) Test for Potassium

Pour 10 cm^3 of sodium cobalt nitrate solution into a glass vial, add one level tea spoon of air dried soil, shake the vial vigorously for a minute, filter the solution, use the pipette to add 2.5 cm^3 of anhydrous propyl 2OL to 5cm^3 of filtrate and mix the two solutions together thoroughly, after three minute compare the turbidity of the solution with a chart of standard.

I) Test for Magnesium

Put 1 cm^3 of soil extraction into a test tube, add one drop of titan yellow solution and shake the tube vigorously, add one drop of 5% sodium hydroxide solution and shake the tube again and observe the colour.

J) Test for Nitrates

Place one drop of the soil extract or a spotting title and add four drops of the dispheny lamine solution, after two minute stir the mixture and compare the colour with standard colour chart.

The findings of the study in soil testing and analysis were also in line with the findings of Playsier in Nwankwo (2007) who said that soil testing and analysis involves collection of soil sample, crushing the collected sample in a mortar, sieving the sample through a 2mm brass, stainless or plastic sieve, packaging the soil sample and taking to the laboratory for analysis. The findings of the study in this direction were also in line with the findings of Silvertooth (2001) who identified soil testing and analysis skills to include consult some laboratories, select one that is near the area to be tested, discuss the soil problem with the consultant or manager of the chosen testing laboratory, obtain testing tools, mark a relatively uniform field fig A and a field that has more than a distinct area fig B, collect soil samples with probe, auger or shovel at 6-12 inches, collect 25 cores from each marked area, mix each of the 25 cores from each area together to give a common composite sample, take 20-30 ounces (volume) or sample container-full, send to laboratory, test for NPK, pH, CEC, Na levels or SAR (Sodium Adsorption Ratio) and collect the lab result with recommendation. The findings of the study were further in conformity with the findings of Synder (2001) who said that soil testing and analysis involves consulting chosen laboratory for recommended sampling depth based on specific tillage systems and fertilizer application methods, using suitable soil augers or probe, marking soil probe with a file or permanent ink to accurately gauge the sampling depth, collecting soil samples, mixing the sample cores and taking to the laboratory for actual analysis among others.

Manure Preparation and Application

It was found out from the study that the respondents agreed that all the 62 skills identified in manure preparation and application were required by teachers of Agricultural Education for effective teaching of soil conservation in Colleges of Education. The discussion of the skill items in manure preparation and application were based on specific manure and presented as follows:

Farmyard manure

It was found out from the study that the respondents agreed that all the 6 skill cluster items in farmyard manure were required for effective teaching of soil conservation in Colleges of Education. These skills include; house animals like goat, sheep, poultry in pen, feed the animals with grasses, legumes, water and other materials, collect animal dung and litter from the pen, mix the daily collected beddings or floor litter together, heaping the materials in a place, allowing them to decay and applying to the soil using appropriated method. The findings of the study in farmyard manure were in line with the findings of Olaitan and Lombin (1985) that reparation and application of farmyard manure involves providing grasses in animal pen, allowing the animal to urinate and defecate on top of the grass, collection of the beddings from the pen and spreading on the farm. The findings of the study were further in agreement with the findings of Archer (1988) who said that steps in farmyard manure preparation and application required allowing animals to deposit their faeces and urine on top of grasses, allowing the beddings sometimes to decompose and spreading the manure in the farm among others. The findings of the study were also in consonant with the findings of Nwankwo (2007) that acquiring farmyard manure for the farm involves housing animals like goat, sheep, poultry in pen, feeding the animals, collecting animal dung and litter from the pen, mixing the daily collected beddings or floor litter together, heaping the materials together in a place, allowing them to decay and applying to the soil using appropriated method.

Compost Manure Preparation and Application

It was found out from the study that the respondents agreed that all the 25 skill cluster items in compost making and application were required for effective teaching of soil conservation in Colleges of Education. These skills include; select appropriate site, map out and label seven plots or dig pits, provide compost materials, cut or shred the materials, build up heaps using grasses among others. The findings of the study in composting were in line with the report of Food and Agricultural organisation (FAO), (1980) that composting requires selection of appropriate site, digging trenches or pits of about 1m deep, filling the pit with organic residues adding alternative layers, covering the pit with layers of refuse and plastering to drive away files. The findings of the study in composting were also in conformity with the findings of Olaitan and Iombin (1985) that composting involves selection of suitable site, mapping out seven plots, labelling the plots as A,B,C,1, 2, 3 and 4, providing fence round the corners, filling the corners with compost materials, cutting the materials with implements, building up the heaps in plots 1,2,3 and 4 with the materials, spraying urine, wood ash, animal dung or a head pan or bucket full of old compost on top of each heap, sprinkling water and handful of soil on each 4 heaps, repeating the process of applying water after each layer until the required level of the compost is attained, driving a strong long stick (testing stick) through the top until it reaches the centre, taking the stick out after the first day and turning the materials from heap 1 and 2 into space A and materials in heap 3 and 4 into space B among others.

Green Manure

It was found out from the study that the respondents agreed that all the 9 skill cluster items in green manure preparation and application were required for effective teaching of soil conservation in Colleges of Education. These skills include; collection of seeds/cuttings, preparation of seedbeds, broadcasting the seeds on the prepared seedbeds, sowing the seeds or cutting on the beds, watering after planting and others. The findings of the study in green manure were in line with the findings of Adede (2001) that green manure can be planted as a sole crop or be intercropped with cereals using such skills as select seeds, prepare and water the seed beds, plant the seeds by broadcasting them, weed the plot regularly to reduce weeds and pests, cut the leaves and stems for fodder if necessary or allow them to grow up to 2years, slash stalk and leaves, turn them into the soil , leave at least 7days before planting the next crop. The findings of the study were also in agreement with the opinion of Howard and Yeshwant (2005) who identified skills in green manure preparation as planting leguminous crop after harvesting crop, irrigating the farm if ample rainfall is less than 5inches, cutting or ploughing the crop before flowering, distributing evenly over the farm and allowing 8 weeks to elapse before sowing the next crop.

Fertilizer application

It was found out from the study that the respondents agreed that all the 8 skill cluster items in fertilizer application were required for effective teaching of soil conservation in Colleges of Education. These skills include; plough the field, broadcast fertilizer uniformly over uncultivated land, make ring round crop stand, spread appropriated quantity fertilizer evenly in the made ring, cover with soil and apply second dose after 3-4 weeks depending on the crop. The findings of the study in fertilizer application were in agreement with the findings of Agbo (1999) who identified the skills in fertilizer application to include spreading fertilizer uniformly over uncultivated land using hang or machine, protecting plantsô stems or roots from being in contact with fertilizer, making an opening in ring form round the crop or in bands, spreading fertilizer evenly in the ring or bands a few centimetre away from the crop and covering the applied fertilizer with soil. The findings of the study were also in consonant with the findings of Youdeowei et al (1999) who said that skills in fertilizer application include ploughing the field/land, spreading the fertilizer uniformly over the ploughed field/land, and applying second dose 3-4 weeks after planting crops.

Mulching

It was found out from the study that the respondents agreed that all the 14 skills items identified in mulching were required by teachers of Agricultural Education for effective teaching of soil conservation in Colleges of Education. These skills include; identify appropriate mulch materials, determine when to apply, collect the identified materials, carry the materials to the site/farm and spreading them on the beds or on top of the soil surface after tillage.

The findings of the study in this direction were in agreement with the findings of Cooper (1999) who indicated that the skills in mulching include collecting suitable mulching materials, carrying the materials to the site/farm and spreading them on the beds or on top of the soil after tillage. The findings of the study were also in line with the findings of Beauliew (2002) that mulching required identifying the appropriate mulch materials, raking them, putting the materials into mulch bin, cutting or shredding the materials using mulching lawn mower, spreading the shredded mulch over the land or cultivated ridges among others.

Crop Rotation

It was found out from the study that the respondents agreed that all the 13 skills items identified in crop rotation were required by teachers of Agricultural Education for effective teaching of soil conservation in the Colleges of Education. These skills include; make a long rotation plan, make a list of crops to grow, group the crops by plant family, create planting schedule, draw a map of beds, ridges or mounds, indicate where to plant each crop in the map, label each crop with the year and plot, implement the plan and others.

The findings of the study in crop rotation were in agreement with the findings of Moeller (2007) who identified skills in crop rotation as making a long range rotation plan by determining the goals in view, creating a planting schedule, following the planting schedule by planting the plants chosen in order of sequence, modifying the order to minimize the loss working with neighbouring growers to ease the benefit of the rotation plan, using the crop adjustment in the plan, being consistent for consistent result and keeping appropriate records so that gain or loss in production can be observed. The author further that the record should indicate crop type, yield and weather along with the cost of soil amendments, fertilizer, pH, chemicals, pesticides and herbicides. The findings of the study in this direction were in agreement with the report made by Maluniu (2009) that skills in crop rotation include selecting the crop varieties, planting specific crops which will help realize the goals, implementing the rotation plan in the rotation order chosen among others

Soil erosion prevention and control

It was found out from the study that the respondents agreed that all the 43 skill items identified in soil erosion prevention and control were required by teachers of Agricultural Education for effective teaching of soil conservation in Colleges of Education. These skills in prevention and control were discussed based on prevention and control thus

Soil Erosion Prevention

It was found out from the study that the respondents agreed that all the 18 skill items identified in soil erosion prevention were required by teachers of Agricultural Education for effective teaching of soil conservation in Colleges of Education. These skills include; spread organic mulch over uncultivated land, make ridges across the slope, make cross bars between ridges, plant grasses on the land that is likely to be eroded and others.

The findings of the study in this direction were in agreement with the findings of Olaitan (2005) who identified skills in soil erosion prevention as mulch the farm, plant grasses on the land that is likely to be eroded, break the slope into series of flat-surfaces called terraces, check walls cut across to prevent rill and landslide, establish crops in strips at right angles to the direction of water flow, break the soil clods moderately in order to avoid excessive damages to soil granules, plant young tree seedlings in areas likely to be eroded in future, prepare ridges in spiral forms to restrict rapid movement of water in the farm. The findings of the study were also in consonant with the findings of eHow (2009) that indicated that skills required to prevent soil erosion include plant trees, shrubs and other plants, grow cover crops on farm land, construct surface runoff barriers, practice terracing on sloped areas among others. The findings of the study in soil erosion prevention were also in conformity with the findings of Feed (2009) that outlined skills in soil erosion prevention to include making land surface rough and establishing vegetative covers among others.

Soil Erosion Control

It was found out from the study that the respondents agreed that all the 25 skill items identified in soil erosion control were required by teachers of Agricultural Education for effective teaching of soil conservation in Colleges of Education. These skills include; plough on the contour, till the soil to produce rough clod dry surface, place plant residues on the surface to obtain maximum roughness, construct small ridges normal to direction of the wind, plant on the contour, put checks in furrows, establish grasses that have the ability to withstand wind, plant tress to act as shelter belts for wind erosion control, mulch with suitable materials and build level terracing and others.

The findings of the study in this direction were in agreement with the findings of Schwab, Fangmeier, Elliot and Fervert (1993) that to control soil erosion requires ploughing on the contour, placing plant residues on the surface to obtain maximum roughness, constructing small ridges to direction of the wind, planting on the contour, putting checks in furrows, establishing grasses that have the ability to live long and withstand wind, planting trees to act as shelter belts for wind erosion control, mulching with suitable materials and building level terracing. The findings of the study in this direction were also in agreement with the findings of Brady and Weil (1999), that practices to be employed in soil erosion control include planting permanent vegetations to slow down runoff trap sediments and eventually build up eroded soils, filling in gullies with sand, shaping gullies for smooth water flows, sowing grasses to serve as water ways, constructing check dams of about 0.5m high at intervals of 4-9m depending on the slope, planting perennial vegetations on exposed road cuts to eliminate soil loss, providing cross channels (shallow ditches or water channel) every 25 to100 m to prevent excessive accumulation of water.

Irrigation

It was found out from the study that the respondents agreed that all the 6 skill items identified in irrigation were required by teachers of Agricultural Education for effective teaching of soil conservation in the Colleges of Education. These skills include identification of the type or method of irrigation to adopt, determination of plant-water requirement, laying the system, irrigating the base plants, calculating water usage and carrying out maintenance practices of the equipment.

The findings of the study in irrigation were in line with the report of Wikipedia (2009) which indicated that the skills required to ensure proper irrigation of the soil include examining the plants to be irrigated, calculating the required quantity of water and then saturating the soil with water and others. However the findings of the study in irrigation were in disagreement with the findings of Web (2007) that stated that skills in irrigation include adjusting the irrigation controller (timer) running timer for seasonal changes in weather once a month, putting a weekly or monthly reminder for the adjustment of timer among others. The researcher would like to support the findings of the study as against the report of Web because the authorǿs report was based on automated system while the respondents were still using mechanical or manual system using watering can.

Generally the findings of the study in 203 skill items in soil conservation were in agreement with the findings of Nwankwo (2007) in a study on requisite skills in soil conservation required for equipping secondary school graduates for profitable crop production in Abia State;

where it was found out that secondary school graduates require 13 skills in tillage, 62 in soil testing and analysis, 18 in each of irrigation soil erosion prevention and control 31 in crop rotation and 17 in afforestation. The findings of the study were also in conformity with findings of Azunku (2007) in a study on soil conservation skills required by students of Agricultural Education in Colleges of Education in South-eastern Nigeria. The author found out that seven soil conservation cluster and their 228 corresponding skill cluster items were required by students of Agriculture in Colleges of Education in South-eastern Nigeria for effective teaching in secondary schools. The findings of the study in soil conservation were further in agreement with the findings of Abu (2009) on competency improvement needs of farmers in soil conservation practices in Kogi State where it was found out that six cluster and 316 competencies were needed by farmers for soil conservation in the state.

The views, statements, reports and findings of the authors whose works were reviewed above helped to validate the findings of the study on the soil conservation skills required by teachers of Agricultural Education for effective teaching of students in Colleges of Education.

Ho_2 The findings of the study on null hypothesis two revealed that there was no significant difference in the mean ratings of the responses of the two groups of respondents (Lecturers and teachers) on 6 clusters and 176 out of their 203 skill cluster items on soil conservation skills required by teachers of Agricultural Education for effective teaching of soil conservation in Colleges of Education in South-eastern Nigeria. These include 16 items in tillage, 49 in soil testing and analysis, 54 in manure preparation and application, 12 in crop rotation, 39 in soil erosion prevention and control and 6 in irrigation. The implication of this was that the professional competencies and experiences of the two groups of respondents did not influence their responses on the 176 skill items in soil conservation practices. However, there was a significant difference in the mean ratings of the two groups of respondents on 27skill cluster items in soil conservation. These include 4 items in tillage, 10 in soil testing and analysis, 8 in manure preparation and application, 1 in crop rotation and 4 in soil erosion prevention and control. The implication of this was that the professional competency and experiences of the two groups of respondents influenced their responses on the 27 skill items.

The findings of the study were in consonance with the findings of Miller (2006) in a study on professional improvement need of metal work teachers on Colleges of Education in South Western Nigeria where it was found out that there was no significant difference in mean ratings of the responses of metalwork teachers on the professional skill areas on which metalwork teachers needed improvement for better performance of teaching job in Colleges of Education. The findings of the study were also in consonance with the findings of Nwankwo (2007) in a study on requisite skills required in soil conservation for equipping secondary school graduates for profitable crop production in Abia state where it was found out that there was no significant difference in the mean ratings of the responses of teachers and extension agents on 209 requisite skill items in soil conservation identified by the study. The findings of this study on the hypothesis two were also in agreement with the findings of Azunku (2008) where it was found out that there was no significant difference on the mean ratings of Lecturers and Teachers of Agricultural science in secondary schools on 7 cluster and their 228 corresponding skill cluster items required by teachers of Agriculture in for effective teaching of soil conservation in secondary schools.

The findings of the authors on hypotheses gave credence to the findings of this study on hypothesis on soil conservation skills required by Teachers of Agricultural Education for effective teaching of their students in Colleges of Education.

3) Instructional skills where teachers of Agricultural Education need improvement for effective teaching of soil conservation in Colleges of Education in South-eastern Nigeria.

It was found out from the study that the teachers of Agricultural Education indicated that they need improvement in three clusters and 38 out of their 39 corresponding skill items in instruction identified by the study for effective teaching of soil conservation in Colleges of Education. The areas where they need improvement include 13 skill items in planning, 13 items in implementing instruction and 12 in evaluating instruction for effective teaching of soil conservation in Colleges of Education in South-eastern Nigeria.

