Effects of Technology-Enhanced Instruction on Agricultural Science Students' Learning Outcome in Senior Secondary Schools in Ekiti State, Nigeria

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ABSTRACT

The study examined the Effects of Technology-Enhanced Instruction on Agricultural Science Students' Learning Outcome in Senior Secondary Schools in Ekiti State, Nigeria. Specifically, the study investigated the effectiveness of technology-enhanced instruction over conventional method (demonstration method) on senior secondary school students' learning outcome in agricultural science. The research design for this study was quasi-experimental using pretest, posttest control group. The population of this study consisted of 14,533 senior secondary school students who were offering Agricultural Science in all the public senior secondary schools II in Ekiti State, Nigeria. The sample for this study comprised 263 senior secondary school class II agricultural science students drawn from the three Senatorial Districts in Ekiti State using intact classes. A research instrument, 'Agricultural Science Learning Outcome' (ASLO) was used to collect data for the study. The instrument was validated and the reliability coefficient is 0.85. The data obtained were analysed using descriptive statistics of mean and standard deviation. Inferential statistics of *t* test, and analysis of covariance (ANCOVA) were used to test the 2 hypotheses at 0.05 level of significance. The study's findings revealed a significant difference in the post-test mean scores of students in the experimental group. Based on the findings of this study, it was recommended that technology-enhanced instructional method should be used to teach both theory and practicals to foster skills development among Agricultural Science students in Secondary Schools in Ekiti State. Also, it was recommended that technology-enhanced instruction should be employed to improve students' learning outcomes in agricultural science.

Keywords: Technology-enhanced method, teaching, students, learning outcomes, Agricultural Science

INTRODUCTION

Technology has to do with the application of scientific knowledge for practical purposes either in industries or on farms. 'Techne and logia" could be explained as the sum of any techniques, skills, methods and processes used in the production of goods or services or in the accomplishment of objectives, (Onimisi, Meligah, Abuh, 2023). The rapidly evolving technologies in agriculture have always put pressure on teachers of technologies in agriculture and Agricultural Science to keep abreast of developments and create fresh curricula, this is because agriculture is a complex, dynamic and rapidly changing industry.

In other to keep pace with the agricultural industry and trends in education, teachers of agriculture are getting more involved in technological advancement and encouraging students to apply technology-based instructions in the teaching and learning process of Agricultural Science in secondary schools. The 21st-century skills in technology are making classroom instructions more appealing and increasing students' engagement across various divides. This is noticeable in the students' acceptance of technology for carrying out different activities in, on and off the farm. It has been observed that students' use of technology for various purposes is highly encouraging, but most importantly in the school environment could be a thing of concern. Technology had

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been identified as tool capable of supporting both teaching and learning because it infuses classroom and workshops with digital learning tools and instructional packages.

Instruction is the deliberate arrangement of activities (including presentation, practice, feedback, and assessment) designed to facilitate achieving specific learning outcomes. It can also be viewed as any intentional effort to stimulate learning by the deliberate arrangement of experiences to help learners achieve a desirable change in capability. Instruction is one of the major teacher's class activities (along with planning and management) with the main purpose of helping students to learn. The general goal of instructional design has been adjudged as being able to make learning easier, quicker, and more meaningful based on its capacity to enhance effective teaching in the classroom.

In view of the above, Famiwole, Adeuya, Adeniran, & Oyediran (2018) and Owolabi and Babasanmi, (2023) observed that Agricultural Science taught at the secondary school levels, has to some extent, not been able to transform the students and the nation's adequately. The scholar noted that the products of secondary schools still lack the basic vocational and entrepreneurial skills and especially practical skills that will prepare students for occupation in agriculture which are expected to be acquired in Agricultural Science for self reliance. He also observed that poor methods of teaching, lack of adequate interaction between the teachers and students and insufficient time to take part in practical due to shortage of time and the use of conventional methods to teach Agricultural Science are some of the major constraints to acquisition of skills required in, on-and – off the farm agricultural activities in secondary schools.

The conventional methods that are commonly used for teaching in secondary schools are; demonstration method, discussion method, discovery method, laboratory method, project method, play-away method, individualized method, co-operative or group teaching, excursion/field trip method, team teaching, case study, competitive method, concept mapping method, among others. It has however been observed that teaching of Agricultural Science in secondary schools in Ekiti State is majorly done with conventional methods such as demonstration and discussion methods.

The foregoing which shows that the use of teacher-centred teaching methods or strategies could lead to the decline in students learning outcomes in Agricultural Science coupled with the evidence from the WAEC Chief Examiners' report on Agricultural Science Paper 2 (Practical) between year 2019 and year 2023 which revealed weak learning outcome among students' in Agricultural Science practical and Ekiti State is not exempted are pointers to the fact that Agricultural Science students in Secondary Schools have not been doing well in terms of learning outcome. This inadequacy could be as a result of many factors, one of which might be the methods employed in teaching the subject.

The conventional method is often referred to as the chalk-and-talk or textbook method. It involves direct instructions by the teacher whose primary role is to pass knowledge to the students and conduct tests and assignments. In conventional method of teaching, the teacher directs students to learn through memorization and recitation techniques without a conscious effort to develop students' critical thinking, problem solving and decision making skills, (Adeoluwa & Sikeade, 2018). The conventional teaching method which is the traditional approach to teaching is teacher-centered which implies that teachers do all the talking, and the students do all the listening. The teacher using this strategy is often seen as the repository of all knowledge while the students are conditioned to be passive recipients of the knowledge transmitted by the teacher. It is often regarded to as teacher-centred because is limiting the room for creative thinking and seldom considering individual differences, (Yab, 2018). The more the reason why the method seems challenged in the 21st century, might be due to the fact that the method often mainly rely on textbooks with little emphasizes on basic skills development. Despite these, the conventional methods of teaching have their own merits such as some brilliant students are fast to understand the concept being taught by the teacher.

Of these conventional methods, demonstration method appears to be the most commonly used by agricultural teachers, in this method, the teacher transmits knowledge to the students who sit passively in the classroom and listen. It involves much of the teacher's energy on preparation and presentation and therefore reduces the pace of content and coverage. Agricultural Science is a subject where knowledge, skill, competency, attitude, facts and value acquisition are fundamental. This method involves the showing, displaying, or giving examples

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of how things work or are operated and the procedure involved in the process. Hence, teaching methods employed need to be designed in a way that the teacher has the responsibility to analyze all aspects of the knowledge acquired by the students.

In view of the observed shortcomings in the conventional method and in order to achieve the objectives of Agricultural Science in secondary schools, the NERDC (2019) stated that Agricultural Science at the secondary schools should be taught theoretically and practically through the engagement of technology in order to develop the right skills and values in the students to improve the learning outcome. The researcher observed that most of the tertiary institutions in Ekiti State seem not to have instructional materials for teaching practicals on the topics like ridge making, tractor, use of planter, spraying, preparation of feed formulation, Goat rearing, Pig rearing, Poultry farming, Grasscutters rearing, Cattle rearing, Sheep rearing, Fish farming, Bee production among others, the teacher only teaches through the conventional method, however, there could be possibly a better innovative means of teaching the subject which necessitated the introduction of innovative strategy such as Technology-Enhanced Instruction.

The term technology-enhanced instruction (TEI) is an instructional method in which students learn important skills by doing what he has keenly watched to change his attitude towards theory and practical in Agriculture Science through audio-visual equipment and computers. It can serve to build bridges between the classroom and real-life experience. Technology-Enhanced Instruction (TEI) helps in improving the efficiency and effectiveness of instruction and motivates students' attitude to learning. It also allows students to learn by themselves. It is student centred and helps students to express their innate ability resulting in creativity and high quality learning outcomes**.**

Statement of the Problem

Today, most of the graduates from the secondary schools are unable to perform simple tasks such as farm implement maintenance, fertilizer application, spraying or planting to distance because of the methods with which they were taught. The researcher observed that the secondary school students' keen interest in Agricultural Science seems to have been played down due to the method of teaching. This possibly could be the reason for the poor performance of the students in the external examination according to WAEC Chief Examiner's reports on Agricultural Science Paper 2 (Practical) of years 2019 and 2023.

The seemingly poor results could be due to the conventional teaching method often adopted by teachers, which were adjudged to dominate the mode of passing instructions in most secondary schools in practical topics like farm implement, tractor, ridger, planter, sprayer, livestock feeds and feeding among others. The observed inadequacies of the teaching method seems to be partly responsible for the Agricultural Science students' poor learning outcome which might have been affecting their level of skill acquisition and attitude to the subject.

In the 21st century teaching and learning process, students' learn differently because of the advancement in technology, which has enabled students' to have access to information only at a press of keys or buttons in their relevant subject areas. Agricultural Science is one of the core vocational subjects offered in secondary schools to create and sustain students' interest in agriculture and to enable students acquire basic knowledge and practical skills. For effective learning outcome in Agricultural Science in secondary schools, emphasis is supposed to be laid on both practical and theoretical aspect of the subject. Consequently, this study intends to investigate the effects of technology-enhanced instruction on Agricultural Science students' learning outcome in Senior Secondary Schools in Ekiti State.

Purpose of the Study

The purpose of the study is to examine the effect of technology-enhanced Instruction on students' learning outcome in Agricultural Science in Senior Secondary Schools in Ekiti State.

Specifically, the study intends to:

1. find the difference in the pre-test and posttest mean scores of students' learning outcome in experimental and control groups.

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2. investigate the difference in the mean scores of students' learning outcome in the experimental and control groups based on location.

3. examine the difference in the mean scores of students' learning outcome in the experimental and control groups based on gender.

4. examine the students' attitude towards Agricultural Science in Senior Secondary Schools based on location and gender in Ekiti State, Nigeria.

Research Questions

The following research questions were raised to guide this study:

1. what is the difference between the pre-test and posttest mean scores of students' learning outcome in experimental and control groups?

2. what is the difference in the mean scores of students' learning outcome in the experimental and control groups based on location?

3. what is the difference in the mean scores of students' learning outcome in the experimental and control groups based on gender?

4. what are the students' attitude towards Agricultural Science in the experimental and control group based on location and gender?