The findings of the study were in conformity with the findings of Akinseinde (1993) in a study on professional in-service needs of Technical Teachers in secondary schools in Delta and Edo States. The author found out that technical teachers needed improvement in planning, delivery and evaluating instruction. The findings of this the study were also in line with the findings of Bryan and Namyong (1997) in a study on assessment of in-service needs of beginning teachers of agriculture in the state of Missouri where it was found out that I2 competencies were identified as having a greater need for in-service education for beginning teachers of Agriculture. The findings of the study were also in conformity with findings of Feral (2003) in a study on ñ do science teachers demographic factors affect their in-service needsò where it was found out that science teachers mostly need in-service need in delivering instruction. The findings of the study were in consonance with the findings of Onyemachi (2004) in a study on the management skills required by teachers for improvement in operating woodwork laboratory in technical colleges in Enugu and Abia States of Nigeria. The author found out that woodwork teachers required improvement in 9 skills in planning, 12 in organizing, 8 in coordinating and 9 in evaluating instruction for effective operation of woodwork laboratories in the two states. The findings of the study were also in line with the findings of Miller (2006) in a study on professional improvement needs of metal work teachers in Colleges of Education in South Western Nigeria where it was found out that metalwork teachers needed improvement in 14 skill items in instructional planning, 11 skill items in instructional implementation and 7 skill items in evaluation of instruction. The findings of the study were also in conformity with findings of Lilia, Kamisah and Subahan (2006) in a study on what Malaysian science teachers need to improve their instruction. The authors found out that Malaysian secondary school science teachers need integrated multimedia and English in instruction in addition to skills in planning, managing and delivering instruction with knowledge and skills in science subjects for effective performance of their job. The findings of the study in skills in instruction where teachers of Agriculture need improvement were in further in agreement with the findings of Dibio (2008) in a study on requisite skills required by teachers of Agricultural Education for improving the teaching of yam production where it was found out that teachers of Agriculture need improvement in 27 skill cluster items identified by the study for effective teaching of yam production. The findings of the authors on improvement need gave credence to the findings of this study on instructional skills where teachers of Agricultural Education need improvement for effective teaching of soil conservation in Colleges of Education.

4) Soil conservation skills where teachers of Agricultural Education need improvement for effective teaching of students in Colleges of Education in South-eastern Nigeria.

It was found out from the study that the teachers of Agricultural Education indicated that they need improvement in six cluster and 152out of 203 corresponding skill cluster items identified in soil conservation for effective teaching of students in the Colleges of Education. The areas where they need improvement include 20 skill items in tillage, 42 in soil testing and analysis, 46 in manure preparation and application, 11 in crop rotation, 28 in soil erosion prevention and control and 5 in irrigation for effective teaching of students of Agriculture in Colleges of Education in South-eastern Nigeria.

The findings of this study were in agreement with the findings of Uga (2004), who carried out a study on work-skill improvement needs of farmers on rice production in Ebonyi state. The author indicated that farmers needed improvement in 9 work-skill items in nursery establishment, 40 work-skill items in field establishment, 11 work-skill items in harvesting, threshing and winnowing, 43 work-skills items in processing and storage and 8 work-skill items in marketing. The findings of this study were also in conformity with the findings of Miller (2006) who carried out a study on professional improvement need of metal work teachers in Colleges of Education in South Western Nigeria. The author found out that metal work teachers needed improvement in 128 out of 130 skill items identified by the study. These areas included 26 skill items in sheet metal, 45 skill items in machine shop practice, 19 in foundry and forgery, 8 in welding and fabrication. The findings of the study were also in agreement with the findings of Ifeanyieze and Olaitan (2009) in a study on the requisite skills required for capacity building of teachers of agriculture for effective teaching of yam production in Colleges of Education in South-eastern Nigeria. The authors found out that teachers of agriculture needed capacity building in 9 skills in each of pre-planting and planting operations; 16 skills in post planting operations 13 skills in processing and storage and 18 in delivering instruction. The findings of the study were also in conformity with the findings of Azunku (2007) in a study on soil conservation skills required by students of Agriculture in

Colleges of Education in South-eastern. The author found out that 7 soil conservation cluster and their 228 corresponding skills cluster items were required by students of Agriculture in Colleges of Education for effective teaching in secondary schools. These cluster and the skill cluster items were tillage 11 items, soil testing and analysis 40 items, manuring 57 items soil erosion prevention and control 39 items drainage 11 items, crop rotation 32 items and afforestation 38 items. The findings of the study were in conformity with the findings of Abu (2009) in a study on competency improvement needs of farmers in soil conservation practices in Kogi state; where it was found out that farmers needed improvement in the cluster listed below with their corresponding competencies in soil conservation practices. Tillage= 14 skill items, soil testing and analysis =82 items, soil erosion prevention and control= 194 items, Manuring = 57 items crop rotation = 16 items and afforestation = 53 items.

The findings of the authors on improvement needs gave credence to the findings of this study on soil conservation skills where teachers of Agricultural Education need improvement for effective teaching of students in Colleges of Education.

CHAPTER V

SUMMARY, CONCLUSION AND RECOMMENDATION

Restatement of the Problem

Graduates of Agricultural Education programme from Universities have been exposed to instructional and soil conservation skills in Agriculture to enable them teach students effectively. World Bank report on Africa (2004) indicated that teachers recruited into the teaching positions do not meet the quality required for effective teaching. The Nigerian Education Research and Development Council (NERDC) in Iheji, Ifeanyieze and Olaitan (2010) also stated that 50% of the teachers in Nigerian educational system are found incompetent. This means that Teachers of Agricultural Education in Colleges of Education in South-eastern Nigeria were not exempted from the World Bank and NERDC report as a study carried out by Ella (2007) revealed that graduates of Agricultural Education programme of Colleges of Education in south-eastern Nigeria acquired low competence in content areas of Agricultural Education during their training. For teachers of Agricultural Education in Colleges of Education to be exonerated from the blame, there was need to find out through assessment if these teachers possessed the required instructional and technical skills for teaching soil conservation. This study therefore identified the instructional and technical skill improvement needs of teachers of Agriculture at Colleges of Education so that they could be re-trained for effective teaching of soil conservation practices to their students. Specifically, the study sought to

1. find out the instructional skills required by teachers of Agricultural Education for effective teaching of soil conservation in Colleges of Education in South-eastern Nigeria.
2. find out the soil conservation skills required by teachers of Agricultural Education for effective teaching of student in Colleges of Education in South-eastern Nigeria.
3. determine the instructional skills where teachers of Agricultural Education need improvement for effective teaching of soil conservation in Colleges of Education in South-eastern Nigeria.
4. determine the soil conservation skills where teachers of Agricultural Education need improvement for effective teaching of students in Colleges of Education in South-eastern Nigeria.

Description of Procedure Used

Four research questions were developed and answered by the study. Two null hypotheses were formulated and tested at 0.05 level of significance and 100 degrees of freedom. The study adopted survey research design making use of Borich Assessment Model for collection of data. The population for the study was 109 made up of 20 Lecturers of Agricultural Education in Universities and 89 teachers of Agricultural Education in Colleges of Education in South-eastern Nigeria. Due to the small number of the population, there was no sampling as the entire population was studied. Relevant literature was reviewed to generate questionnaire items used for the study. The questionnaire was divided into two parts A and B. Part A was used to collect information on the personal data of the respondents while Part B was divided into two sections 1 and 2. Section 1 was made up of questionnaire items in instruction while section two consisted of questionnaire items on soil conservation skills. Five experts face validated the instrument. Ten copies of the questionnaire were given to teachers of Agricultural Education at Institute of Ecumenical Study Enugu which was not included in the study. The copies of the questionnaire were collected and utilised for determining the internal consistency of the items using Cronbach alpha method This yielded coefficients between 0.83 and 0.97, for the instructional and technical skill questionnaire respectively, thus indicating that the instrument was reliable. The questionnaire was administered on 109 respondents by the researcher and five trained research assistants. Out of the one hundred and nine (109) copies of the questionnaire administered, one hundred and two (102) were retrieved and analysed. Mean, standard deviation and Improvement Need Index (INI) were used to answer the research questions while t-test statistic (two-tailed) was used to test the null hypotheses at 0.05 level significance and 100 degrees of freedom. The analysis helped to generate findings that were discussed in chapter four.

Major findings of the Study

It was found out that

1. Three clusters with their thirty nine (39) corresponding skill items in instruction were required (10 highly required and 29 averagely required) by teachers of Agricultural Education for effective teaching of soil conservation in Colleges of Education in South-eastern Nigeria.
2. The first hypothesis tested revealed that there was no significant difference in the mean ratings of the responses of the two groups of respondents (Lecturers and Teachers) on three (3) clusters and thirty-five (planning, 9/13 and implementing 14/14 and 12/12) out of their thirty-nine skill items in instruction required by teachers of Agriculture for effective teaching of soil conservation in Colleges of Education in South-eastern Nigeria. Specifically, there was a significant difference in four (4) skill cluster items in planning instruction; therefore, the null hypothesis of no significant difference was rejected for the four (4) items while it was upheld for the thirty-three (35) skill items which were 9 items in planning, 14 items in implementing and 12 items in evaluating instruction.

3. Six clusters with their two hundred and three (203) corresponding skill items in soil conservation were required (91 highly required and 112 averagely required) by teachers of Agricultural Education for effective teaching of students in Colleges of Education in South-eastern Nigeria.

4. There was no significant difference in the mean ratings of the responses of the two groups of respondents (Lecturers and Teachers) on six (6) clusters and one hundred and seventy-six (176) out of their two hundred and three (203) skill items in soil conservation required by teachers of Agriculture for effective teaching of students in Colleges of Education in South-eastern Nigeria. Specifically, there was a significant in twenty-seven (27) (4 in tillage, 10 in soil testing and analysis, 8 in manuring, 1 in crop rotation and 4 in soil erosion) skill items in soil conservation; therefore, the null hypothesis of no significant difference was rejected for the 27 items while it was upheld for the 176 items in soil conservation.

5. Teachers of Agricultural Education in Colleges of Education need improvement in three clusters with their thirty-eight (38) corresponding skill items in instruction for effective teaching of soil conservation in Colleges of Education in South-eastern Nigeria.

6. Teachers of Agricultural Education in Colleges of Education also need improvement in six clusters and one hundred and fifty-two (152) out of their two hundred and three (203) corresponding skill items in soil conservation for effective teaching of students in Colleges of Education in South-eastern Nigeria.

Conclusion

Based on the findings and discussions of the study, the following conclusions were made;

1. Teachers of Agricultural Education require appropriate instructional skills in order to teach soil conservation components of their curriculum effectively.
2. Both lecturers and teachers of Agriculture in Universities and colleges of Education collaboratively agreed that instructional and soil conservation skills should be utilized by teachers to effectively teach soil conservation component of the curriculum.
3. Teachers of Agricultural Education are deficient in majority of instructional and technical skills required for effective teaching of soil conservation practices based on the performance gap analysis of the study.

4. Interventions are needed on the part of college administration and government in organising capacity building workshops or re-training of teachers utilising identified skills in their need areas for improving their effectiveness in teaching soil conservation

Implication of the Study

The findings of this study have some educational implications for teachers of Agricultural Education and administrators of the Colleges of Education.

If the findings of this study on skills required in instruction and soil conservation practices are implemented by Colleges of Education, teachers of agricultural education in these Colleges could utilize the skills identified by this study in planning, implementing and evaluating instruction to improve their teaching in soil conservation practices effectively. The teachers could also become aware of their deficient areas and so make themselves available for re-training programme through workshops or in-service training in universities in order to equip themselves professionally and technically for their teaching job.

If the findings of this study on deficiency areas of teachers of Agricultural Education in Colleges of Education are implemented by NCCE, the administrators of Colleges of Education could help approve improvement intervention for the re-training of their teachers so that they can teach soil conservation effectively to their students in the colleges.

Recommendations

The following recommendations were made for implementation based on the findings of this study,

Teachers of Agricultural Education should utilize the findings of this study on their improvement need to seek for sponsorship from their administrators in order to attend re-training programme for improving their competency in teaching soil conservation practices.

The administrators should utilize the findings of this study on the skills required in instruction and soil conservation; and areas where their teachers of Agriculture need improvement to approve requests from their teachers for sponsorship to participate in re-training programmes to equip them effectively for teaching soil conservation to the students in their colleges.

The administrators of Colleges of Education should utilize the findings of this study on the skills required in instruction and soil conservation practices and areas where their teachers need improvement and organise internal workshops in their colleges for re-training of their teachers or they could use the information and solicit for fund from NCCE and other government agencies in order to improve their teachers professionally for better performance of their job.

The identified areas where teachers need improvement could be incorporate into the pre-service training programme and curriculum of institutions training teachers for Colleges of Education.

Suggestion for further Studies

The following suggestions were made for further research;

Technical skill improvement needs of NCE graduates of Agricultural Education for effective teaching of Agriculture in Junior Secondary Schools in South-eastern Nigeria.

Material resource inputs into Agricultural Education Programme for effective re-training of teachers of Agricultural Education in soil conservation Colleges of Education in Soil conservation in South-eastern Nigeria.

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APPENDIX A

Name of Institutions (Universities and Colleges of Education) in South-eastern Nigeria and number of staff

Universities in South Eastern Nigeria and the number of Lecturers of Agricultural Education

S/	Name of University in South-eastern Nigeria	Numbers Of Lecturers of Agricultural Education
1	Abia State University	1
2	Ebonyi State University	5
3	Enugu State University of Science and Technology	2
4	Imo State University	3
5	University of Agriculture, Umudike	1
6	University of Nigeria, Nsukka	8
	Total	**20**

Source: University Staff Nominal Rolls 2010.

Colleges of Education in South Eastern Nigeria and the number of Teachers of Agriculture

S/	State	Name of Colleges of Education	Number of Lectures of
1	Abia	College of Education, Arochukwu, Abia	9
2	Anambra	a) College of Education, Nsugbe b) Federal College of Education (Technical), Umunze	20 12
3	Ebonyi	College of Education, Ikwo,	17
4	Enugu	Enugu State College of Education (Technical), Enugu. Federal College of Education, Eha-Amufu	8 10
5	Imo	Alvan Ikoku College of Education, Owerri	13
		Total	**89**

Source; Muhammad (2007)

APPENDIX B

Department OF Vocational Teacher Education

University of Nigeria

Nsukka

Date -----------

Dear Sir

Request for Validation of Research Instrument

I am a postgraduate (PhD) student in the above department, University of Nigeria, Nsukka. I am currently undertaking a research project aimed at identifying the professional and technical skills required by teachers of Colleges of Education in teaching of soil conservation. It is hoped that the skills identifies will be developed into a module that will be used as a training programme for the re-training of teachers of Agriculture in Colleges of Education in South-eastern Nigeria.

The attached is a draft copy of the questionnaire for the study. You are please requested to spare your busy time to help vet the items for clarity, relevance and total coverage of the required skills in each conservation technique for use in the collection of data for the study.

You are also requested to put down your comments and suggestions for improving the quality of the instrument. The researcher pleads you to append your signature and date after vetting the items

Thanks for your assistance

Yours faithfully,

APPENDIX C

Reliability Coefficient, for the Professional and TecHRical Skill Questionnaire

			R
Type of skill	Professional	Planning	0.69
		Implementation	0.77
		Evaluation	0.95
		Overall	0.83
	Technical	Tillage	0.84
		Soil Testing & Analysis	0.85
		Determination of cation Exchange	0.82
		Determination of soil pH	0.87
		Measurement of acidity	0.87
		Test for Phosphorus	0.86
		Test for Potassium	0.94
		Test for Magnesium	0.76
		Test for Nitrates	0.71
		Manure preparation & Application	
		Farm yard manure	0.92
		Compost manure	0.94
		Green Manure	0.83
		Fertilizer application	0.64
		Mulching	0.85
		Crop Rotation	0.73
		Soil Erosion Prevention and Control	
		Erosion Prevention	0.74
		Erosion Control	0.66
		Irrigation	0.73

		Overall	**0.97**

APPENDIX D

Department OF Vocational Teacher Education
University of Nigeria
Nsukka
Date -----------

Dear Sir

Request to Respond to Questionnaire

I am a postgraduate (PhD) student in the above department, University of Nigeria, Nsukka. This questionnaire is designed to elicit information that will be useful for carrying out a study titled **Professional and Technical Skill Improvement Needs of Teachers of Agricultural Education Programme in Soil Conservation in Colleges of Education in South-eastern Nigeria.**

You are please requested to respond to the items as objectively as possible. Every information supplied will be treated confidential and will be used specifically for academic purpose.

I therefore appeal to you to spare part of your time to complete the copy of the questionnaire given to you

Thanks for your assistance
Yours faithfully, sgd

F.O Ifeanyieze Prof N.J Ogbazi
PG/Ph.D/06/42114 Supervisor
Student

APPENDIX E

INSTRUCTIONAL SKILLS

Mean Ratings of the Responses of Lectures and Teachers on the Instructional Skills Required for Effective Teaching of Soil Conservation in Colleges of Education in South-eastern Nigeria.