Research Hypotheses

The following research hypotheses were formulated and tested at 0.05 level of significance.

1. There is no significant difference in the students' learning outcome (academic performance and attitude) in the experimental and control groups based on gender (male and female).

2. There is no significant difference in the students' attitude in Agricultural Science in the experimental and control groups based on location (rural and urban).

LITERATURE REVIEW

Concepts of Agricultural Science and Agricultural Education

Agricultural Science is the application of scientific principles to the growing of crops and rearing of animals for man's use and industrial purposes. Agricultural Science as a broad multidisciplinary field deals with the selection, breeding and management of crops and domestic animals for economic production. (Otekunrin and Oni, 2020). Ndem and Akubue, (2018) agreed that Agricultural Science deals with the production of crops and rearing of farm animals by man for the purpose of providing food, raw materials and shelter. It also involves the science of processing, preservation, storage, marketing and distribution of the agricultural products. From the above definitions, Agricultural Science is the science, art, or practice of cultivating the soil, producing crops, and raising livestock and in varying degrees the preparation, processing and marketing of the resulting products. They include the technologies of soil cultivation, crop cultivation and harvesting, animal production, and the processing of plant and animal products for human consumption and use.

Agricultural Science was introduced into secondary school curriculum (FGN, 1977), with the commencement of 6-3-3-4 system of education, Agricultural Science was made a core subject at both junior and senior secondary school curricula. The present 9 years of continuous schooling made Agricultural Science a pre vocational subject at the Junior Secondary School level and an elective vocational subject at the Senior Secondary School.

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Importance of Practical Agriculture in Secondary Schools

The term practical agriculture as defined by Nlebem and Chukwu (2020) as the fundamental principle of returning man to the farm. It has also been seen as the act and practices of the various agricultural activities as it has enormous importance in secondary schools. The researcher agreed that practical work facilitates the process of acquisition of basic knowledge and practical skills that prepares students for occupation in agriculture. It has been a strong base where young mind students are been introduced to the interesting and practical aspect of the subject. Practical agriculture also add to the students practical knowledge, practical agriculture makes the subject expand from just theory into a conglomeration of theory and practical, where these students have the opportunity to practice all what they have learnt in the class.

Researchers like Jason and Carla, (2017) posited that practical agriculture also add to the students' learning outcome as Agricultural Science examination are mostly in two forms; practical and theory, and the students see the practical aspect as an opportunity to help boost and upgrade their deficiencies in the theory aspects even the West African Examination Council (WAEC) syllabi gives sufficient room for practical agriculture amidst other practical science subjects.

Farm Machinery in Agricultural Science

Farm Machinery refers to all machines and tools that are used in the production, harvesting, and care of farm products, and includes trailers that are used to transport agricultural produce or agricultural production materials between a local place of storage or supply and the farm, agricultural tractors, threshing machinery, hay-baling machinery, corn shellers, hammer mills, and machinery used in the production of horticultural, agricultural, and vegetable products. Agricultural machinery relates to the mechanical structures and devices used in farming or other agriculture. There are many types of such equipment, from hand tools and power tools to tractors and the countless kinds of farm implements that they tow or operate. Diverse arrays of equipment are used in both organic and non-organic farming, (Daudu, Yarama, Issa and Fatunbi, 2020). There are many types of equipment used by farmers they are hand tools, power tools like tractors. Especially since the advent of mechanized agriculture, agricultural machinery is an indispensable part of how the world is fed. According to Ndubuisi, (2019), farm machinery refers to complex machine and implement used for carrying out farming operations. Examples include: tractors, ridgers, sprayers, planter, bulldozers, shellers, driers, and incubators. The most important implement or machines in the farm, which is used for operating many farm implements is the tractor.

Conventional Methods of Teaching in Agricultural Science in Secondary schools.

Teaching is a concept central to education and any academic setting. Teaching methods as defined by Ogri and Julie, (2017), Amadioha, (2018) and Balogun and Yusuf (2019) as a plan of action designed to achieve learning programme design for a learner. It could be a master plan or program procedure schedule to achieve a particular objective. To this effect, method of teaching can be referred to an act of convincing, motivating, facilitating, focusing, engaging, directing and arousing the interest of the learner towards a particular concept or phenomena. Infact, for a teacher to teach effectively, he/she has to take a reservoir of methods, however, not all methods can be applied in all places at all times. It is therefore necessary to vary instruction, not only to keep the students attention but to let them work together with content and in a variety of ways that are applicable to various learning methods.

Methods are teachers style, manner or ways of presenting information, knowledge and values to learners in a bid to achieve instructional objectives. Researchers have shown that teachers in secondary schools have been found to use the various pedagogical methods at their disposal in the various subjects. According to Njura, Kaberia and Taaliu (2019), observed various methods like discussion method, lecture method, fieldtrip method, role-playing method, demonstration method, discovery method, seminar among others which are classified as conventional teaching method, can be effectively used by the teacher to teach agriculture science

Amongst the methods of teaching Agricultural Science is Project Method. This method encourages students' activities and initiative. Project Method is the cooperative study of a real life situation by a class or even by a

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whole school under the guidance of the teacher (Olaitan & Famiwole, 2017). A Project Method in Agricultural Science is usually undertaken by individuals or small groups. The project is identified, systematical planned, implemented and evaluated based on the stated objectives of the Agricultural Science lesson. The researcher viewed it as an activity willingly undertaken by the students in which emphasis is put on learning by doing. The student works according to his interest and willingness. It may last for a week, weeks and months and even a term depending on the nature of the project. It includes such activities like drawing maps, drawing models of various machines arranging exhibitions, organization of debates, how to handle implement like plough, sprayer etc., investigation on the growth rate of crops planted with fertilizer, among others (Johnson, 2022). Each student or group of students would have to work diligently trying to get information from books, libraries, magazines, and corporate bodies and farm organizations.

Lecture method: Amongst the methods of teaching Agricultural Science is the lecture method which is an uninterrupted teacher centred and expository discourse which relegates students to the role of passive spectators in the classroom. Lecture method according to Njura, Kaberia and Taaliu, (2019) posited that lecture method is the least effective in developing agricultural skill because the method no form of interaction from the teacher to the student and can be quite boring. The teacher engages in this method in other to complete syllabus and to attend to his large class size.

Technology-enhanced Instruction and Students' Learning Outcome in Agricultural Science

In a research carried out by Hussain (2021) on "Traditional versus computer-mediated approaches of teaching educational measurement in Colleges of Education (COE) at Sultan Qaboos University (SQU) in Oman." The population of the study was 51 undergraduate teacher education majors in the COE SQU. The design adopted was pretest, posttest and control group. There were two groups in the study which included experimental group (n=2x) taught using computer mediated instruction and control group using conventional method. The tools used to analyzed data were the t-test statistic, mean and standard deviation. The findings from the study showed that all the group members in the computer mediated instruction and class actively frequently participated in the group and class fora, and all the questions were answered. The study is related to the present study in that they both used the same design of pretest, posttest control group and computer mediate or technology enhanced method for their experimental group. However, the study is different from the current study in that the previous study used College of Education Students in Oman, while the present study used secondary schools in Ekiti State, Nigeria. Also, the current study worked on Agricultural Science while the previous study worked on Educational Measurement.

METHODOLOGY

The design of the study was quasi-experimental which employed pretest-posttest control group. A pretest-posttest design is usually a quasi-experiment where participants are studied before and after the experimental manipulation. The quasi-experimental design is used when true experimental design cannot be carried out because it involves human beings who are already assigned into various classes which cannot be altered. The population of this study consist of 14,533 Ekiti State Senior Secondary School II Students offering Agricultural Science in the 205 Public Secondary Schools during 2022/2023 academic session. (Source: *Ekiti State Ministry of Education, Science and Technology, 2022).*

The sample for the study comprised 263 Senior Secondary School Two (SSSII) students in intact classes that are offering Agricultural Science selected from 12 Public Secondary Schools in the three Senatorial Districts in Ekiti State using multistage sampling procedures to cater for variables of gender (male and female) and location of schools (rural or urban).

At the first stage, two (2) Local Government Areas (LGAs) was selected from each of the three (3) Senatorial Districts through balloting. Stage two involved the selection of two (2) schools from each of the six (6) Local Government Areas (LGAs) from Ekiti State, thereby making twelve (12) public schools using a purposive sampling technique with the consideration of school location. The third stage involved the selection of Senior Secondary School Class students offering Agricultural Science from the intact classes in the sampled schools.

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That is, six schools for the experimental group and another six for the control group. The experimental group was taught farm machinery and engineering as a topic with these sub-topics including tractor, sprayer, planter and ridge making using technology-enhanced instructional method while the control groups were taught the same topics using conventional method (demonstration method).

The study made use of one research instrument titled; Agricultural Science Learning Outcome, (ASLO). The instrument comprised parts A, B and C. Part A elicited the personal data of the respondents such as gender, location, name of school and age. Part B was on the Agricultural Science Performance Test (ASPT) which was drawn from the identified sub-topics of farm machinery and engineering in the curriculum for senior secondary school II. It comprised 20 items of multiple choice questions followed by four options lettered A-D, out of which the teste was expected to select the best option to the questions and 5 practical questions. The ASPT was developed by the researcher for data collection which consisted of 2 units to measure the level of knowledge of the students and measure the acquisition of practical skill based on the four content areas that will be covered. Part C was made up of 20 items to measure Students' Attitude towards Agricultural Science. This was structured on a 4- point Likert rating of scale; Strongly Agree (SA) = 4; Agree (A) = 3; Disagree (D) = 2; and Strongly Disagree (SD) = I. Each respondent was made to tick the appropriate option. The responses were collated and marked for data analysis. The research instrument 'Agricultural Science Learning Outcome' (ASLO) was subjected to face and content validity. The instrument was given to experts in the Departments of Vocational and Industrial Technology Education, Computer Science Education, and Test and Measurement in Bamidele Olumilua University of Education, Science and Technology, Ikere Ekiti. Thorough scrutiny of the instrument was carried out and necessary corrections were effected for the instrument to be adjudged valid for the study. The reliability of the instrument was established by administering the instrument on 30 respondents who were not be part of the sample selected for the study. The responses to the instrument after administering was subjected to a test and retest reliability co-efficiency analysis, using Pearson product moment co-efficient correlation. The researcher seek permission from the Principals of the selected schools before the administration of the test. Part A of the instrument consisted of students' bio-data information, Part B consisted 20 items to measure the level of knowledge of the students and 5 items to measure the level of skillful ability of the students on Agricultural Science practical and Part C have 20 items to measure the students attitude towards Agricultural Science.