N=102

S/N	Item statement on Professional Skills	$\bar{X}$	SD	Remark
	Planning Skills			
1	Conduct a need analysis on soil conservation	3.54	0.78	HR
2	Consult curriculum standards on soil conservation practices	3.30	0.75	AR
3	Determine the basic skills required in soil conservation practices	3.51	0.66	HR
4	Determine the objective required in soil conservation practices	3.43	0.75	AR
5	Identify skills that need to be scaffold (sequenced)	3.26	0.81	,,
6	Break the soil conservation course into units or lesson topics	3.42	0.81	,,
7	Develop objectives for each topic on soil conservation while writing the lesson plan	3.51	0.80	HR
8	Identify materials/resources that are best suited for accomplishing each lesson topic.	3.62	0.61	,,
9	Design class activities that may involve listening, speaking, reading writing and manipulating	3.32	0.77	AR
10	Identify opportunities for learners to put the skills into practice outside learning environment.	3.47	0.80	,,

11	Identify instructional strategies that include variety of activities focusing on the objectives	3.54	0.89	HR
12	Provide the materials that will help in the achievement of each topic in soil conservation	3.53	0.83	,,
13	Review objectives periodically	3.38	0.71	AR
		3.45	**0.77**	,,
	Implementation Skills			
14	Inform students technically of the objectives of each lesson on soil conservation	3.33	0.82	AR
15	Provide students with clear statement of skills required in each topic of soil conservation lesson	3.30	0.94	,,
16	Provide students with clear statement of assessment requirements	3.34	0.77	,,
17	Introduce the topic to the students.	3.51	0.89	HR
18	Give summary or revision of the previous lesson to link it with the days lesson	3.48	0.80	AR
19	(For a new lesson), test the studentsôentry behaviour with generally stimulating questions that are familiar but in the direction of the lesson on soil conservation	3.33	0.98	,,
20	Present the subject content in soil conservation in a coherent manner	3.40	0.88	,,
21	Utilise different instructional strategies	3.33	0.89	,,
22	Introduce learning materials at appropriate time.	3.56	0.85	HR
23	Ask questions to guide the learnersô	3.49	0.87	AR
24	Give students opportunity to answer the questions on soil conservation practices.	3.48	0.75	,,
25	Correct wrong answers where nobody could do so in the class.	3.53	0.83	HR
26	Provide opportunities for individual	3.10	0.86	AR

	consultations after the lesson			
27	Modify the lesson based on studentsôreply to questions.	3.23	0.75	,,
		3.38	**0.94**	,,
	Evaluation skills			
28	Determine the assessment procedures on each topic on soil conservation	3.29	0.94	AR
29	Decide how to judge the performance of students on theory or practical.	3.33	0.88	,,
30	esign the assessment focusing on the content ıat is most important for students to learn	3.27	0.88	,,
31	Pose closure questions at the end of each dayôs lesson on soil conservation.	3.38	0.91	,,
32	Provide cross-word puzzles or a more challenging worksheet to keep fast working students busy and advanced ones engaged.	2.94	0.78	,,
33	Observe studentsôbody language while carrying out activities on soil conservation.	2.88	0.91	,,
34	Observe students frequently off-task behaviours in the classroom	3.67	0.83	HR
35	Observe students in group while discussing soil conservation practices	3.23	0.79	AR
36	Utilise a variety of formal, informal. Formative and summative assessments methods	3.34	0.87	,,
37	Assign grades to studentsôperformance	3.40	0.93	,,
38	Use assessment results to evaluate students interest in the content areas of agriculture	3.14	1.02	,,
39	Give feedback (result) to students on their performances in soil conservation practices	3.39	0.80	,,
		3.27	**0.89**	,,

TOTAL HR = 10, AR = 29

APPENDIX F

Hypothesis 1
t-test Analysis of the responses of lecturers and teachers on the Instructional skills required for effective teaching of soil conservation.
N= 102

S/N	Instructional Skills	$\overline{X}_1$	S_1	$\overline{X}_2$	S_2	$\overline{X}_G$	SD	t- cal	t-tab	Rem
	Planning Kills									
1	Conduct a need analysis on soil conservation	3.12	0.03	3.56	0.75	3.34	0.83	2.20	1.98	S
2	Consult curriculum standards on soil conservation practices	2.94	0.67	3.31	0.13	3.13	0.81	1.85	,,	NS
3	Determine the basic skills required in soil conservation practices	3.12	0.17	3.53	0.53	3.33	0.70	2.24	,,	S
4	Determine the objective required in soil conservation practice	3.29	0.59	3.40	0.61	3.35	0.76	0.53	,,	NS
5	Identify skills that need to be scaffold (sequenced)	3.06	0.41	3.24	0.46	3.15	0.85	0.82	,,	NS
6	Break the soil conservation course into units or lesson topics	3.24	0.44	3.40	0.49	3.32	0.85	0.77	,,	NS
7	Develop objectives for each topic on soil conservation while writing the lesson plan	3.24	0.27	3.51	0.19	3.38	0.78	1.20	,,	NS
8	Identify materials/resources that are best suited for accomplishing each Lesson topic.	3.29	0.19	3.62	0.22	3.46	0.67	2.08	,,	S
9	Design class activities that may involve listening, speaking, reading writing	2.88	0.24	3.34	0.70	3.11	0.73	2.29	,,	S

	and manipulating									
10	Identify opportunities for learners to put the skills into practice outside Learning environment.	3.35	0.70	3.44	0.70	3.40	0.80	0.39	,,	NS
11	Identify instructional strategies that include a variety of activities focusing on the objectives	3.24	0.80	3.18	0.80	3.21	0.87	0.25	,,	NS
12	Provide the materials that will help in the achievement of each topic in soil conservation	3.35	0.49	3.51	0.51	3.43	0.85	0.69	,,	NS
13	Review objectives Periodically	3.06	0.08	3.39	0.11	3.23	0.72	1.77	,,	NS
								1.32		
	Implementation Skills									
14	Inform students technically of the objectives of each lesson on soil conservation (expectation at the end of the lesson)	3.24	0.83	3.28	0.83	3.26	0.83	0.21	,,	NS
15	Provide students with clear statement of skills required in each topic of soil conservation lesson	3.18	0.74	3.26	0.76	3.22	0.97	0.33	,,	NS
16	Provide students with clear statement of assessment requirements	3.12	0.30	3.33	0.35	3.23	0.81	1.04	,,	NS
17	Introduce the topic to the students.	3.18	0.15	3.52	0.19	3.35	0.91	1.46	,,	NS
18	Give summary or revision of the previous lesson to link it with the days lesson	3.18	0.15	3.48	0.20	3.33	0.83	1.44	,,	NS
19	(For a new lesson), test the studentsôentry	3.06	0.30	3.33	0.33	3.20	1.00	1.04	,,	NS

	behaviour with generally stimulating questions that are familiar but in the direction of the lesson on soil conservation									
20	Present the subject content in soil conservation in a coherent manner	3.12	0.23	3.40	0.26	3.26	0.90	1.22	,,	NS
21	Utilise different instructional strategies	3.06	0.26	3.23	0.30	3.20	0.93	.14	,,	NS
22	Introduce learning materials at appropriate time.	3.06	0.16	3.60	0.01	3.33	0.80	0.45	,,	S
23	Ask questions to guide the learnersô	2.53	0.00	3.62	0.01	3.08	0.90	,.52	,,	NS
24	Give students opportunity to answer the questions on soil conservation practices .	3.06	0.02	3.51	0.05	3.29	0.78	.29	,,	S
25	Correct wrong answers where nobody could do so in the class.	3.41	0.71	3.49	0.72	3.45	0.85	0.37	,,	NS
26	Provide opportunities for individual consultations after the lesson	2.88	0.38	3.08	0.26	2.98	0.75	0.87	,,	NS
27	Modify the lesson based on studentsôreply to questions.	2.94	0.16	3.22	0.23	3.08	0.81	.42	,,	NS
								1.00		
	Evaluation skills									
28	Determine the assessment procedures on each topic on soil conservation	3.35	0.57	3.21	0.55	3.28	0.91	0.57	,,	NS
29	Decide how to judge the performance. On theory or practical in soil conservation practices.	3.29	0.96	3.28	0.96	3.29	0.86	0.05	,,	NS

30	Design the assessment focusing on the content that is most important for students to learn	2.88	0.08	3.28	0.13	3.08	0.92	.74	,,	NS
31	Pose closure questions at the end of each dayôs lesson.	3.29	0.86	3.34	0.84	3.32	0.86	0.18	,,	NS
32	Provide cross-word puzzles or a more challenging worksheet to keep fast working students busy and advanced ones engaged.	2.94	0.78	2.88	0.77	2.91	0.87	0.28	,,	NS
33	Observe studentsô body language while carrying out activities on soil conservation.	2.82	0.96	2.84	0.96	2.83	0.85	0.05	,,	NS
34	Observe students frequently off-task behaviours in the classroom	3.18	0.35	2.99	0.35	3.09	0.79	0.85	,,	NS
35	Observe students in group while discussing soil conservation practices	3.12	0.74	3.19	0.76	3.16	0.82	0.34	,,	NS
36	Utilise a variety of formal, informal. Formative and summative assessments methods	3.06	0.23	3.34	0.22	3.20	0.86	1.22	,,	NS
37	Assign grades to studentsô performance	3.35	1.00	3.35	1.00	3.35	0.87	0.00	,,	NS
38	Use assessment results to evaluate students interest in the content areas of agriculture	2.94	0.49	3.13	0.50	3.04	1.03	0.69	,,	NS
39	Give feedback (result) to students on their performances in soil conservation practices	3.35	0.96	3.34	0.96	3.35	0.88	0.50	,,	NS
								0.58		

APPENDIX G

SOIL CONSERVATION SKILLS

Mean Ratings of the Lectures and Teachers on Soil Conservation Skills Required by Teachers of Agriculture for Effective Teaching of Students in Colleges of Education in South-eastern Nigeria.

S/N	Item Statement on the Technical Skills	N=102 $\bar{X}$	SD	Remarks
	Tillage Skills			
1	Turn the soil with mouldboard-plough to bury surface materials,	3.41	0.79	AR
2	Mix the soil with chisel plough.	3.04	0.86	..
3	Loosen the soil with hoe	3.23	0.86	..
4	Stir the soil with hoe and or shovel	3.21	0.89	..
5	Bury the weeds	3.11	0.89	..
6	Scrape the soil surface	3.07	1.01	..
7	Smoothen the crushed surface	2.88	0.95	..
8	Till the soil leaving straw and stubble on the soil surface.	2.92	1.00	..
9	Perform tillage at right angles to the prevailing winds	2,99	0.96	..
10	Follow the contour of the land in hilly landscape to intercept water during heavy rainfall.	3.38	0.96	..
11	Break the soil with hoe or tillage Equipment	3.30	1.02	..
12	Twist and collect the soil with the hoe	3.12	0.88	..
13	Raise the hoe with the soil	3.08	1.06	..
14	Invert the soil while incorporating crop residues.	3.33	0.98	..
15	Construct flat beds	3.27	0.97	..
16	Construct ridges and furrows	3.34	0.97	..

17	Make cross bars	3.31	0.84	..
18	Break old ridges to build new ones on the furrows by inverting half of the soil from adjacent ridges on both left and right.	3.56	0.75	HR
19	If beds are required, construct wide beds that can accommodate two rows of crop plants.	3.40	0.88	..
20	Mulch the constructed ridges or beds with crop residues	3.27	0.91	..
		3.21	0.91	..
	Soil Testing and Analysis Skills			
	Collection of soil sample for testing			
21	Consult some laboratories that are good in soil testing and analysis	3.49	0.80	,,
22	Select one that is near the area to be ·sted if any.	3.25	0.78	..
23	Discuss the soil problem with the ›nsultant or manager of the chosen testing .boratory.	3.31	0.83	..
24	Obtain the implement for sampling from ıe extension officer (probe or auger, trowel · spade) !	3.13	0.92	..
25	Move to the site that need testing.	3.23	0.87	..
26	Scrape away the surface litter.	3.16	0.79	..
27	Mark a relatively uniform field fig A (that is one that can be easily managed in a consistent manner)	3.30	0.81	..
28	Mark field that has more than a distinct area which cannot be easily managed in a consistent manner fig B	3.43	0.83	..
29	Insert the probe or auger into the soil to the plough depth or at least 6inches	3.40	0.73	..
30	Collect soil samples with probe, auger or shovel	3.35	0.88	..
31	Collect 25 cores from each marked area	3.40	0.77	..

32	Mix each of the 25 cores from each area together to give a common composite sample.	3.46	0.78	AR
33	Take 20-30 ounces (volume)	3.43	0.80	..
34	Crush the collected sample in a mortar	3.38	0.81	..
35	Sieve the sample through a 2mm brass stainless or plastic sieve	3.63	0.88	HR
36	Package the soil samples into container	3.69	0.67	..
37	Store in a clean closed container	3.59	0.73	..
38	Take to the laboratory for analysis	3.54	0.73	..
39	Test for CEC, NPK Ma and pH	3.49	0.77	..AR
40	Air dry the sample below 120^{of} if not shipped immediately to the laboratory	3.51	0.77	..HR
41	Collect lab result with recommendation.	3.56	0.66	..
	Determination of Cation Exchange Capacity			
42	Place filter papers in two funnels and fill them with the soil sample.	3.45	0.68	,,
43	Leach the soil in one of the funnels with a 100% potassium nitrate (KNO_3) solution	3.54	0.84	HR
44	Add few drops of soil indicator solution to both leachates \	3.71	0.57	,,
45	Observe the leachate.	3.63	0.68	,,
	E) Determination of soil pH			
46	Fill a test tube to a depth of almost 1cm with the soil to be tested.	3.45	0.79	AR
47	Add the 1cm of barium sulphate.	3.56	0.75	HR
48	Fill the tube with distilled water leaving a space of 4 cm from the top of the tube.	3.62	0.72	..

49	Shake the tube thoroughly.\	3.54	0.78	HR
50	Allow the content to settle, and then add ï 10 drops of universal indicator.	3.42	0.98	AR
51	Shake the tube again and allow the content to settle.	3.30	1.03	..
52	Hold the test tube again at the pointed colour chart.	352	0.77	HR
53	Compare each colour of the chart with the colour of the suspension containing the indicator and note the pH of the colour which it matches exactly.	3.39	0.88	AR
	F) Measurement of acidity to determine lime requirement of the soil			
54	Place a small quantity of calcium carbonate on a glass.	3.33	1.04	,,
55	Half fill a test tube with soil indicator solution.	3.50	0.92	HR
56	Add a drop of acid and shake the tube thoroughly.	3.49	0.85	AR
57	Add a few drops of sodium hydroxide solution and shake again.	3.35	0.98	..
58	Place a small quantity of soil or a piece of waxed paper and add drops of soil indicator solution until some of it runs out of the soil.	3.51	0.89	..HR
59	Test all the samples of the soil which are available and	3.43	0.92	..AR
60	Record the pH of each of them.	3.62	0.78	..HR
61	Use colour chart to relate the pH of soil sample and recommend application of lime per hectare.	3.36	0.94	..AR
	G) Test for Phosphorus			
62	Pour $10cm^3$ of ammonium molybdate	3.42	0.93	AR

	solution into the glass vial.			
63	Add 1g of soil and shake the vial vigorously for one minute.\	3,52	0.77	HR
64	Filter the solution.	3,57	0.66	..
65	Add a grain of dry powdered tin (ii) chloride solution to 5 cm^3 of the filtrate.	3.57	0.70	..
66	Observe the intensity of the colour of molybdenum.	3.52	0.71	..
	H) Test for Potassium			
67	Pour 10 cm^3 of sodium cobalt nitrate solution into a glass vial.	3.69	0.67	,,
68	Add one level tea spoon of air dried soil	3.61	0.65	..
69	Shake the vial vigorously for a minute.	3.50	0.77	..
70	Filter the solution.	3.64	0.57	..
71	Use the pipette to add 2.5 cm^3 of anhydrous propyl 2OL to 5cm^3 of filtrate and mix the two solutions together thoroughly.	3.53	0.78	..
72	After three minute compare the turbidity of the solution with a standard chart.	3.55	0.78	..
	I) Test for Magnesium			
73	Put 1 cm^3 of soil extraction into a test tube.	3.58	0.69	,,
74	Add one drop of titan yellow solution and shake the tube vigorously.	3,54	0.76	..
75	Add one drop of 5% sodium hydroxide solution and shake the tube.	3.51	0.75	..
76	Observe the colour.	3.43	0.73	..AR
	J) Test for Nitrates			
77	Place one drop of the soil extract on a spotting title and add four drops of the	3.56	0.73	HR

	dispheny lamine solution.			
78	After two minute stir the mixture.	3.62	0.57	..
79	Compare the colour with standard colour Chart	3.66	0.57	..
	Skills in Manure Preparation and Application	**3.51**	**0.74**	..
	i) Farm yard manure			
80	House animals: goat, sheep, or poultry in appropriate pen.	3.62	0.65	
81	Feed the animals with grasses, legumes, water and other materials.	3.64	0.75	..
82	Collect animal dung and litter from the pen.	3.63	0.64	..
83	Heap the daily collected beddings together in a place.	3.75	0.50	..
84	Allow them to decay.	3.70	0.62	..
85	Apply to the soil using broadcasting method	3.53	0.83	..
	ii) Compost manure			
86	Select appropriate site for compost preparation	3.53	0.73	,,
87	Map out seven plots/spaces	3.54	0.74	..
88	Label the plots/spaces as A,B,C,1, 2, 3 and 4	3.59	0.74	..
89	Dig trenches or pits of about 1m deep in each plot mapped.	3.54	0.79	..
90	Provide wall or fence round the corners.	3.53	0.73	..
91	Provide compost materials	3.54	0.71	HR

92	Cut the compost materials with cutlass.	3.41	0.83	AR
93	Build up the heaps in plots 1,2,3 and 4 with the cut materials.	3.50	0.70	HR
94	Spray urine, wood ash, animal dung or a head pan or bucket full of old compost on top of each layer	3.53	0.79	..
95	Sprinkle water on each 4 heaps	3.41	0.78	AR
96	Sprinkle hand full of soil	3.46	0.82	..
97	Add other layers of compost materials in alternate manner.	3.41	0.95	..
98	Repeat the process of applying water after each layer until the required level of the compost is attained	3.53	0.85	HR
99	Drive a strong long stick (testing stick) through the top until it reaches the centre	3.54	0.70	..
100	Cover the pit with layers of refuse of 15-20cm.	3.50	0.91	..
101	Plaster/ cover to drive away files	3.42	0.70	AR
102	Allow materials to sink	3.54	0.67	HR
103	Take the stick out after the first day	3.54	0.69	..
104	Feel the testing stick to know if it is hot cold, damp, or moist	3.40	0.86	AR
105	Turn the materials (removing layer by layer) from heap 1 and 2 into space A and materials in heap 3 and 4 into space B.	3.46	0.84	..
106	Stack materials in the spaces from where the materials were removed i.e. 1, 2, 3 and 4 to continue another process	3.40	0.95	..
107	Move the materials in heap óAôto óCôand those in óBôto óCôafter a fortnight.	3.50	0.88	HR
108	Provide a shade over the decayed compost.	3.54	0.69	..
109	Cover the prepared compost to prevent	3.57	0.75	..