At the beginning of the test, the instructions of the test will be announced. The students will be asked to choose the correct answer. The time allocated for the test will be 40 minutes. Concerning the marking scheme there will be 2 marks for each item. Direct observation will be used by the research assistants to evaluate participants on the competencies expected of them in Unit II, If an expected competency is found to have been acquired, any rating from Very High, (VH), High (H), Low (L) or Very Low (VL) will be ticked, so the total scores will be 50 marks. For the students' previous knowledge, the same pre-test will be rearranged and used at the end of the study as post-test to assess the students' learning outcome on the topics, the objective of the post-test will be to assess the effect of both instructional methods (experimental and control) (technology-enhanced instruction and demonstration methods as treatments), on students' learning outcome (academic performance and attitude). The data obtained for the study will be analyzed using both descriptive and inferential statistics. The research questions were answered using descriptive statistics of mean, and standard deviation. Inferential statistics of *t* test and analysis of covariance (ANCOVA) were used to test hypotheses at 0.05 level of significance using SPSS Version 23.

RESULTS

Descriptive Analysis

Research Question 1:

What is the difference in the pre-test and post-test mean scores of students' learning outcome in experimental and control groups?

In order to answer the question, mean scores relating to students' outcome towards Agricultural Science before and after being exposed technology-enhanced instruction and conventional teaching method were computed and compared. The result is presented in Table 1.

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Table 1: Pre-test and Post-test mean scores of students' learning outcome in Experimental and Control Groups.

Groups	N	Pre-test		Post-test		Mean Difference
		Mean	SD	Mean	SD	
Experimental	131	63.21	18.13	72.04	11.52	8.83
Control	132	61.17	17.29	63.89	20.44	2.72

The result in Table 1 revealed that students in the experimental group and control group had performance mean score of 63.21 and 61.17 respectively for the pre-test score with respective measure of variability of 18.13 for the experimental group and 17.29 for the control group. This established the homogeneity of the test among the two groups.

The mean score of students in experimental and control groups for the post test score are 72.04 and 63.89 respectively with respective measure of variability of 11.52 and 20.44. The mean difference between the performance mean scores of students in the experimental group before and after treatment is 8.83 while that of students in the control group is 2.72. This implies that those in the experimental group had the higher mean score. Hence, the use of technology-enhanced instruction strategy has positive effect on the learning outcome of students in Agricultural Science.

Research Question 2:

What is the difference in the mean scores of students' learning outcome in the experimental and control groups based on location?

Table 2: Analysis of difference in the mean scores of students' learning outcome in the experimental and control groups based on location

Location	Techniques	No (%)	Mean	SD
Urban	Tech. Enhanced	77 (29.3%)	71.01	11.08
	Conventional	77 (29.3%)	60.27	12.74
Rural	Tech. Enhanced	54 (20.5%)	69.07	13.22
	Conventional	55 (20.9%)	59.31	14.76

Table 2 revealed the mean and standard deviation of the difference in the mean scores of students' learning outcome in the experimental and control groups based on location. For the students in urban location, it was shown that the score of those taught using Technology Enhanced Instruction (Experimental group) has a mean of score of (71.01) and standard deviation of (11.08). The conventional group has a mean score of (60.27) and standard deviation of (12.74). The mean scores has difference of (10.74) and difference in measure of variability (standard deviation) was (1.66). This implies that average performance of students in urban location who were taught Agricultural Science using Technology Enhanced Instruction was significantly higher than those in Control group taught using Demonstration method.

Also, for the students in rural location, it was shown that the score of those taught using Technology Enhanced Instruction (Experimental group) has a mean of score of (69.07) and standard deviation of (13.22). The conventional group has a mean score of (58.31) and standard deviation of (14.76). The mean scores has difference of (9.76) and difference in measure of variability (standard deviation) was (1.54). This implies that average performance of students in rural location who were taught Agricultural Science using Technology Enhanced Instruction was significantly higher than those in Control group taught using Demonstration method. Hence, students in urban location had higher learning outcomes than their counterparts in rural location when they are been taught Agricultural Science using Technology Enhanced Instruction.

Research Question 3:

What is the difference in the mean scores of students' learning outcome in the experimental and control groups based on gender?

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Table 3: Analysis of difference in the mean scores of students' learning outcome in the experimental and control groups based on gender

Gender	Techniques	Mean	SD
Male	Experimental	77.51	10.87
	Conventional	75.29	11.09
Female	Experimental	77.97	10.54
	Conventional	66.83	13.38

Table 3 revealed the mean and standard deviation of the difference in the mean scores of students' learning outcome in the experimental and control groups based on gender. For male students, it was shown that the score of those taught using Technology Enhanced Instruction (Experimental group) has a mean of score of (77.51) and standard deviation of (10.87). The conventional group has a mean score of (75.29) and standard deviation of (11.09). The mean scores has difference of (2.22) and difference in measure of variability (standard deviation) was (0.22). This implies that average performance of male students who were taught Agricultural Science using Technology Enhanced Instruction was significantly higher than those in Control group taught using Demonstration method.