	effect of sun or rain			
110	Apply using appropriate method like ring, band or broadcasting.	3.52	0.94	..
	Green manure			
111	Collect green manure crop seeds/ cuttings	3.77	0.59	,,
112	Prepare seed beds.	3.64	0.71	..
113	Broadcast small seeds of legumes	3.49	0.77	AR
114	Plant seeds or cuttings; spacing them closely	3.49	0.68	..
115	Plant larger seeds in rows between the rows of cereals	3.49	0.82	..
116	Water the seed beds after planting	3.47	0.75	..
117	Weed the plot regularly to reduce pests	3.41	0.79	..
118	Plough in the crop distributing evenly over the farm just after it had flowered	3.28	0.83	..
119	Leave at least 7days before planting the next crop	3.23	1.07	..
	Skills in fertilizer application			
120	Plough the field/land	3.52	0.86	,,
121	Broadcast fertilizer uniformly over uncultivated land using hang or machine.	3.69	0.68	..
122	Mix fertilizer with soil	3.66	0.68	..
123	Protect plantsôstems or roots from being in contact with fertilizer	3.44	0.82	AR
124	Make an opening in ring-form round the crop or bands if crops are planted in rows/ridges	3.76	0.96	HR
125	Spread fertilizer evenly in the ring or bands a few centimetre away from the crop	3.38	0.99	AR

126	Cover the applied fertilizer with soil	3.47	0.83	..
127	At about 3-4 weeks after planting, apply second dose of fertilizer by placing on a ring close to the plan	3.35	0.87	..
				..
	Skills in mulching			
128	Identify the appropriate mulch materials	3.37	0.89	AR ..
129	Collect/rake dry plant materials that do not rot quickly.	3.52	0.84	HR
130	Put them into a mulch bin.	3.33	0.85	AR
131	Cut or shred the leaves using mulching lawn mower	3.50	0.79	HR
132	Determine when to apply the material	3.39	0.87	AR
133	Carry the materials to the field	3.56	0.70	HR
134	Spread the materials on the soil surface with hand or rake before or after planting.	3.39	0.88	AR
135	Spread on the cultivated beds or ridges	3.53	0.74	HR
136	Spread around young crop plants	3.42	0.88	AR
137	Spread mulch materials during dry season	3.48	0.71	..
138	Spread mulch materials during rainy season in places where the soil is easily eroded.	2.98	0.24	..
139	Maintain a layer of mulch material at 7-15cm (3-6 inches) deep all over bed, around the growing plant and more on the eroded places	3.27	1.02	AR
140	Spread plastic mulch materials.	3.36	0.90	..
141	Poke holes in the plastic mulch materials provide access for the plants	3.50	0.85	HR
		3.15	**0.68**	**AR**
	Skills in Crop Rotation			
142	Make a long range rotation plan by determining the goals in view	3.32	1.02	AR

143	Make a list of crops to grow in the farm	3.33	0.95	..
144	Group them together by plant family.	3.36	0.80	,,
145	Create a planting schedule	3.45	0.72	,,
146	Draw a map of the beds, ridges or mounds on a graph paper and make several copies.	3.29	0.95	,,
147	Use the map to plan where to plant each crop	3.27	0.94	,,
148	Note crops that are to be grown and where on the map.	3.38	0.86	,,
149	Label each crop with the year including a fallow in the rotation	3.56	0.77	HR
150	Implement the plan by planting specific crops in the mapped spaces	3.59	0.70	,,
151	Follow the planting schedule by planting the plants chosen in order of sequence	3.33	0.87	,,
152	Be consistent for consistent result	3.67	0.60	HR
153	Keep records so that gains (or losses) in production can be observed.	3.64	0.83	,,
154	Modify the order to minimize loss	3.64	0.72	,,
		3.30	**0.73**	
	Skills in soil erosion prevention and Control			
	(i) Soil Erosion Prevention			
155	Spread organic mulch over uncultivated land.	3.70	0.68	HR
156	Make ridges across the slope.	3.63	0.71	,,

157	Make cross bars between ridges.	3.63		,,
158	Plant grasses on the land that is likely to be eroded.	3.59	0.69	,,
159	Break the slope into series of flat-surfaces called terraces.	3.59	0.68	,,
160	Establish crops in strips at right angles to the direction of water flow.	3.65	0.71	,,
161	Break the soil clods moderately in order to avoid excessive damages to soil granules.	3.56	0.71	,,
162	Plant young tree seedlings in areas likely to be eroded in future.	3.60	0.77	,,
163	Prepare ridges in spiral forms to restrict rapid movement of water in the farm.	3.57	0.69	,,
164	Grow plants that are indigenous to the area.	3.74	0.53	,,
165	Plant and maintain enough strong, healthy growing vegetation like trees and shrubs.	3.42	0.87	AR
166	Keep the soil moist by covering with damp piles of mulch.	3.47	0.87	,,
167	Practice a tillage method that does not make the soil over fine.	3.54	0.74	HR
168	Construct physical structures made of earth, stone or other materials	3.37	0.89	AR
169	Construct wind barrier at the boundaries of the farm,.	3.45	0.76	,,
170	Plant patches of high grass and allow the ass to grow to at least three inches to omote retention of water in the soil.	3.50	0.77	HR
171	Plant cover crops that will assist in covering the ground; reducing runoff.	3.48	0.67	AR
172	Water plants early in the morning, when evaporation is low.	3.53	0.60	HR

Skills in Soil Erosion Control

173	Plough on the contour.	3.42	0.81	AR
174	Make concrete walls.	3.48	0.88	,,
175	Place blankets and mats tightly and securely on affected area	3.15	0.99	,,
176	Construct large cement pavers into a retaining wall to prevent the water from travelling onwards	3.33	0.96	,,
177	Use large boulder type rocks or concrete pavers on shorelines	3.34	0.84	,,
178	Place grass onto the eroded areas where it will grow over, covering the surface	3.53	0.78	HR
179	Place grass onto the eroded areas where it will grow over, covering the surface	3.67	0.72	,,
180	Till the soil to produce rough clod	3.58	0.78	,,
181	Place plant residues on the surface to obtain maximum roughness.	3.63	0.70	,,
182	Construct small ridges to direction of the wind/water	3.46	0.69	AR
183	Plant crops on the contour.	3.52	0.64	HR
184	Put checks in furrows.	3.33	1.02	AR
185	Establish grasses that have the ability to live long and withstand wind.	3.60	0.82	HR
186	Plant tress to act as shelter belts.	3.34	0.86	AR
187	Build level terracing.	3.16	1.05	,,
188	Fill in gullies with sand.	3.26	0.93	,,
189	Shape gullies for smooth water flows.	3.26.	0.78	,,
190	Construct dams of 0.5m high at intervals of 4-9m depending on the slope.	3.23	1.04	,,
191	Plant perennial vegetations on exposed road cuts to eliminate soil loss.	2.91	1.00	,

192	Provide cross channels (shallow ditches or water channel) every 25to100 m to prevent excessive accumulation of water	3.13	1.06	,,
193	Plant windbreaks and tenacious grasses	3.01	1.08	,,
194	Make bunds between two strips surface.	2.80	1.19	,,
195	Construct deep pathways for diverting running water and channelling them into exit pipes or tunnels.	2.94	1.13	,,
196	Make barriers along the slope with sand bags and logs of wood.	2.99	1.12	,,
197	Build tunnels in form of large exit pipes or joined ringed concrete.	3.16	1.11	,,
		3.37	**0.82**	..
	Skills in Irrigation			
198	Identify the irrigation method and types to adopt.	3.14	1.13	Required
199	Determine plant water requirements.	3.19	1.06	..
200	Lay out the system.	3.42	0.96	..
201	Irrigate the "base plant." Using watering can or any other	3.11	1.11	..
202	Calculate the water usage for the crop.	3.19	1.02	..
203	Carry out appropriate maintenance practices of the equipment	3.04	1.14	..
		3.18	**0.90**	..

Total HR = 91 AR = 112

APPENDIX H

Hypothesis 2

t-test analysis of the lecturers and teachers on soil conservation skills required for effective teaching of students in Colleges of Education.
N= 102 (17 Lectures & 85 Teachers)

S/N	Soil Conservation Skills	$\bar{X}_1$	S_1	$\bar{X}_2$	S_2	$\bar{X}G$	SD	t-cal	t-tab	R
	Tillage Skills									
1	Turn the soil with	3.29	0.70	3.38	0.72	3.34	0.82	0.39	1.98	NS

	mouldboard-plough to bury surface materials,									
2	Mix the soil with chisel or plough.	2.94	0.82	3.00	0.82	2.97	0.91	0.26	,,	NS
3	Loosen the soil with hoe/plough	2.88	0.12	3.24	0.16	3.06	0.89	1.56	,,	NS
4	Stir the soil with hoe and or shovel	3.24	0.73	3.15	0.75	3.20	0.93	0.35	,,	NS
5	Bury the weeds	3.59	0.02	3.15	0.02	2.87	0.87	2.45	,,	S
6	Scrape the soil surface	3.53	0.03	3.12	0.06	2.83	1.05	2.23	,,	S
7	Smoothen the crushed surface	2.35	0.02	2.93	0.00	2.64	0.79	2.35	,,	S
8	Till the soil leaving straw and stubble on the soil surface.	2.47	0.07	2.95	0.05	2.71	0.94	1.83	,,	NS
9	Perform tillage at right angles to the prevailing winds	2.24	0.80	3.08	0.02	3.78	0.91	1.28	,,	NS
10	Follow the contour of the land in hilly landscape to intercept water during heavy rainfall	3.00	0.12	3.40	0.12	3.20	0.95	1.58	,,	NS
11	Break the soil with hoe or any tillage equipment	3.12	0.52	3.29	0.51	3.21	1.01	0.65	,,	NS
12	Twist and collect the soil with the hoe	2.65	0.04	3.13	0.02	2.89	0.80	2.09	,,	S
13	Raise the hoe with the soil	2.94	0.71	3.05	0.72	3.00	1.08	0.38	,,	NS
14	Invert the soil while incorporating crop residues.	3.35	0.75	3.27	0.25	3.31	0.96	0.32	,,	NS
15	Construct flat beds	3.35	0.56	3.20	0.57	3.28	0.99	0.59	,,	NS
16	Construct ridges and furrows	3.06	0.24	3.34	0.28	3.20	0.93	1.19	,,	NS

17	Make cross bars	3.06	0.29	3.29	0.41	3.18	0.94	1.05	,,	NS
18	Break old ridges to build new ones on the furrow by inverting half of the soil from adjacent ridges on both sides	3.53	0.91	3.51	0.92	3.52	0.80	0.12	,,	NS
19	If beds are required, construct wide beds that can accommodate two rows of crop plants.	3.06	0.13	3.41	0.13	3.24	0.86	1.53	,,	NS
20	Mulch the constructed ridges or beds with crop residues.	3.35	0.50	3.19	0.45	3.27	0.87	0.67	,,	NS
								1,25		**NS**
	Soil testing & Analysis									
	i. Soil Sampling									
21	Consult some laboratories that are good in soil testing and analysis	3.12	0.07	3.51	0.10	3.16	0.82	1.84	,,	NS
22	Select one that is near the area to be tested.	2.94	0.14	3.25	0.10	3.10	0.73	1.48	,,	NS
23	Discuss the soil problem with the consultant or manager of the chosen soil testing laboratory	3.12	0.43	3.29	0.37	3.21	0.78	0.80	,,	NS
24	Obtain the implement for sampling from the extension officer (probe or auger, trowel or spade)	2.94	0.50	3.11	0.44	3.03	0.85	0.67	,,	NS
25	Move to the site that need testing.	2.88	0.13	3.24	0.23	3.06	0.96	1.53	,,	NS
26	Scrape away the surface litter.	2.94	0.35	3.14	0.33	3.04	0.75	0.95	,,	NS
27	Mark a relatively uniform field fig A (that is one that can be easily managed in a consistent manner)	3.53	0.12	3.19	0.20	3.36	0.88	1.59	,,	NS

28	Mark field that has more than a distinct area which cannot be easily managed in a consistent manner fig B	3.59	0.14	3.34	0.09	3.47	0.58	1.45	,,	NS
29	Insert the probe or auger into the soil to the plough depth or at least 6inches	3.00	0.03	3.42	0.07	3.21	0.78	2.24	1.98	S
30	Collect soil samples with probe, auger or shovel	2.82	0.01	3.40	0.04	3.11	0.93	2.51	,,	S
31	Collect 25 cores from each marked area	3.18	0.30	3.39	0.45	3.29	0.88	1.04	,,	NS
32	Mix each of the 25 cores from each area together to give a common composite sample .	3.53	0.50	3.39	0.47	3.46	0.76	0.68	,,	NS
33	Take 20-30 ounces (volume)	3.41	0.87	3.38	0.86	3.40	0.72	0.17	,,	NS
34	Crush the collected sample in a mortar	3.06	0.13	3.39	0.15	3.23	0.82	1.54	,,	NS
35	Sieve the sample through a 2mm brass, stainless or plastic sieve	3.53	0.79	3.59	0.76	3.56	0.70	0.32	,,	NS
36	Package the soil samples into container	3.71	0.65	3.62	0.55	3.67	0.59	0.46	,,	NS
37	Store in a clean closed container	3.53	0.95	3.54	0.96	3.54	0.76	0.06	,,	NS
38	Take to the laboratory for analysis	3.29	0.73	3.53	0.26	3.41	0.75	1.22	,,	NS
39	Test for CEC, NPK Ma and pH	3.24	0.23	3.48	0.30	3.36	0.82	1.22	,,	NS
40	Air dry the sample below 120^{of} if not shipped immediately to the laboratory	3.71	0.15	3.41	0.05	3.56	0.64	1.45	,,	NS
41	Collect lab result with recommendation.	3.41	0.50	3.53	0.54	3.47	0.68	0.67	,,	NS

	Determination of Cation Exchange Capacity									
42	Place filter papers in two funnels and fill them with the soil sample.	3.12	0.06	3.46	0.08	3.29	0.68	1.92	,,	NS
43	Leach the soil in one of the funnels with a 100% potassium nitrate (KNO_3) solution	3.53	0.83	3.48	0.86	3.51	0.91	0.21	,,	NS
44	Add few drops of soil indicator solution to both leachates	3.65	0.94	3.66	0.94	3.66	0.59	0.08	1.98	NS
45	Observe the leachate.	3.82	0.10	3.53	0.02	3.68	056.	1.64	,,	NS
	Soil pH									
46	Place a small quantity of calcium carbonate on a glass.	3.53	0.47	3.38	0.33	3.46	0.69	0.73	,,	NS
47	Half fill a test tube with soil indicator solution.	3.47	0.82	3.52	0.76	3.50	0.66	0.23	,,	NS
48	Add a drop of acid and shake the tube thoroughly.	3.59	0.90	3.56	087.	3.58	0.63	0.12	,,	NS
49	Add a few drops of sodium hydroxide solution and shake	3.29	0.26	3.53	0.22	3.41	0.75	0.14	,,	NS
50	Place a small quantity of soil or a piece of waxed paper and add drops of soil indicator solution until some of it runs out of the soil.	3.59	0.33	3.33	0.22	3.46	0.87	0.99	,,	NS
51	Test all the samples of the soil which are available and	3.29	0.87	3.25	0.83	3.27	0.93	0.17	,,	NS
52	Record the pH of each of them.	3.41	0.73	3.48	0.64	3.45	0.66	0.35	,,	NS

53	Use colour chart to relate the pH of soil sample and recommend application of lime per hectare.	.359	0.21	3.29	0.07	3.14	0.73	1.26	,,	NS
	Lime Requirement									
54	Fill a test tube to a depth of almost 1cm with the soil to be tested.	.329	0.97	3.28	0.96	3.29	0.93	0.04	,,	NS
55	Add the 1cm of barium sulphate.	.353	0.70	3.44	0.57	3.49	0.75	0.38	,,	NS
56	Fill the tube with distilled water leaving a space of 4 cm from the top of the tube.	.359	0.44	3.41	0.27	3.50	0.71	0.78	,,	NS
57	Shake the tube thoroughly.	3.59	0.19	3.25	0.14	3.42	1.91	1.31	1.98	NS
58	Allow the content to settle, and then add 8 ï 10 drops of universal indicator.	2.76	0.00	3.60	0.02	3.18	1.01	3.77	,,	S
59	Shake the tube again and allow the content to settle.	3.35	0.89	3.39	0.89	3.37	0.96	0.14	,,	NS
60	Hold the test tube again at the pointed colour chart.	3.65	0.65	3.55	0.53	3.60	0.66	0.45		NS
61	Compare each colour of the chart with the colour of the suspension containing the indicator and note the pH of the colour which it matches exactly.	3.06	0.22	3.36	0.29	3.22	1.00	1.22		NS
	Test for Phosphorus (P)									
62	Pour 10cm^3 of ammonium molybdate solution into the glass vial.	3.24	0.91	3.40	44	3.32	0.86	0.66	,,	NS
63	Add 1g of soil and shake the vial vigorously for one minute.	3.24	0.17	3.57	53	3.38	0.72	1.29	,,	NS
64	Filter the solution.	3.24	0.04	3.59	0.06	42	0.65	2.06	,,	S

65	Add a grain of dry powdered tin (ii) chloride solution to 5 cm^3 of the filtrate.	3.24	0.07	3.58	0.18	41	.80	1.86	,,	NS
66	Observe the intensity of the colour of molybdenum.	3.44	0.71	3.48	0.64	3.45	.68	0.37	,,	NS
	Test for Potassium (K)									
67	Pour 10 cm^3 of sodium cobalt nitrate solution into a glass vial.	3.94	0.04	3.58	0.00	3.26	0.48	2.08	,,	S
68	Add one level tea spoon of air dried soil	3.47	0.55	3.58	0.47	3.53	0.60	0.61	,,	NS
69	Shake the vial vigorously for a minute.	3.35	0.57	3.47	0.05	3.41	0.26	0.58	,,	NS
70	Filter the solution.	3.35	0.06	3.64	0.09	3.50	0.58	1.89	,,	NS
71	Use the pipette to add 2.5 cm^3 of anhydrous propyl 2OL to 5cm^3 of filtrate and mix the two solutions	3.00	0.01	3.58	0.01	3.29	0.77	2.88	,,	S
72	After three minute compare the turbidity of the solution with a standard chart.	3.53	0.85	3.49	0.51	3.51	0.62	0.19	1.98	NS
	Test for Magnesium (Mg)									
73	Put 1 cm^3 of soil extraction into a test tube.	2.94	0.00	3.65	0.00	3.30	0.71	4.18	,,	S
74	Add one drop of titan yellow solution and shake the tube vigorously.	3.35	0.41	3.52	0.52	3.44	0.85	0.82	,,	NS
75	Add one drop of 5% sodium hydroxide solution and shake the tube.	3.06	0.02	3.54	0.06	3.30	0.83	2.47	,,	S
76	Observe the colour.	3.47	0.63	3.38	0.54	3.43	1.29	0.48	,,	NS
	Test for Nitrates (NO_3)									
77	Place one drop of the soil extract on a spotting title	3.18	0.04	3.58	0.08	3.48	0.	2.10	,,	S

	and add four drops of the dispheny lamine solution.									
78	After two minute stir the mixture.	3.29	0.03	3.62	0.05	3.46	0.58	2.21	,,	S
79	Compare the colour with standard colour chart	3.58	0.53	3.62	0.31	3.58	0.55	0.62	,,	NS
								1.23	**1.98**	NS
	Manure Preparation and Application									
	1. Farmyard manure									
80	House animals: goat, sheep, or poultry in pen.	3.18	0.00	3.67	0.03	3.43	0.74	3.35	1.98	S
81	Feed the animals with grasses, legumes, water and other materials.	3.06	0.00	3.69	0.02	3.38	0.84	2.35		S
82	Collect animal dung and litter from the pen.	3.18	0.00	3.66	0.63	3.42	0.69	2.96	,,	S
83	Heap the daily collected beddings together in a place.	3.71	0.93	3.69	0.93	3.70	0.49	0.09	,,	NS
84	Allow them to decay.	3.76	0.40	3.62	0.28	3.70	0.55	0.85	,,	NS
85	Apply to the soil using broadcasting method	3.06	0.02	3.56	0.12	3.32	0.98	2.35	,,	S
	Compost									
86	Select appropriate site for compost preparation	3.29	0.29	3.52	0.38	3.41	0.83	1,16	1.98	NS
87	Map out seven plots/spaces	3.12	0.02	3.57	0.11	3.35	0.85	2.32	,,	S
88	Label the plots/spaces as A,B,C,1, 2, 3 and 4	3.59	0.77	3.53	0.82	3.56	0.84	0.30	,,	NS
89	Dig trenches or pits of about 1m deep in each plot mapped.	3.76	0.12	3.44	0.02	3.61	0.64	1.58	,,	NS
90	Provide wall or fence round the corners.	3.35	0.43	3.51	0.55	3.43	0.84	0.79	,,	NS
91	Provide compost materials	3.53	0.81	3.48	0.75	3.51	0.64	0.25	,,	NS

92	Cut the compost materials with cutlass.	3.12	0.18	3.41	0.24	3.27	0.87	1.34	,,	NS
93	Build up the heaps in plots 1,2,3 and 4 with the cut materials	3.53	0.61	3.44	0.68	3.49	0.77	0.51	,,	NS
94	Spray urine, wood ash, animal dung or a head pan or bucket full of old compost on top of each layer	3.29	0.29	3.52	0.39	3.41	0.87	1.06	,,	NS
95	Sprinkle water on each of the 4 heaps	3.76	0.02	3.28	00	3.64	0.63	2.37	,,	S
96	Sprinkle hand full of soil	3.35	0.75	3.42	0.72	3.39	0.78	0.32	,,	NS
97	Add other layers of compost materials in alternate manner.	3,88	0.02	3.46	0.09	3.17	1.06	0.33	,,	NS
98	Repeat the process of applying water after each layer until the required level of the compost is attained	3.53	0.40	3.47	0.82	3.50	0.92	0.25	,,	NS
99	Drive a strong long stick (testing stick) through the top until it reaches the centre	3.47	0.90	3.49	0.90	3.46	0.71	0.13	,,	NS
100	Cover the pit with layers of refuse of 15-20cm.	3.35	0.63	3.47	0.69	3.41	0.99	0.49	,,	NS
101	Plaster/ cover to drive away files	318	0.21	3.41	0.27	3.30	0.75	1.26	,,	NS
102	Allow materials to sink	3.35	0.36	3.52	0.43	3.44	0.72	0.92	1.98	NS
103	Take the stick out after the first day	3.47	0.90	3.49	0.90	3.34	0.70	0.13	,,	NS
104	Feel the testing stick to know if it is hot, cold, damp, or moist	3.47	0.54	3.33	0.38	3.40	0.72	0.61	,,	NS
105	Turn the materials	3.35	0.75	3.42	0.79	3.39	0.91	0.32	,,	NS

	(removing layer by layer) from heap 1 and 2 into space A and materials in heap 3 and 4 into space									
.										
106	Stack materials in the spaces from where the materials were removed i.e. 1, 2, 3 and 4 to continue another process	3.29	0.78	3.36	0.82	3.33	1.04	0.28	,,	NS
107	Move the materials in heap óAôto óCôand those in óBôto óCôafter a fortnight.	3.65	0,31	3.41	0.24	3.53	0.80	1.01	,,	NS
108	Provide a shade over the decayed compost.	3.71	0.16	3.45	0.07	3.56	0.60	1.43	,,	NS
109	Cover the prepared compost to prevent effect of sun or rain	3.76	0.14	3.47	0.04	3.62	0.62	1.48	,,	NS
110	Apply using appropriate method like ring, band or broadcasting.	3.12	0.09	3.54	0.20	3.33	1.06	1.71	,,	NS
	Green Manure									
111	Collect green manure crop seeds/ cuttings	3.88	0.20	3.68	0.06	3.78	0.48	1.29	,,	NS
112	Prepare seed beds.	3.47	0.46	3.61	0.47	3.54	0.77	0.75	,,	NS
113	Broadcast small seeds of legumes	3.41	0.87	3.45	0.86	3.43	0.75	0.17	,,	NS
114	Plant seeds or cuttings; spacing them closely	3.18	0.08	3.49	0.14	3.34	0.73	1.77	1.96	NS
115	Plant larger seeds in rows between the rows of cereals	3.41	0.87	3.45	0.89	3.43	0.89	1.16	,,	NS
116	Water the seed beds after planting	3.82	0.02	3.34	0.00	3.58	0.59	2.48	1.98	S
117	Weed the plot regularly to reduce pests	3.18	0.29	3.40	0.22	3.29	0.73	1.06	,,	NS
118	Plough in the crop	2.88	0.06	3.31	0.06	3.10	0.81	1.94	,,	NS

	distributing evenly over the farm just after it had flowered									
119	Leave at least 7days before planting the next crop	3.59	0.02	3.26	0.08	2.93	1.19	2.42	,,	S
	Fertilizer Application									
120	Plough the field/land	3.41	0.76	3.48	0.76	3.45	0.87	0.31	,,	NS
121	Broadcast fertilizer uniformly over uncultivated land using hand or machine.	3.41	0.14	3.68	0.74	3.55	0.76	1.49	,,	NS
122	Mix fertilizer with soil	3.53	0.60	3.62	0.62	3.58	0.70	0.52	,	NS
123	Protect plantsôstems or roots from being in contact with fertilizer	3.59	0.28	3.35	0.14	3.47	0.69	1.08	,,	NS
124	Make an opening in ring-form round the crop or bands if crops are planted in rows/ridges	3.71	1.00	3.71	1.00	3.71	0.52	0.00	,,	NS
125	Spread fertilizer evenly in the ring or bands a few centimetre away from the crop.	3.35	0.93	3.33	0.93	3.34	1.00	0.89	,,	NS
126	Cover the applied fertilizer with soil	3.35	0.71	3.44	0.70	3.40	0.82	0.37	,,	NS
127	At about 3-4 weeks after planting, apply second dose of fertilizer by placing on a ring close to the plant	3.12	0.33	3.34	0.42	3.23	0.94	,0.9	,,	NS
	Skills in Mulching									
128	Identify the appropriate mulch materials	3.35	0.88	3.32	0,86	3.34	0.82	0.15	,,	NS
129	Collect/rake dry plant materials that do not rot quickly.	3.65	0.35	3.44	0.18	3.55	0.69	0.95	1.98	NS

130	Put them into a mulch bin.	3.35	0.72	3.27	0.68	3.31	0.70	0.36	,,	NS
131	Cut or shred the leaves using mulching lawn mower	3.65	0.27	3.41	0.13	3.53	0.67	1.12	,,	NS
132	Determine when to apply the material	3.53	0.34	3.31	0.31	3.42	0.85	0.96	,,	NS
133	Carry the materials to the Field.	3.47	0.80	3.52	o.75	3.50	0.62	0.85	,,	NS
134	Spread the materials on the soil surface with hand or rake before or after planting.	3.41	0.73	3.33	0.71	3.37	0.85	0.35	,,	NS
135	Spread on the cultivated beds or ridges	3.24	0.13	3.53	0.19	3.39	0.77	1.53	,,	NS
136	Spread around young crop plants	3.41	0.87	3.36	0.83	3.39	0.85	0.20	,,	NS
137	Spread mulch materials during dry season	3.47	0.81	3.42	0.74	3.44	0.63	0.25	,,	NS
138	Spread mulch materials during rainy season in places where the soil is easily eroded.	3.41	0.06	3.04	0.08	2.73	1.29	1.92	,,	NS
139	Maintain a layer of mulch material at 7-15cm (3-6 inches) deep all over bed, around the growing plant and more on the eroded places	3.12	0.67	3.24	0.83	3.18	1.04	0.43	,,	NS
140	Spread plastic mulch materials.	3.00	0.12	3.38	0.18	3.19	0.96	1.59	,,	NS
141	Poke holes in the plastic mulch materials to provide access for the plants	3.24	0.26	3.49	0.39	3.37	0.97	1.15	,,	NS
								0.55	**1.98**	**NS**
	Crop Rotation									
142	Make a long range rotation plan by	3.12	0.44	3.33	0.46	3.23	1.04	0.28	,,	NS

	determining the goals in view									
143	Make a list of crops to grow in the farm	3.18	0.64	3.29	0.57	3.24	0.86	0.47	1.98	NS
144	Group them together by plant family.	3.18	0.44	3.34	0.45	3.26	0.81	0.77	,,	NS
145	Create a planting schedule	3.06	0.03	3.47	0.03	3.29	0.69	2.09	,,	S
146	Draw a map of the beds, ridges or mounds on a graph paper and make several copies.	2.94	0.16	3.29	0.20	3.17	0.98	1.41	,,	NS
147	Use the map to plan where to plant each crop	2.82	0.06	3.29	0.16	3.06	1.07	1.91	,,	NS
148	Note crops that are to be grown and where on the map.	3.00	0.08	3.40	0.09	3.20	0.86	1.77	,,	NS
149	Label each crop with the year including a fallow in the rotation	3.65	0.41	3.48	0.34	3.57	0.71	0.51	,,	NS
150	Implement the plan by lanting specific crops in the apped spaces	3.53	0.95	3.54	0.94	3.54	0.62	0.06	,,	NS
151	Follow the planting schedule by planting the plants chosen in order of sequence	3.29	0.96	3.28	0.96	3.29	0.83	0.51	,,	NS
152	Be consistent for consistent result	3.71	0.51	3.60	0.43	3.66	0.55	0.67	,,	NS
153	Keep records so that gains (or losses) in production can be observed.	3.47	0.47	0.61	0.35	3.54	0.64	0.73	,,	NS
154	Modify the order to minimize lost	3.47	0.47	3.61	0.35	3.59	0.64	0.73	,,	NS
								1.03	**1.98**	**NS**
	Soil Erosion Prevention and Control									
	Soil Erosion Prevention									

155	Spread organic mulch over uncultivated land.	3.76	0.44	3.62	0.29	3.69	0.57	0.78	,,	NS
156	Make ridges across the slope.	3.29	0.07	3.64	0.23	3.97	0.85	1.83	,,	NS
157	Make cross bars between ridges.	3.47	0.44	3.60	0.37	3.54	0.58	0.78	,,	NS
158	Plant grasses on the land that is likely to be eroded.	3.53	0.95	3.54	0.95	3.54	0.70	0.06	,,	NS
159	Break the slope into series of flat-surfaces called terraces.	3.59	0.75	3.53	0.68	3.56	0.62	0.32	,,	NS
160	Establish crops in strips at right angles to the direction of water flow.	3.65	0.76	3.59	0.23	3.62	0.61	0.31	,,	NS
161	Break the soil clods moderately in order to avoid excessive damages to granules	3.47	0.81	3.52	0.84	3.50	0.78	0.25	,,	NS
162	Plant young tree seedlings in areas likely to be eroded in future.	4.00	0.01	3.46	0.00	3.73	0.44	2.74	,,	S
163	Prepare ridges in spiral forms to restrict rapid movement of water in the farm.	3.71	0.22	3.48	0.12	3.60	0.62	1.23	,,	NS
164	Grow plants that are indigenous to the area.	3.65	0.14	3.69	0.80	3.67	0.60	0.34	,,	NS
165	Plant and maintain enough strong, healthy growing vegetation like trees and shrubs.	3.65	0.19	3.34	0.06	3.50	0.71	1.33	,,	NS
166	Keep the soil moist by covering with damp piles of mulch.	3.47	0.80	3.41	0.80	3.46	0.88	0.25	,,	NS
167	Practice a tillage method that does not make the soil over fine.	3.29	0.24	3.53	0.36	3.41	0.85	1.18	,,	NS

168	Construct physical structures made of earth, stone or other materials.	3.47	0.46	3.29	0.34	3.38	0.78	0.74	,,	NS
169	Construct wind barrier at the boundaries of the farm,.	3.29	0.53	3.42	0.57	3.36	0.80	0.64	,,	NS
170	Plant patches of high grass and allow the grass to grow to at least three inches to promote retention of water in the soil.	3.06	0.02	3.53	0.09	3.30	0.86	2.36	,,	S
171	Plant cover crops that will assist in covering the ground; reducing runoff.	3.29	0.36	3.46	0.46	3.38	0.74	0.93	1.98	NS
172	Water plants early in the morning, when evaporation is low.	3.53	0.75	3..4	0.76	3.50	0.70	0.32	,,	NS
	Soil Erosion Control									
173	Plough on the contour.	2.88	0.01	3.47	0.06	3.18	0.93	2.81	,,	S
174	Make concrete walls.	3.12	0.25	3.39	0.33	3.26	0.95	1.15	,,	NS
175	Place blankets and mats tightly and securely on affected area	2.76	013	3.16	0.23	2.96	1.09	1.51	,,	NS
176	Construct large cement pavers into a retaining wall to prevent the water from travelling onwards	2.88	0.06	3.36	0.11	3.12	1.21	1.90	,,	NS
177	Use large boulder type rocks or concrete pavers on shorelines	3.00	0.11	3.35	0.08	3.28	0.79	1.59	,,	NS
178	Place grass onto the eroded areas where it will grow over, covering the surface	3.06	0.01	3.56	0.07	3.31	0.81	1.50	,,	NS
179	Place grass onto the eroded areas where it will	3.35	0.10	3.67	0.22	3.51	0.82	1.68	,,	NS

	grow over, covering the surface.									
180	Till the soil to produce rough clod	3.18	0.04	3.60	0.12	3.39	0.86	2.08	,,	S
181	Place plant residues on the surface to obtain maximum roughness.	3.53	0.75	3.59	0.78	3.56	0.74	0.32	,,	NS
182	Construct small ridges to direction of the wind/water	3.29	0.43	3.44	0.39	3.37	0.64	0.80	,,	NS
183	Plant crops on the contour.	3.59	0.41	3.45	0.40	3.52	0.64	0.83	,,	NS
184	Put checks in furrows.	3.29	0.97	3.28	0.97	3.29	1.04	0.04	,,	NS
185	Establish grasses that have the ability to live long and withstand wind.	3.29	0.83	3.25	0.82	3.27	0.88	0.22	,,	NS
186	Plant tress to act as shelter belts.	3.41	0.54	3.27	0.38	3.34	0.72	0.61	1.98	NS
187	Build level terracing.	2.82	0.22	3.16	0.33	2.99	1.16	1.22	,,	NS
188	Fill in gullies with sand.	2.71	0.01	3.31	0.03	3.01	0.94	1.50	,,	NS
189	Shape gullies for smooth water flows.	2.94	0.12	3.26	0.13	3.10	0.76	1.55	,,	NS
190	Construct dams of 0.5m high at intervals of 4-9m depending on the slope.	3.12	0.80	3.19	0.83	3.16	1.12	0.26	,,	NS
191	Plant perennial vegetations on exposed road cuts to eliminate soil loss.	3.59	0.18	2.94	0.20	2.97	1.00	1.34	,,	NS
192	Provide cross channels (shallow ditches or water channel) every 25m to100m to prevent excessive accumulation of water	3.29	0.36	3.04	0.29	3.17	0.98	0.92	,,	NS
193	Plant windbreaks and tenacious grasses	3.24	0.25	2.91	0.29	3.08	1.11	1.15	,,	NS

194	Make bunds between two strips surface.	2.82	0.77	2.73	0.80	3.78	1.27	0.30	,,	NS
195	Construct deep pathways for diverting running water and channelling them into exit pipes or tunnels.	2.88	0.97	2.89	0.97	2.89	1.21	0.04	,,	NS
196	Make barriers along the slope with sand bags and logs of wood.	2.59	0.15	3.01	0.24	2.80	1.21	1.44	,,	NS
197	Build tunnels in form of large exit pipes or joined ringed concrete.	2.65	0.06	3.20	0.09	2.93	1.13	1.90	,,	NS
								1.10	**1.98**	**NS**
	Irrigation									
198	Identify the irrigation method and types to adopt.	3.12	0.91	3.08	0.91	3.10	1.28	0.12	,,	NS
199	Determine plant water requirements.	2.71	0.07	3.22	0.14	2.97	1.15	1.86	,,	NS
200	Lay out the system.	3.00	0.08	3.45	0.14	2.23	1.42	1.76	1.98	NS
201	Irrigate the "base plant." Using watering can or any other tool	2.82	0.34	3.11	0.37	2.97	1.14	0.96	,,	NS
202	Calculate the water usage for the crop.	2.71	0.06	3.22	0.15	2.97	1.14	1.95	,,	NS
203	Carry out appropriate maintenance practices of the equipment	3.00	0.97	2.99	0.97	3.00	1.16	0.04	,,	NS
								1.12	**1.98**	**NS**

APPENDIX I

Performance Gap Analysis of Mean Ratings of Teachers on the Instructional Skills Required for Effective Teaching in Colleges of Education.