Also, for female students, it was shown that the score of those taught using Technology Enhanced Instruction (Experimental group) has a mean of score of (77.97) and standard deviation of (10.54). The conventional group has a mean score of (66.83) and standard deviation of (13.38). The mean scores has difference of (11.14) and difference in measure of variability (standard deviation) was (2.84). This implies that average performance of female students who were taught Agricultural Science using Technology Enhanced Instruction was significantly higher than those in Control group taught using Demonstration method. Hence, there was no significant difference in male and female learning outcomes when they are been taught Agricultural Science using Technology Enhanced Instruction.

Research Question 4:

What are the students' attitude towards Agricultural Science in the experimental and control groups based on gender and location?

Table 4: Analysis of difference in the mean scores of students' attitude towards agricultural science in the experimental and control groups based gender and on location

Gender	Techniques	Location	No (%)	Mean	SD
Male	Tech. Enhanced	Urban	45 (17.1)	77.51	10.87
		Rural	23 (8.7)	69.05	13.11
	Conventional	Urban	36 (13.7)	75.29	11.09
		Rural	25 (9.5)	59.74	14.38
Female	Tech. Enhanced	Urban	32 (12.2)	77.97	10.54
		Rural	31 (11.8)	69.44	12.57
	Conventional	Urban	41 (15.6)	66.83	13.38
		Rural	30 (11.4)	63.74	14.27

Table 4 revealed the mean and standard deviation of the difference in the mean scores of students' learning outcome in the experimental and control groups based on gender and location. For male students, it was shown that the score of the students in urban location taught Agricultural Science using Technology Enhanced Instruction has a mean of score of (77.51) and standard deviation of (10.87), while the score of male students in rural location taught Agricultural Science using Technology Enhanced Instruction has a mean of score of (69.05) and standard deviation of (13.11). The mean scores has difference of (8.46) and difference in measure of variability (standard deviation) was (2.24). This implies that average performance of male students in urban location was significantly higher than those in rural location when they are exposed to Technology Enhanced Instruction of teaching.

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It was shown that the score of male students in urban location taught Agricultural Science using Demonstration method of teaching has a mean of score of (75.29) and standard deviation of (11.09), while the score of male students in rural location taught Agricultural Science using Demonstration strategy has a mean of score of (59.74) and standard deviation of (14.38). The mean scores has difference of (15.55) and difference in measure of variability (standard deviation) was (3.29). This implies that average performance of male students in urban location was significantly higher than those in rural location when they are exposed to Demonstration method of teaching.

Also, for female students, it was shown that the score of the students in urban location taught Agricultural Science using Technology Enhanced Instruction has a mean of score of (77.97) and standard deviation of (10.54), while the score of female students in rural location taught Agricultural Science using Technology Enhanced Instruction has a mean of score of (69.44) and standard deviation of (12.57). The mean scores has difference of (8.53) and difference in measure of variability (standard deviation) was (2.03). This implies that average performance of female students in urban location was significantly higher than those in rural location when they are exposed to Technology Enhanced Instruction of teaching.

It was further shown that the score of female students in urban location taught Agricultural science using Demonstration method of teaching has a mean of score of (66.83) and standard deviation of (13.38), while the score of female students in rural location taught Agricultural science using Demonstration strategy has a mean of score of (63.74) and standard deviation of (14.27). The mean scores has difference of (3.09) and difference in measure of variability (standard deviation) was (0.89). This implies that average performance of female students in urban location was not significantly higher than those in rural location when they are exposed to Demonstration method of teaching.

Summarily, the Table 4 revealed that significant difference existed in the average performance of students when they are been exposed to Technology Enhanced Instruction and Demonstration method of teaching in Agricultural Science with respect to their gender and location.

Testing of Hypotheses

Hypothesis 1

There is no significant difference in the students' learning outcome in the experimental and control groups based on gender (male and female).

To test this hypothesis, performance mean scores of both male and female students were computed and compared for statistical significance using Analysis of Covariance (ANCOVA) at 0.05 level. The results are presented in Table 5 as follows;

Table 5: Analysis of Covariance (ANCOVA) summary of difference in the students' learning outcome in the experimental and control groups based on gender.

Source	SS	Df	MS	F	P
Corrected Model	19241.055[a]	3	728.352	39.522	0.001
Intercept	5744.350	1	3844.350	17.576	0.001
Covariate(Pre-test)	3.744	1	3.564	19.348	0.732
Gender	1730.391	1	920.195	32.507	0.732
Group	5727.125		2738.618		
Gender X Group	3.417		1.5935		
Error	2719.006	261	14.368		
Total	197033.000	263			
Corrected Total	5644.061	262			

a. R squared = 0.309 (Adjusted R squared = 0.297)
b. Computed using alpha = 0.05

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Table 5 showed significant difference in the students' learning outcome in the experimental and control groups based on gender (male and female). It was revealed that the significant value of 32.507 was greater than 0.05 (at the 95% level of confidence) obtained for both male and female Agricultural Science students involved in the study. This indicated that there was no significant difference between the mean scores of male and female students' performance in both experimental group (those that were exposed to technology-enhanced instruction) and control group (those that were not exposed to technology-enhanced instruction). Hence, the null hypothesis was not rejected. This implies that there was no significant difference in the students' learning outcome in the experimental and control groups based on gender (male and female).