N=85

S/N	Item Statement	$\bar{X}_R$	$\bar{X}_p$	PG $\bar{X}_R – \bar{X}_p$	Remarks
	Planning Kills				
1	Conduct a need analysis on soil Conservation	3.49	1.94	1.55	Improvement Needed (IN)
2	Consult curriculum standards on soil conservation practices.	3.23	1.94	1.29	,,
3	Determine the basic skills required in soil conservation practices.	3.46	2.00	1.46	,,
4	Determine the objective required in soil conservation practices.	3.38	1.93	1.45	,,
5	Identify skills that need to be scaffold (sequenced).	3.21	1.87	1.34	,,
6	Break the soil conservation course into units or lesson topics.	3.37	1.97	1.40	,,

7	Develop objectives for each topic on soil conservation while writing the lesson plan.	3.46	1.84	1.62	,,
8	Identify materials/resources that are best suited for accomplishing each lesson topic.	3.57	1.74	1.73	,,
9	Design class activities that may involve listening, speaking, reading writing and manipulating.	3.26	1.81	1.35	,,
10	Identify opportunities for learners to put the skills into practice outside learning environment.	3.42	1.89	1.53	,,
11	Identify instructional strategies that include a variety of activities focusing on the objectives.	3.19	1.94	1.25	,,
12	Provide the materials that will help in the achievement of each topic in soil conservation	3.48	1.83	1.65	,,
13	Review objectives periodically	3.33	1.89	1.44	Improvement Needed
		3.37	**1.89**	**1.48**	
	Implementation Skills				
14	Inform students technically of the objectives of each lesson on soil conservation (expectation at the end of the lesson).	3.27	2.01	1.26	,,
15	Provide students with clear statement of skills required in each topic of soil conservation lesson.	3.25	2.08	1.17	,
16	Provide students with clear statement of assessment requirements.	3.29	1.97	1.32	,,
17	Introduce the topic to the students.	3.46	2.01	1.45	,,
18	Give summary or revision of the previous lesson to link it with the days lesson	3.43	1.94		,,
19	(For a new lesson), test the studentsôentry behaviour with generally stimulating questions that are familiar but in the direction of the lesson on soil conservation.	3.28	1.98	1.34	,,
20	Present the subject content in soil conservation in a coherent manner.	3.35	1.94	1.37	,

21	Utilise different instructional strategies	3.28	1.88	1.34	,,
22	Introduce learning materials at appropriate time.	3.51	1.97	1.63	..
23	Ask questions to guide the learnersô	3.44	1.95	1.47	,,
24	Give students opportunity to answer the questions on soil conservation practices.	3.43	2.01	1.48	,,
25	Correct wrong answers where nobody could do so in the class.	3.48	1.85	1.43	,,
26	Provide opportunities for individual consultations after the lesson	3.05	1.97	1.52	,,
27	Modify the lesson based on studentsôreply to questions.	3.18	3.18	0.00	No Improvement Needed (NIN)
		3.34	**1.97**	**1.37**	NIN
	Evaluation skills				
28	Determine the assessment procedures on each topic on soil conservation	3.24	1.95	1.29	IN
29	Decide how to judge the performance. on theory or practical in soil conservation practices.	3.28	2.00	1.28	ñ
30	Design the assessment focusing on the content that is most important for students to learn	3.22	1.97	1.26	ñ
31	Pose closure questions at the end of each dayõs lesson on soil conservation.	3.33	1.80	1.53	ñ
32	Provide cross-word puzzles or a more challenging worksheet to keep fast working students busy and advanced ones engaged.	2.89	1.98	0.85	ñ
33	Observe studentsôbody language while carrying out activities on soil conservation.	2.93	1.75	1.18	ñ
34	Observe students frequently off-task behaviours in the classroom	3.02	1.85	1.17	ñ
35	Observe students in group while discussing soil conservation practices	3.18	1.92	1.26	ñ

36	Utilise a variety of formal, informal. Formative and summative assessments methods	3.29	1.99	1.30	ñ
37	Assign grades to studentsôperformance	3.35	2.01	1.34	ñ
38	Use assessment results to evaluate student interest in the content areas of agriculture	3.10	1.93	1.17	ñ
39	Give feedback (result) to students on their performances in soil conservation ractices	3.34	1.89	1.45	ñ
		3.17	**1.89**	**1.28**	ñ

APPENDIX J

Performance Gap Analysis of Mean Ratings of Teachers on the Soil Conservation Skills Required for Effective Teaching of students in Colleges of Education.

N = 85

S/N	**Item Statement**	$\overline{X}_R$	$\overline{X}_p$	**(PG)** $\overline{X}_R - \overline{X}_P$	**Remarks**
	Tillage Skills				
1	Turn the soil with mouldboard-plough to bury surface materials,	3.46	1.86	1.60	I N
2	Mix the soil with chisel plough.	3.51	1.79	1.72	,,
3	Loosen the soil with hoe	3.40	1.79	1.61	ñ
4	Stir the soil with hoe and or shovel	3.49	1.65	1.84	ñ
5	Bury the weeds	3.66	1.74	1.92	ñ
6	Scrape the soil surface	3.58	1.75	1.83	ñ
7	Smoothen the crushed surface	3.40	1.69	1.81	ñ
8	Till the soil leaving straw and stubble on the soil surface.	3.51	1.85	1.66	ñ
9	Perform tillage at right angles to the prevailing	3.59	1.30	2.29	ñ

	winds				
10	Follow the contour of the land in hilly landscape to intercept water during heavy rainfall.	3.41	1.75	1.66	ñ
11	Break the soil with hoe or tillage equipment	3.37	1.69	1.68	ñ
12	Twist and collect the soil with the hoe	3.26	1.82	1.44	ñ
13	Raise the hoe with the soil	3.47	174.	1.73	ñ
14	Invert the soil while incorporating crop residues.	3.34	1.78	1.56	ñ
15	Construct flat beds	3.28	1.81	1.47	,,
16	Construct ridges and furrows	3.45	1.75	1.70	,,
17	Make cross bars	3.44	1.89	1.55	,,
18	Break old ridges to build new ones on the furrows by inverting half of the soil from adjacent ridges on both left and right	3.30	1.87	1.43	I N
19	If beds are required, construct wide beds that can accommodate two rows of crop plants.	3.46	1.85	1.61	I ,,
20	Mulch the constructed ridges or beds with 'op Residues	3.38	1.89	1.49	,,
		3.44	**1.78**	**1.66**	,,
	Soil Testing and Analysis Skills				
	i) Soil sampling				
21	Consult some laboratories that are good in soil testing and analysis	3.57	1.81	1.76	I ,,
22	Select one that is near the area to be tested if any.	3.31	1.86	1.45	,,
23	Discuss the soil problem with the consultant or manager of the chosen testing laboratory.	3.37	1.75	1.62	,,
24	Obtain the implement for sampling from the extension officer (probe or auger, trowel or spade)	3.47	1.65	1.82	,,
25	Move to the site that need testing.	3.53	1.77	1.81	,,
26	Scrape away the surface litter.	3.52	1.80	1.72	,,

27	Mark a relatively uniform field fig A (that is one that can be easily managed in a consistent manner)	3.47	1.75	1.72	,,
28	Mark field that has more than a distinct area which cannot be easily managed in a consistent manner fig B	3.64	1.87	1.77	,,
29	Insert the probe or auger into the soil to the plough depth or at least 6inches	3.59	1.81	1.78	,,
30	Collect soil samples with probe, auger or shovel	3.45	1.88	1.57	,,
31	Collect 25 cores from each marked area	3.59	1.72	1.87	,,
32	Mix each of the 25 cores from each area together to give a common composite sample.	3.48	1.84	1.64	,,
33	Take 20-30 ounces (volume)	3.50	1.81	1.69	,,
34	Crush the collected sample in a mortar	3.53	1.79	1.74	,,
35	Sieve the sample through a 2mm brass, stainless or plastic sieve	3.49	1.87	1.62	,,
36	Package the soil samples into container	3.46	1.81	1.65	,,
37	Store in a clean closed container	3.39	1.79	1.60	,,
38	Take to the laboratory for analysis	3.51	1.87	1.64	,,
39	Test for CEC, NPK Ma and pH	3.57	1.88	1.69	,,
40	Air dry the sample below 120^{of} if not shipped immediately to the laboratory	3.61	1.80	1.81	,,
41	Collect lab result with recommendation.	3.58	1.80	1.78	,,
	ii) Cation Exchange capacity				
42	Place filter papers in two funnels and fill them with the soil sample.	3.59	1.85	1.74	,,
43	Leach the soil in one of the funnels with a 100% potassium nitrate (KNO_3) solution	3.58	1.82	1.76	,,
44	Add few drops of soil indicator solution to both leachates	3.70	1.80	1.90	,,

45	Observe the leachate.	3.65	1.78	1.86	,,
	iii) Soil pH				
46	Fill a test tube to a depth of almost 1cm with the soil to be tested.	3.48	1.78	1.70	,,
47	Add the 1cm of barium sulphate.	3.48	1.82	1.66	,,
48	Fill the tube with distilled water leaving a ɔace of 4 cm from the top of the tube.	3.49	1.77	1.72	,,
49	Shake the tube thoroughly.	3.54	1.81	1.73	,,
50	Allow the content to settle, and then add 8 ï ʖ drops of universal indicator.	3.49	1.86	1.63	,,
51	Shake the tube again and allow the content to settle.	3.48	3.48	0.00	N I N
52	Hold the test tube again at the pointed colour chart.	3.49	3.57	- 0.08	,,
53	Compare each colour with the colour of the suspension containing the indicator and note the pH of the colour which it matches exactly.	3.36	3.73	- 0.37	,,
	iv) Lime requirement of the soil				
54	Place a small quantity of calcium carbonate on a glass.	3.45	3.64	- 0.09	,,
55	Half fill a test tube with soil indicator solution.	3.48	3.55	- 0.07	,,
56	Add a drop of acid and shake the tube thoroughly.	3.36	3.53	- 0.17	,,
57	Add few drops of sodium hydroxide solution ɿd shake again.	3.41	3.57	- 0.16	,,
58	Place a small quantity of soil or a piece of waxed paper and add drops of soil indicator solution until some of it runs out of the soil.	3.36	3.79	- 0.43	,,
59	Test all the samples of the soil which are	3.48	3.25	0.23	,,

	available				
60	Record the pH of each of them.	3.49	3.32	0.17	,,
61	Use colour chart to relate the pH of soil ample and recommend application of lime per hectare.	3.45	3.74	- 0.29	,,
	G) Test for Phosphorus				
62	Pour $10cm^3$ of ammonium molybdate solution into the glass vial.	3.37	3.61	- 0. 24	,,
63	Add 1g of soil and shake the vial vigorously for one minute.	3.49	3.64	- 0. 15	,,
64	Filter the solution.	3.49	3.46	0.03	I N
65	Add a grain of dry powdered tin (ii) chloride solution to 5 cm^3 of the filtrate.	3.35	3.15	0.20	,,
66	Observe the intensity of the colour of molybdenum.	3.41	3.40	0.01	,,
	H) Test for Potassium				
67	Pour 10 cm^3 of sodium cobalt nitrate solution into a glass vial.	3.35	3.54	-0.19	N I N
68	Add one level tea spoon of air dried soil	3.45	3.38	0.07	I N
69	Shake the vial vigorously for a minute.	3.48	3.45	0.04	,,
70	Filter the solution.	3.52	3.44	0.08	,,
71	Use the pipette to add 2.5 cm^3 of anhydrous propyl 2OL to $5cm^3$ of filtrate and mix the two solutions together thoroughly.	3.47	3.19	0.28	,,
72	After three minute compare the turbidity of the solution with a standard chart.	3.72	3.01	0.41	,,
	I) Test for Magnesium				
73	Put 1 cm^3 of soil extraction into a test tube.	3.59	3.38	0.21	,,
74	Add one drop of titan yellow solution and shake the tube vigorously.	3.44	3.58	- 0.14	N I N
75	Add one drop of 5% sodium hydroxide olution and shake the tube.	3.44	3.53	- 0.09	,,

76	Observe the colour.	3.44	3.49	- 005.	,,
	J) Test for Nitrates				
77	Place one drop of the soil extract on a spotting title and add four drops of the dispheny mine solution.	3.42	3.42	0.00	N I N
78	After two minute stir the mixture.	3.36	3.29	0.07	I N
79	Compare the colour with standard colour chart	3.24	3.38	- 0.14	N I N
		3.46	**2.92**	**0.54**	I N

	Manure Preparation and Application				
	i) Farm yard manure				
80	House animals: goat, sheep, or poultry in pen.	3.15	2.92	0.23	I N
81	Feed the animals with grasses, legumes, ater and other materials.	3.47	3.58	- 011.	N I N
82	Collect animal dung and litter from the pen.	3.64	1.89	1.75	I N
83	Heap the daily collected beddings together in place.	3.61	1.89	1.72	,,
84	Identify the area to apply the manure.	3.39	1.82	1.57	,,
85	Apply to the soil using broadcasting method	3.71	1.89	1.82	,,
	ii) Compost manure				
86	Select appropriate site for compost reparation	3.33	1.85	1.48	I N
87	Map out seven plots/spaces	3.42	1.82	1.60	,,
88	Label the plots/spaces as A,B,C,1, 2, 3 and 4	3.30	1.85	1.45	,,

89	Dig trenches or pits of about 1m deep in each plot mapped.	3.32	1,87	1.45	,,
90	Provide wall or fence round the corners.	3.47	1.79	1.68	,,
91	Provide compost materials	3.28	1.79	1.49	
92	Cut the compost materials with cutlass.	3.45	1.72	1.73	
93	Build up the heaps in plots 1,2,3 and 4 with ıe cut materials	3.35	1.82	1.53	
94	Spray urine, wood ash, animal dung or a head pan or bucket full of old compost on top of each layer	3.51	1.91	1.62	,,
95	Sprinkle water on each 4 heaps	3.34	79	1.60	,,
96	Sprinkle hand full of soil	3.48	1.86	1.55	,,
97	Add other layers of compost materials in alternate manner.	3.37	1.94	1.43	I N
98	Repeat the process of applying water after each layer until the required level of the compost is attained	3.43	1.93	1.50	,,
99	Drive a strong long stick (testing stick) through the top until it reaches the centre	2.93	1.89	1.04	,,
100	Cover the pit with layers of refuse of 15-20cm.	3.22	1.98	1.24	,,
101	Plaster/ cover to drive away files	3.31	1.86	1.45	,,
102	Allow materials to sink	3.43	1.91	1.52	,,
103	Take the stick out after the first day	3.29	1.91	1.38	,,
104	Feel the testing stick to know if it is hot, cold, damp, or moist	3.28	1.88	1.40	,,
105	Turn the materials (removing layer by layer) from heap 1 and 2 into space A and materials in heap 3 and 4 into space B.	3.31	1.85	1.46	,,
106	Stack materials in the spaces from where the	3.40	1.86	1.54	,,

	materials were removed i.e. 1, 2, 3 and 4 to continue another process				
107	Move the materials in heap óAôto óCôand those in óBôto óCôafter a fortnight.	3.24	1.91	1.33	,,
108	Provide a shade over the decayed compost.	3.22	1.85	1.37	,
109	Cover the prepared compost to prevent effect of sun or rain	3.33	1.91	1.42	,,
110	Apply using appropriate method like ring, band or broadcasting.	3.51	1.87	1.64	,,
	iii) Green manure				
111	Collect green manure crop seeds/ cuttings	3.54	1.84	1.70	,,
112	Prepare seed beds.	3.28	3.34	- 0.06	,,
113	Broadcast small seeds of legumes	3.62	3.53	0.09	,,
114	Plant seeds or cuttings; spacing them closely	3.59	3.27	0.32	,,
115	Plant larger seeds in rows between the rows f cereals	3.59	3.58	0.01	I N
116	Water the seed beds after planting	3.65	3.62	0.03	I N
117	Weed the plot regularly to reduce pests	3.58	3.22	0.36	,,
118	Plough in the crop distributing evenly over the farm just after it had flowered	3.58	3.51	0.07	,,
119	Leave at least 7days before planting the next crop	3.54	3.43	0.11	,,
	iv) Fertilizer application				
120	Plough the field/land	3.54	3.51	0.03	,,
121	Broadcast fertilizer uniformly over uncultivated .nd using hang or machine.	3.60	3.34	0.26	,,
122	Mix fertilizer with soil	3.51	3.44	0.07	,,
123	Protect plantsôstems or roots from being in contact with fertilizer	3.55	3.58	- 0.03	N I N
124	Make an opening in ring-form round the crop	3.52	3.72	- 0.20	,,

	bands if crops are planted in rows/ridges				
125	Spread fertilizer evenly in the ring or bands a few centimetre away from the crop	3.69	3.61	0.08	I N
126	Cover the applied fertilizer with soil	3.39	3.52	- 0.13	N I N
127	At about 3-4 weeks after planting, apply second dose of fertilizer by placing on a ring close to the plant	3.42	3.67	- 025.	,,
	G) Mulching				
128	Identify the appropriate mulch materials	3.32	3.69	- 0.37	N I N
129	Collect/rake dry plant materials that do not rot quickly.	3.47	3.80	- 0.33	,,
130	Put them into a mulch bin.	3.28	3.69	- 0.41	,,
131	Cut or shred the leaves using mulching lawn mower	3.45	376.	- 0.31	,,
132	Determine when to apply the material	3.34	3.75	- 0.41	N I N
133	Carry the materials to the field	3.51	3.47	0.04	I N
134	Spread the materials on the soil surface with hand or rake before or after planting.	3.34	3.46	- 0.32	N I N
135	Spread on the cultivated beds or ridges	3.48	3.68	- 0.20	,,
136	Spread around young crop plants	3.37	3.47	- 0.10	,,
137	Spread mulch materials during dry season	3.43	3.48	- 0.05	,,
138	Spread mulch materials during rainy season in places where the soil is easily eroded.	2.93	3.44	- 0.51	,,
139	Maintain a layer of mulch material at 7-15cm (3-6 inches) deep all over bed, around the growing plant and more on the eroded places	3.53	3.22	0.31	I N
140	Spread plastic mulch materials.	3.69	3.31	0.38	,,
141	Poke holes in the plastic mulch materials to provide access for the plants	3.67	3.45	0.22	,,

		3.43	**2.92**	**0.51**	,,
	H) Crop Rotation				
142	Make a long range rotation plan by d determining the goals in view	3.29	3.71	- 0.42	N I N
143	Make a list of crops to grow in the farm	3.28	3.69	- 0.41	,,
144	Group them together by plant family.	3.31	1.78	1.53	I N
145	Create a planting schedule	3.40	1.85	1.55	,,
146	Draw a map of the beds, ridges or mounds on a graph paper and make several copies.	3.86	1.89	1.35	,,
147	Use the map to plan where to plant each crop	3.22	1.79	1.43	,,
148	Note crops that are to be grown and where on the map.	3.33	1.81	1.52	,,
149	Label each crop with the year including a fallow in the rotation	3.51	1.79	1.72	,,
150	Implement the plan by planting specific crops in the mapped spaces	3.54	1.77	1.77	,,
151	Follow the planting schedule by planting the plants chosen in order of sequence	3.28	1.78	1.50	,,
152	Be consistent for consistent result	3.62	1.77	1.85	,,
153	Keep records so that gains (or losses) in production can be observed.	3.59	1.81	1.78	,,
154	Modify the order to minimize the loss	3.59	1.82	1.77	,,
		3.41	**2.05**	**1.36**	,,
	Skills in soil erosion prevention and Control				
	1) Soil Erosion Prevention				
155	Spread organic mulch over uncultivated land.	3.65	1.84	1.81	,,
156	Make ridges across the slope.	58	1.81	1.77	,,

157	Make cross bars between ridges.	3.58	1.71	1.87	,,
158	Plant grasses on the land that is likely to be eroded.	3.54	3.54	0.00	N I N
159	Break the slope into series of flat-surfaces called terraces.	3.60	1.85	1.75	I N
160	Establish crops in strips at right angles to the direction of water flow.	3.60	1.81	1.89	,,
161	Break the soil clods moderately in order to avoid excessive damages to soil granules.	3.51	1.82	1.69	,,
162	Plant young tree seedlings in areas likely to be eroded in future.	3.55	1.75	1.80	,,
163	Prepare ridges in spiral forms to restrict rapid ıovement of water in the farm.	3.52	1.89	1.63	,,
164	Grow plants that are indigenous to the area.	3.69	1.81	1.88	,,
165	Plant and maintain enough strong, healthy growing vegetation like trees and shrubs.	3.39	1.83	1.56	,,
166	Keep the soil moist by covering with damp piles of mulch.	3.42	1.77	1.65	,,
167	Practice a tillage method that does not make the soil over fine.	3.49	1.78	1.71	,,
168	Construct physical structures made of earth , stone or other materials	3.62	1.82	1.80	,,
169	Construct wind barrier at the boundaries of the farm,.	3.40	1.82	1.58	,,
170	Plant patches of high grass and allow the grass to grow to at least three inches to promote retention of water in the soil.	3.45	1.88	1.57	,,
171	Plant cover crops that will assist in covering ıe ground; reducing runoff.	3.46	1.82	1.64	,,
172	Water plants early in the morning, when evaporation is low.	3.48	1.85	1.63	,,

Skills in Soil Erosion Control

173	Plough on the contour.	3.37	3.34	0.03	,,
174	Make concrete walls.	3.43	3.71	- 0.28	N I N
175	Place blankets and mats tightly and securely on affected area	3.10	3.52	- 0.42	,,
176	Construct large cement pavers into a retaining wall to prevent the water from travelling onwards	3.28	3.31	- 0.03	,,
177	Use large boulder type rocks or concrete pavers on shorelines	3.29	3.39	- 0.10	,,
178	Place grass onto the eroded areas where it ill grow over, covering the surface	3.48	3.23	0.25	I N
179	Place grass onto the eroded areas where it ill grow over, covering the surface	62	3.88	- 0.26	N I N
180	Till the soil to produce rough clod	53	3.44	0.09	I N
181	Place plant residues on the surface to obtain maximum rougHRess.	3.58	3.53	0.30	,,
182	Construct small ridges to direction of the wind/water	3.41	3.18	0.23	,,
183	Plant crops on the contour.	3.47	3.58	- 0.11	N I N
184	Put checks in furrows.	3.28	3.32	- 0.04	,,
185	Establish grasses that have the ability to live long and withstand wind.	3.55	3.56	- 0.01	,,
186	Plant tress to act as shelter belts.	3.29	3.12	0.17	I N
187	Build level terracing.	3.11	3.24	- 0.13	N I N
188	Fill in gullies with sand.	3.21	3.06	0.05	I N
189	Shape gullies for smooth water flows.	3.21	3.24	- 0.03	N I N
190	Construct dams of 0.5m high at intervals of 4-9m depending on the slope.	3.18	3.41	- 0.23	,,
191	Plant perennial vegetations on exposed road cuts to eliminate soil loss.	3.88	3.46	0.42	I N

192	Provide cross channels (shallow ditches or water channel) every 25to100 m to prevent excessive accumulation of water	3.08	3.19	- 0.11	N I N
193	Plant windbreaks and tenacious grasses	2.96	3.44	- 0.45	,,
194	Make bunds between two strips surface.	3.75	3.65	0.10	I N
195	Construct deep pathways for diverting running ater and channelling them into exit pipes or ınnels.	2.89	3.18	- 0.22	N I N
196	Make barriers along the slope with sand bags ıd logs of wood.	3.94	3.00	- 0.06	,,
197	Build tunnels in form of large exit pipes or ined ringed concrete.	3.11	2.94	0.17	I N
		3.40	**2.09**	**1.31**	,,
	Skills in Irrigation				
198	Identify the irrigation method and types to adopt.	3.09	3.34	- 0.25	N I N
199	Determine plant water requirements.	3.14	2.95	0.19	I N
200	Lay out the system.	3.37	3.07	0.30	,,
201	Irrigate the "base plant." Using watering can or any other	3.06	2.92	0.14	,,
202	Calculate the water usage for the crop.	3.14	1.71	1.97	,,
203	Carry out appropriate maintenance practices of the equipment	2.99	1.69	1.30	,,
		3.13	**2.61**	**0.52**	**,,**

APPENDIX K

Questionnaire for Lecturers of Agricultural Education in Universities in South Eastern Nigeria

INSTRUCTION: PLEASE COMPLETE THE QUESTIONNAIRE BY CHECKING {√} ON THE OPTION THAT BEST JUSTIFIES YOUR VIEW.

Part One: Request For Information On Your Personal Data.

Name of Institution-----------

Highest Qualification: (i) NCE [ ]. (ii) B. Sc. [ ]. (iii) Masters [ ]. Ph.D [ ] .

Experience on the present job: (i) 1 ï 5 years [ ] (ii) 6 ï 10 years [ ].
(iii) 11 ï 15 years [ ].. (iv) 16 ï 20years [ ].. (v) 21 years and above [ ]

Part Two: Request for Your Opinion on the Items using the scales provided below for each item. The four columns refers to the level to which each item is required for effective teaching of soil conservation.

HR - Highly Required
AR - Averagely Required
SR - Slightly Required
NR - Not Required

Instructional Skills required for teaching in Colleges of Education

S/N	Item Statement	HR	AR	SR	NR
	Planning Instruction				
1	Conduct a need analysis on soil conservation				
2	Consult curriculum standards on soil conservation practices.				
3	Determine the basic skills required in soil conservation practices.				
4	Determine the objective required in soil conservation practices.				
5	Identify skills that need to be scaffold (sequenced).				
6	Break the soil conservation course into units or lesson topics.				
7	Develop objectives for each topic on soil conservation while writing the lesson plan.				
8	Identify materials/resources that are best suited for accomplishing each lesson topic.				
9	Design class activities that may involve listening, speaking, reading writing and manipulating.				
10	Identify opportunities for learners to put the skills into practice outside learning environment.				
11	Identify instructional strategies that include a variety of activities focusing on the objectives.				
12	Provide the materials that will help in the achievement of each topic in soil conservation				
13	Review objectives periodically				
	Implementation Skills				
14	Inform students technically of the objectives of each lesson on soil conservation (expectation at the end of the lesson).				
15	Provide students with clear statement of skills required in each topic of soil conservation lesson.				
16	Provide students with clear statement of assessment requirements.				
17	Introduce the topic to the students.				
18	Give summary or revision of the previous lesson to link it with the days lesson				
19	(For a new lesson), test the studentsôentry behaviour with generally stimulating questions that are familiar but in the direction of the lesson on soil conservation.				
20	Present the subject content in soil conservation in a coherent manner.				
21	Utilize different instructional strategies				
22	Introduce learning materials at appropriate time.				

23	Ask questions to guide the learnersô				
24	Give students opportunity to answer the questions on soil conservation practices.				
25	Correct wrong answers where nobody could do so in the class.				
26	Provide opportunities for individual consultations after the lesson				
27	Modify the lesson based on studentsôreply to questions.				
28	**Evaluating Instruction** Determine the assessment procedures on each topic on soil Conservation				
29	Decide how to judge the performance. on theory or practical in soil conservation practices.				
30	Design the assessment focusing on the content that is most important for students to learn				
31	Pose closure questions at the end of each dayôs lesson on soil conservation.				
32	Provide cross-word puzzles or a more challenging worksheet to keep fast working students busy and advanced ones engaged.				
33	Observe studentsôbody language while carrying out activities on soil conservation.				
34	Observe students frequently off-task behaviours in the Classroom				
35	Observe students in group while discussing soil conservation Practices				
36	Utilise a variety of formal, informal. Formative and summative assessments methods				
37	Assign grades to studentsôperformance				
38	Use assessment results to evaluate student interest in the content areas of agriculture				
39	Give feedback (result) to students on their performances in soil conservation practices				

Soil conservation skills required for teaching in Colleges of Education.

1	**Tillage Skills** Turn the soil with mouldboard-plough to bury surface materials.	**HR**	**AR**	**SR**	**NR**	
2	Mix the soil with chisel plough.					
3	Loosen the soil with hoe					
4	Stir the soil with hoe and or shovel					
5	Bury the weeds					
6	Scrape the soil surface					
7	Smoothen the crushed surface					
8	Till the soil leaving straw and stubble on the soil surface.					
9	Perform tillage at right angles to the prevailing winds					

10	Follow the contour of the land in hilly landscape to intercept water during heavy rainfall.					
11	Break the soil with hoe or tillage equipment					
12	Twist and collect the soil with the hoe					
13	Raise the hoe with the soil					
14	Invert the soil while incorporating crop residues.					
15	Construct flat beds					
16	Construct ridges and furrows					
17	Make cross bars					
18	Break old ridges to build new ones on the furrows by inverting half of the soil from adjacent ridges on both left and right					
19	If beds are required, construct wide beds that can accommodate two rows of crop plants.					
20	Mulch the constructed ridges or beds with crop residues					
	Soil Testing and Analysis Skills **Soil sampling**					
21	Consult some laboratories that are good in soil testing and analysis.					
22	Select one that is near the area to be tested if any.					
23	Discuss the soil problem with the consultant or manager of the chosen testing laboratory.					
24	Obtain the implement for sampling from the extension officer (probe or auger, trowel or spade)					
25	Move to the site that need testing.					
26	Scrape away the surface litter.					
27	Mark a relatively uniform field fig A (that is one that can be easily managed in a consistent manner)					
28	Mark field that has more than a distinct area which cannot be easily managed in a consistent manner fig B					
29	Insert the probe or auger into the soil to the plough depth or at least 6inches					
30	Collect soil samples with probe, auger or shovel					
31	Collect 25 cores from each marked area					
32	Mix each of the 25 cores from each area together to give a common composite sample.					
33	Take 20-30 ounces (volume)					
34	Crush the collected sample in a mortar					
35	Sieve the sample through a 2mm brass, stainless or plastic sieve					
36	Package the soil samples into container					
37	Store in a clean closed container					
38	Take to the laboratory for analysis					
39	Test for CEC, NPK Ma and pH					
40	Air dry the sample below 120^{of} if not shipped immediately to the Laboratory					
41	Collect lab result with recommendation.					
	 Cation Exchange capacity					

42	Place filter papers in two funnels and fill them with the soil sample.					
43	Leach the soil in one of the funnels with a 100% potassium nitrate (KNO_3) solution					
44	Add few drops of soil indicator solution to both leachates \					
45	Observe the leachate.					
	Soil pH					
46	Fill a test tube to a depth of almost 1cm with the soil to be tested.					
47	Add the 1cm of barium sulphate.					
48	Fill the tube with distilled water leaving a space of 4 cm from the top of the tube.					
49	Shake the tube thoroughly.					
50	Allow the content to settle, and then add 8 ï 10 drops of universal indicator.					
51	Shake the tube again and allow the content to settle.					
52	Hold the test tube again at the pointed colour chart.					
53	Compare each colour with the colour of the suspension containing the indicator and note the pH of the colour which it matches exactly.					
	Lime requirement of the soil					
54	Place a small quantity of calcium carbonate on a glass.					
55	Half fill a test tube with soil indicator solution.					
56	Add a drop of acid and shake the tube thoroughly.					
57	Add few drops of sodium hydroxide solution and shake again.					
58	Place a small quantity of soil or a piece of waxed paper and add drops of soil indicator solution until some of it runs out of the soil.					
59	Test all the samples of the soil which are available					
60	Record the pH of each of them.					
61	Use colour chart to relate the pH of soil sample and recommend application of lime per hectare.					
	Test for Phosphorus					
62	Pour $10cm^3$ of ammonium molybdate solution into the glass vial.					
63	Add 1g of soil and shake the vial vigorously for one minute.					
64	Filter the solution.					
65	Add a grain of dry powdered tin (ii) chloride solution to 5 cm^3 of the filtrate.					
66	Observe the intensity of the colour of molybdenum.					
	Test for Potassium					
67	Pour 10 cm^3 of sodium cobalt nitrate solution into a glass vial.					
68	Add one level tea spoon of air dried soil					
69	Shake the vial vigorously for a minute.					
70	Filter the solution.					
71	Use the pipette to add 2.5 cm^3 of anhydrous propyl 2OL to $5cm^3$ of filtrate and mix the two solutions together thoroughly.					