Hypothesis 2

There is no significant difference in the students' learning outcome in Agricultural Science in the experimental and control groups based on location (rural and urban).

To test this hypothesis, mean scores of Agricultural Science students in urban and rural areas in experimental and control groups were computed and compared for statistical significance using Analysis of Covariance (ANCOVA) at 0.05 level. The results are presented in Tables 6 and 7 as follows;

Table 6 Analysis of Covariance (ANCOVA) summary of difference in the students' learning outcome in Agricultural Science in the experimental and control groups based on location (rural and urban).

Source	**SS**	**df**	**MS**	**F**	**P**
Corrected Model	23587.215[a]	3	813.452	37.022	0.000
Intercept	4876.570	1	4474.270	29.376	0.000
Covariate(Pre-test)	3.274	1	3.074	0.259	0.001
School Location	1641.391	1	868.205	0.032	0.001
Group	6217.125		3178.718		
Location X Group	2.237		1.6345		
Error	1189.006	261	13.218		
Total	183033.020	263			
Corrected Total	4874.064	262			

a. R squared = 0.406 (Adjusted R squared = 0.311)
b. Computed using alpha = 0.05

Table 6 showed the difference in the students' learning outcome in Agricultural Science in the experimental and control groups based on location (rural and urban). The table indicated that the significant value 0.032 was less than 0.05 (at the 95% level of confidence) obtained for both students in urban and rural areas involved in the study was significant at 0.05 level of significance. This indicated that there was significant difference between the mean scores of students in urban and rural areas when they were subjected to technology-enhanced instruction. Hence, the null hypothesis was rejected. This implies that students in urban and rural areas exposed to the different treatments differ significantly in the Agricultural Science subject.

In order to provide some indications of the level of variation of performances of the students in both experimental and control groups, a Multiple Classification Analysis (MCA) was computed. The result is shown in Table 9 below;

Table 7: Multiple Classification Analysis (MCA) of mean scores of students in each of the experimental and control groups with respect to location (rural and urban).

Grand Mean = 63.84					
Variable + Location	**N**	**Unadjusted Deviation**	**Eta**	**Adjusted for Independent + Covariate**	**Beta**
Urban Location	150	5.95		5.83	
Rural Location	113	-5.57	0.87	-5.63	0.07
Multiple R^2				.824	
Multiple R				.867	

P<0.05

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The result in table 7 shows the Multiple Classification Analysis (MCA) of mean scores of students exposed to technology-enhanced instruction (experimental group) and those who are not exposed to technology-enhanced instruction (control group). It was revealed that, with a grand mean of 63.84, students in experimental group in urban area had adjusted mean score 69.79 (63.84+5.95) which is higher than that of their counterparts in conventional group in rural area 58.27 (63.84+(-5.57)). This implies that junior secondary school students in experimental group in urban location performed better than their fellow counterparts in control group in rural area when been taught with technology-enhanced instruction. The treatment explain about 87% ($Eta^2 = 0.87$) of the observed variance in students' performance in Agricultural Science. The treatments in the two groups accounted for 82.4% ($R^2 = 0.824$) observed variance in the students' overall performance.

DISCUSSION OF FINDINGS

The findings from the descriptive analysis of the study showed in Table 1 that there was homogeneity among the groups during pre-test stage and the use of the technology-enhanced instruction had a positive effect on students' performance during the post-test stage. This is in line with the submission of Eze (2018) who sees technology enhanced instruction as enhancing learning and changing the attitude of students and as well as developing their sense of efficacy. Also, Adeoluwa and Sikeade, (2018), Ayoade and Jubril, (2019), and Ebere and Abamuche, (2019), Akinboye et al, (2020) posited that the use of technology create a different learning approach resulting in different attitude to learning levels of motivation and engagement and therefore a different attainment level. This indicated that performance of students in Agricultural Science was predicated on their ability to visualize and represent their knowledge in Agricultural Science via technological enhanced instruction and their ability to decode and internalize facts read from texts.

Furthermore, in Table 2, it was shown that there was significant difference in the average performance of students in Agricultural Science in the group of students exposed to technology-enhanced instruction and those in the group of students not exposed to technology-enhanced instruction based on location. Ajibare and Fabamise, (2018) and Aduwo, et al (2019) corroborated the study that there is always a significant difference between students in the urban area that the rural area because of their exposure to social infrastructure.