72	After three minute compare the turbidity of the solution with a standard chart.					
	Test for Magnesium					
73	Put 1 cm^3 of soil extraction into a test tube.					
74	Add one drop of titan yellow solution and shake the tube vigorously.					
75	Add one drop of 5% sodium hydroxide solution and shake the tube.					
76	Observe the colour.					
	Test for Nitrates					
77	Place one drop of the soil extract on a spotting title and add four drops of the dispheny lamine solution.					
78	After two minute stir the mixture.					
79	Compare the colour with standard colour chart					
	Manure Preparation and Application **Farm yard manure**					
80	House animals: goat, sheep, or poultry in pen.					
81	Feed the animals with grasses, legumes, water and other materials.					
82	Collect animal dung and litter from the pen.					
83	Heap the daily collected beddings together in a place.					
84	Allow them to decay.					
85	Apply to the soil using broadcasting method					
	Compost manure					
86	Select appropriate site for compost preparation					
87	Map out seven plots/spaces					
88	Label the plots/spaces as A,B,C,1, 2, 3 and 4					
89	Dig trenches or pits of about 1m deep in each plot mapped.					
90	Provide wall or fence round the corners.					
91	Provide compost materials					
92	Cut the compost materials with cutlass.					
93	Build up the heaps in plots 1,2,3 and 4 with the cut materials					
94	Spray urine, wood ash, animal dung or a head pan or bucket full of old compost on top of each layer					
95	Sprinkle water on each 4 heaps					
96	Sprinkle hand full of soil					
97	Add other layers of compost materials in alternate manner.					
98	Repeat the process of applying water after each layer until the required level of the compost is attained					
99	Drive a strong long stick (testing stick) through the top until it reaches the centre					
100	Cover the pit with layers of refuse of 15-20cm.					
101	Plaster/ cover to drive away files					
102	Allow materials to sink					

103	Take the stick out after the first day					
104	Feel the testing stick to know if it is hot, cold, damp, or moist					
105	Turn the materials (removing layer by layer) from heap 1 and 2 into space A and materials in heap 3 and 4 into space B.					
106	Stack materials in the spaces from where the materials were removed i.e. 1, 2, 3 and 4 to continue another process					
107	Move the materials in heap óAôto óCôand those in óBôto óCôafter a fortnight.					
108	Provide a shade over the decayed compost.					
109	Cover the prepared compost to prevent effect of sun or rain.					
110	Apply using appropriate method like ring, band or broadcasting.					
	Green manure					
111	Collect green manure crop seeds/ cuttings					
112	Prepare seed beds.					
113	Broadcast small seeds of legumes					
114	Plant seeds or cuttings; spacing them closely					
115	Plant larger seeds in rows between the rows of cereals					
116	Water the seed beds after planting					
117	Weed the plot regularly to reduce pests					
118	Plough in the crop distributing evenly over the farm just after it had flowered					
119	Leave at least 7days before planting the next crop					
	Fertilizer application					
120	Plough the field/land					
121	Broadcast fertilizer uniformly over uncultivated land using hang or machine.					
122	Mix fertilizer with soil					
123	Protect plantsôstems or roots from being in contact with fertilizer					
124	Make an opening in ring-form round the crop or bands if crops are planted in rows/ridges					
125	Spread fertilizer evenly in the ring or bands a few centimetre away from the crop					
126	Cover the applied fertilizer with soil					
127	At about 3-4 weeks after planting, apply second dose of fertilizer by placing on a ring close to the plant					
	Mulching					
128	Identify the appropriate mulch materials					
129	Collect/rake dry plant materials that do not rot quickly.					
130	Put them into a mulch bin.					
131	Cut or shred the leaves using mulching lawn mower					
132	Determine when to apply the material					
133	Carry the materials to the field					
134	Spread the materials on the soil surface with hand or rake before or after planting.					
135	Spread on the cultivated beds or ridges					
136	Spread around young crop plants					

137	Spread mulch materials during dry season					
138	Spread mulch materials during rainy season in places where the soil is easily eroded.					
139	Maintain a layer of mulch material at 7-15cm (3-6 inches) deep all over bed, around the growing plant and more on the eroded places					
140	Spread plastic mulch materials.					
141	Poke holes in the plastic mulch materials to provide access for the plants					
	Crop Rotation					
142	Make a long range rotation plan by determining the goals in view					
143	Make a list of crops to grow in the farm					
144	Group them together by plant family.					
145	Create a planting schedule					
146	Draw a map of the beds, ridges or mounds on a graph paper and make several copies.					
147	Use the map to plan where to plant each crop					
148	Note crops that are to be grown and where on the map.					
149	Label each crop with the year including a fallow in the rotation					
150	Implement the plan by planting specific crops in the mapped Spaces					
151	Follow the planting schedule by planting the plants chosen in order of sequence					
152	Be consistent for consistent result					
153	Keep records so that gains (or losses) in production can be observed.					
154	Modify the order to minimize the loss					
	Skills in soil erosion prevention and control **Soil Erosion Prevention**					
155	Spread organic mulch over uncultivated land.					
156	Make ridges across the slope.					
157	Make cross bars between ridges.					
158	Plant grasses on the land that is likely to be eroded.					
159	Break the slope into series of flat-surfaces called terraces.					
160	Establish crops in strips at right angles to the direction of water flow.					
161	Break the soil clods moderately in order to avoid excessive damages to soil granules.					
162	Plant young tree seedlings in areas likely to be eroded in future.					
163	Prepare ridges in spiral forms to restrict rapid movement of water in the farm.					
164	Grow plants that are indigenous to the area.					
165	Plant and maintain enough strong, healthy growing vegetation like trees and shrubs.					
166	Keep the soil moist by covering with damp piles of mulch.					
167	Practice a tillage method that does not make the soil over fine.					
168	Construct physical structures made of earth, stone or other materials					

169	Construct wind barrier at the boundaries of the farm.					
170	Plant patches of high grass and allow the grass to grow to at least three inches to promote retention of water in the soil.					
171	Plant cover crops that will assist in covering the ground; reducing runoff.					
172	Water plants early in the morning, when evaporation is low.					
173	Plough on the contour.					
174	Make concrete walls.					
175	Place blankets and mats tightly and securely on affected area					
176	Construct large cement pavers into a retaining wall to prevent the water from travelling onwards					
177	Use large boulder type rocks or concrete pavers on shorelines					
178	Place grass onto the eroded areas where it will grow over, covering the surface					
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186	Plant tress to act as shelter belts.					
187	Build level terracing.					
188	Fill in gullies with sand.					
189	Shape gullies for smooth water flows.					
190	Construct dams of 0.5m high at intervals of 4-9m depending on the slope.					
191	Plant perennial vegetations on exposed road cuts to eliminate soil loss.					
192	Provide cross channels (shallow ditches or water channel) every 25to100 m to prevent excessive accumulation of water					
193	Plant windbreaks and tenacious grasses					
194	Make bunds between two strips surface.					
195	Construct deep pathways for diverting running water and channelling them into exit pipes or tunnels.					
196	Make barriers along the slope with sand bags and logs of wood.					
197	Build tunnels in form of large exit pipes or joined ringed concrete.					
	Skills in Irrigation					
198	Identify the irrigation method and types to adopt.					
199	Determine plant water requirements.					
200	Lay out the system.					
201	Irrigate the "base plant." Using watering can or any other					
202	Calculate the water usage for the crop.					
203	Carry out appropriate maintenance practices of the equipment					

APPENDIX L

Questionnaire for Teachers of Colleges of Education in South Eastern Nigeria

INSTRUCTION: PLEASE COMPLETE THE QUESTIONNAIRE BY CHECKING {√} ON THE OPTION THAT BEST JUSTIFIES YOUR VIEW.

Part One: Request For Information On Your Personal Data.

Name of Institution-----------

Highest Qualification: (i) NCE [ ]. (ii) B. Sc. [ ]. (iii) Masters [ ]. Ph.D [ ] .

Experience on the present job: (i) 1 ï 5 years [ ] (ii) 6 ï 10 years [ ].
(iii) 11 ï 15 years [ ].. (iv) 16 ï 20years [ ].. (v) 21 years and above [ ]

Part Two: Request for Your Opinion on the Items using the scales provided below for each item. The first four columns refer to the level to which the item is required for effective teaching.

HR - Highly Required
AN - Averagely Required
SN - Slightly Required
NN - Not Required

The last four columns indicate the level to which you can perform each item
HP - High Performance
AP - Average Performance
LP - Low Performance

NP - No Performance

Instructional Skills required for teaching in Colleges of Education

S/N	Item Statement	HR	AR	SR	NR	HP	AP	LP	NP
1	**Planning Instruction** Conduct a need analysis on soil Conservation								
2	Consult curriculum standards on soil conservation practices.								
3	Determine the basic skills required in soil conservation practices.								
4	Determine the objective required in soil conservation practices.								
5	Identify skills that need to be scaffold (sequenced).								
6	Break the soil conservation course into units or lesson topics.								
7	Develop objectives for each topic on soil conservation while writing the lesson plan.								
8	Identify materials/resources that are best suited for accomplishing each lesson topic.								
9	Design class activities that may involve listening, speaking, reading writing and manipulating.								
10	Identify opportunities for learners to put the skills into practice outside learning environment.								
11	Identify instructional strategies that include a variety of activities focusing on the objectives.								
12	Provide the materials that will help in the achievement of each topic in soil conservation								
13	Review the objective periodically								
14	**Implementation Skills** Inform students technically of the objectives of each lesson on soil conservation (expectation at the end of the lesson).								
15	Provide students with clear statement of skills required in each topic of soil conservation lesson.								
16	Provide students with clear statement of assessment requirements.								
17	Introduce the topic to the students.								
18	Give summary or revision of the previous lesson to link it with the days lesson								
19	(For a new lesson), test the studentsô entry behaviour with generally stimulating questions that are familiar but in the direction of the lesson on soil conservation.								

20	Present the subject content in soil conservation in a coherent manner.								
21	Utilize different instructional strategies								
22	Introduce learning materials at appropriate time.								
23	Ask questions to guide the learnersô								
24	Give students opportunity to answer the questions on soil conservation practices.								
25	Correct wrong answers where nobody could do so in the class.								
26	Provide opportunities for individual consultations after the lesson								
27	Modify the lesson based on students reply to questions.								
28	**Evaluating Instruction** Determine the assessment procedures on each topic on soil conservation								
29	Decide how to judge the performance. on theory or practical in soil conservation practices.								
30	Design the assessment focusing on the content that is most important for students to learn.								
31	Pose closure questions at the end of each dayôs lesson on soil conservation.								
32	Provide cross-word puzzles or a more challenging worksheet to keep fast working students busy and advanced ones engaged.								
33	Observe studentsôbody language while carrying out activities on soil conservation.								
34	Observe students frequently off-task behaviours in the Classroom								
35	Observe students in group while discussing soil Conservation practices								
36	Utilise a variety of formal, informal. Formative and summative assessments methods								
37	Assign grades to studentsôperformance								
38	Use assessment results to evaluate student interest in the content areas of agriculture								
39	Give feedback (result) to students on their performances in soil conservation practices								

Soil Conservation skills required for effective teaching in Colleges of Education

	Tillage Skills								
1	Turn the soil with mouldboard-plough to bury ırface materials.	HR	AR	SR	NR	HP	AP	LP	NP
2	Mix the soil with chisel plough.								
3	Loosen the soil with hoe								
4	Stir the soil with hoe and or shovel								
5	Bury the weeds								
6	Scrape the soil surface								
7	Smoothen the crushed surface								
8	Till the soil leaving straw and stubble on the soil surface.								
9	Perform tillage at right angles to the prevailing wind								
10	Follow the contour of the land in hilly landscape to intercept water during heavy rainfall.								
11	Break the soil with hoe or tillage Equipment								
12	Twist and collect the soil with the hoe								
13	Raise the hoe with the soil								
14	Invert the soil while incorporating crop residues.								
15	Construct flat beds								
16	Construct ridges and furrows								
17	Make cross bars								
18	Break old ridges to build new ones on the furrows inverting half of the soil from adjacent ridges on both left and right								
19	If beds are required, construct wide beds that can accommodate two rows of crop plants.								
20	Mulch the constructed ridges or beds with crop residues								
	Soil Testing and Analysis Skills **Soil sampling**								
21	Consult some laboratories that are good in soil testing and analysis.								
22	Select one that is near the area to be tested if any.								
23	Discuss the soil problem with the consultant or manager of the chosen testing laboratory.								
24	Obtain the implement for sampling from the extension officer (probe or auger, trowel or spade)								
25	Move to the site that need testing								
26	Scrape away the surface litter.								
27	Mark a relatively uniform field fig A (that is one that can be easily managed in a consistent manner)								

28	Mark field that has more than a distinct area which which cannot be easily managed in a consistent manner fig B								
29	Insert the probe or auger into the soil to the plough depth or at least 6inches								
30	Collect soil samples with probe, auger or shovel								
31	Collect 25 cores from each marked Area								
32	Mix each of the 25 cores from each area together to give a common composite sample.								
33	Take 20-30 ounces (volume)								
34	Crush the collected sample in a Mortar								
35	Sieve the sample through a 2mm brass, stainless plastic sieve								
36	Package the soil samples into Container								
37	Store in a clean closed container								
38	Take to the laboratory for analysis								
39	Test for CEC, NPK Ma and Ph								
40	Air dry the sample below 120^{of} if not shipped immediately to the laboratory								
41	Collect lab result with recommendation.								
	Cation Exchange capacity								
42	Place filter papers in two funnels and fill them with the soil sample.								
43	Leach the soil in one of the funnels with a 100% potassium nitrate (KNO_3) solution								
44	Add few drops of soil indicator solution to both leachates								
45	Observe the leachate.								
	Soil Ph								
46	Fill a test tube to a depth of almost 1cm with the soil to be tested.								
47	Add the 1cm of barium sulphate.								
48	Fill the tube with distilled water leaving a space of 4 cm from the top Of the tube.								
49	Shake the tube thoroughly.								
50	Allow the content to settle, and then add 8-10 drops of universal indicator.								
51	Shake the tube again and allow the content to settle.								
52	Hold the test tube again at the pointed colour chart.								
53	Compare each colour with the colour of the suspension containing the indicator and note the pH of the colour which it matches exactly.								

	Lime requirement of the soil								
54	Place a small quantity of calcium carbonate on a glass.								
55	Half fill a test tube with soil indicator solution.								
56	Add a drop of acid and shake the tube thoroughly.								
57	Add few drops of sodium hydroxide solution and shake again.								
58	Place a small quantity of soil or a piece of waxed paper and add drops of soil indicator solution until some of it runs out of the soil.								
59	Test all the samples of the soil which are available								
60	Record the pH of each of them.								
61	Use colour chart to relate the pH of soil sample Recommend application of lime per hectare.								
	Test for Phosphorus								
62	Pour 10cm^3 of ammonium molybdate solution into the glass vial.								
63	Add 1g of soil and shake the vial vigorously for One minute.								
64	Filter the solution.								
65	Add a grain of dry powdered tin (ii) chloride solution to 5 cm^3 of the filtrate.								
66	Observe the intensity of the colour of molybdenum.								
	Test for Potassium								
67	Pour 10 cm^3 of sodium cobalt nitrate solution into a glass vial.								
68	Add one level tea spoon of air dried Soil								
69	Shake the vial vigorously for a minute.								
70	Filter the solution.								
71	Use the pipette to add 2.5 cm^3 of anhydrous propyl 2OL to 5cm^3 of filtrate and mix the two solutions together thoroughly.								
72	After three minute compare the turbidity of the solution with a standard chart.								
	Test for Magnesium								
73	Put 1 cm^3 of soil extraction into a test tube.								
74	Add one drop of titan yellow solution and shake the tube vigorously.								
75	Add one drop of 5% sodium hydroxide solution								

	and shake the tube.								
76	Observe the colour.								
	Test for Nitrates								
77	Place one drop of the soil extract on a spotting title and add four drops of dispheny lamine solution.								
78	After two minute stir the mixture.								
79	Compare the colour with standard colour chart								
	Manure Preparation and Application **i) Farm yard manure**								
80	House animals: goat, sheep, or poultry in pen.								
81	Feed the animals with grasses, legumes, water and other materials.								
82	Collect animal dung and litter from the pen.								
83	Heap the daily collected beddings together in a place.								
84	Allow them to decay.								
85	Apply to the soil using broadcasting method								
	Compost manure								
86	Select appropriate site for compost Preparation								
87	Map out seven plots/spaces								
88	Label the plots/spaces as A,B,C,1, 2, 3 and 4								
89	Dig trenches or pits of about 1m deep in each plot plot mapped.								
90	Provide wall or fence round the corners.								
91	Provide compost materials								
92	Cut the compost materials with cutlass.								
93	Build up the heaps in plots 1,2,3 and 4 with the cut Materials								
94	Spray urine, wood ash, animal dung with barrow, head pan or bucket full of old compost on top of each layer								
95	Sprinkle water on each 4 heaps								
96	Sprinkle hand full of soil								
97	Add other layers of compost materials in alternate manner.								
98	Repeat the process of applying water after each layer until the required level of compost is attained								
99	Drive a strong long stick (testing stick) through the top until it reaches the centre								
100	Cover the pit with layers of refuse of 15-20cm.								
101	Plaster/ cover to drive away files								
102	Allow materials to sink								

103	Take the stick out after the first day								
104	Feel the testing stick to know if it is hot, cold, damp or moist								
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