It was further revealed in Table 3 that average performance of students in Agricultural Science in the group of students exposed to technology-enhanced instruction was significantly higher than those in the group of students not exposed to technology-enhanced instruction. This is in line with the position of Olumorin, Orunmoluyi, Obielodan and Yusuf, (2019) that technology enhanced instructions can assist secondary school students to cope with the increasing demands for skills and entrepreneurs, and minimize the impact of continuous decrease in the size of qualified teachers. Also, Adeoluwa and Sikeade, (2018), Ayoade and Jubril, (2019), and Ebere and Abamuche, (2019) and Daramola, 2020) opined that the use of technology create a different learning approach resulting in different attitude to learning levels of motivation and engagement and therefore a different attainment level. It was further revealed that there was no significant difference in the average performance of students in Agricultural Science in the group of students exposed to technology-enhanced instruction and those in the group of students not exposed to technology-enhanced instruction based on gender.

The inferential analysis of the study in Table 5 revealed that there was no significant difference between the mean scores of male and female students' performance in Agricultural Science in the experimental and control groups. This implies that there was homogeneity in the performance mean score of male and female students when they are been exposed to technology-enhanced instruction. This was at variance with the study by Otekunrin and Oni (2019) who carried out a study to examine the attitude and academic performance of single-sex (Boys and Girls only) high school students in the teaching and learning of Agricultural Science in the aspect of practical knowledge of Agriculture. It was found that the mean scores obtained by one girls' only school was significantly different from one boys only school. Also, Olaoye and Ogunmilade (2013) and Famiwole, Ogunjobi, Oyewole and Attah, (2020) who submitted that male students performed better than female students in academic achievement in Woodwork being a vocational subject. The study however supported the findings of Aduwo, Aransiola, Ikuteyijo, Alao, Deji, Ayinde, Adebooye, and Oyedele, (2019) who submitted that gender has no influence on learning outcomes and acquisition of practical oriented skills by students studying Agricultural Science in Secondary Schools.

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The findings in Table 6 found that there was significant difference between the mean scores of students in urban and rural areas in the experimental and control groups with students from urban location performing better than their counterparts from rural location. To further laid credence to this, a Multiple Classification Analysis (MCA) was conducted and it was shown that students in experimental group (urban area) had higher adjusted mean score than their counterparts in conventional group (rural area). This implies that students in experimental group in urban location performed better than their fellow counterparts in control group in rural area when been exposed to technology-enhanced instruction. This corroborated the findings of Osokoya and Akuche (2012) and Aduwo et al, (2019) who conducted a study on the effect of school location on students' learning outcomes. It was found that school location had a significant effect on the students in urban area performed better than rural students in all forms of achievement tests. The study however was at variance with the study of Essien (2017) and Ajibare and Fabamise, (2018) who investigated the influence of school location on students' academic achievement and found that school location has no significant influence on students' academic achievement.

The findings further indicated that school location is one of the factors that has strong effect on teaching and learning process. This supported the finding from the study of Olaoye and Ogunmilade (2013) and Falode et al (2020) who submitted that urban students performed better than rural students in academic achievement in woodwork. The findings is at variance with the study of Adigun (2016) who found that the location of the community in which the school is situated has effects on the attitude and performance of the students. He found that students in the rural areas performed better in Agricultural Science than their counterparts in urban areas.

Summary

This study determined the effects of technology-enhanced instruction on Agricultural Science students' learning outcomes in Secondary School in Ekiti State, Nigeria. Specifically, the study investigated the difference in the pre-test and post test mean score of students learning outcome, find out whether there would be gender difference in the pre-test and post-test mean scores of students' learning outcome among those exposed to technology-enhanced instruction and that those who were not exposed to technology-enhanced instruction in Agricultural Science in secondary school. The study equally find out whether there would be difference in the mean scores performance of male and female students, as well as those in urban and rural areas.

The findings from the analysis are as follows:

1. The pretest conducted revealed that the two groups were homogenous before the commencement of the experiment. The experimental group taught with technology enhanced instruction had a more positive effect on student performance during the post test stage.
2. There was no significant difference between the mean scores of male and female students' performance in Agricultural Science in the experimental and control groups.
3. There was significant difference between the mean scores of students in urban and rural areas in the experimental and control groups with students from urban location performing better than their counterparts from rural location.

CONCLUSION

From the findings of this study, it could be concluded that technology-enhanced instruction is a more effective method for positive attitude and performance of students' in Agricultural Science than the conventional method. The study also concluded that technology-enhanced instructional strategy is not gender biased as the study found no disparity in the learning outcome of both male and female students in the experimental and control groups. The study concluded that the exposure of the students to the technology enhanced instruction changed their attitude positively towards both theory and practical's. Also, the study concluded that students' location has effect on their learning outcome as those in urban area outperformed their counterparts in rural area.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations were made.

1. The use of technology-enhanced strategy should be used in teaching Agricultural Science in secondary schools.
2. The use of technology-enhanced instruction should be made compulsory among senior secondary school students so as to have a better understanding in both theory and practicals.
3. Agricultural Science teachers should be given adequate orientation, training and re-training through workshops and seminars to update their knowledge in the use of technology-enhanced instruction in teaching.
4. Agricultural Science students should go for field-trips and excursion in technology oriented farms to enhance or to positively change their attitude towards agricultural science.

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Conflict of interest

The authors declare that there exists no conflict of interest relating to this research study.

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