



A Literature Synthesis and Evaluation of Experimental Studies in Agricultural Education Researches Within Period 2011-2021

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Abstract

The purpose of this study is to find and synthesize existing Agricultural Education (AE) researches of Nigeria authors extraction that used experimental or quasi experimental designed and were published within period 2011-2021. A mixed approach research synthesis design was adopted. Five research questions were raised and answered. Thirty AE research articles met the selection criteria. The selected studies were synthesized based on research focus, recommendation, result, sample size and duration of treatment. Thirteen of the selected studies experimented on academic performance of students, out of which five shared themes with either of, method of active learning or technology. Five common themes in research recommendations were discovered by coding the recommendations of each publication, four of the selected studies recommend that government and school administrators should ensure adequate provision of technological devices in schools to make the use of technology effective in teaching. It was concluded that majority of the studies examined used a shorter treatment duration and that AE researches of Nigerian extraction were low. The impact of technology, academic achievement, and active learning approaches were trends in the synthesized studies. Professionals should be recruited and retrained to keep up with agricultural developmental trends, teachers should use video technology to enhance teaching and learning, and curriculum should be adjusted to include new innovative technique were among recommendations made.

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INTRODUCTION

No country can progress beyond its current educational level or standard, as a result, education is viewed as a catalyst for a country's political and socioeconomic progress. Effectiveness of any country to address its major development issues such as poverty, unemployment, insecurity and inequality are solved through educational system. The rising rate of poverty, terrorism and banditry in Nigeria can be ascribed to bad handling of the country's developmental issues through education. One of the purposes of education in Nigeria is for educational institutions to engage in teaching, research, and programmes, as well as maintain basic educational standards that would contribute to the country's agricultural and the overall development. Despite the growing number of researches, policies and strategies to solve the numerous problems in Nigeria, little has been accomplished, as the rate of rising myriads of problems persist and despite the fact that academia continues to churn out researches in larger quantities on a daily basis, either published in academic journals or made available for public outreach via the internet. Yet, there seems to be a gap in the kind of research conducted by scholars.

The quality of the studies conducted in the field of AE for instance have not been determined to have matched the needs of the current position in agriculture, economic development or combating the menace of food insecurity that is devastating Nigeria (Matemilola & Elegbede, 2017). There is a widespread conviction that educational research is an unavoidable component of any meaningful national progress. For any educational research to be effective for good development, it must be a functional type, which allows for improved learning and practice, and turn it into something valuable (Darling-Hammond, et al., 2020). The development capacities and skills are focused toward making people exploit their natural resources (International Institute for

Sustainable Development, 2021). This is common particularly in the field of AE.

According to Chewachong and Hayward (2021) AE is hampered by insufficient qualified teachers both quantity and quality, diminishing the educational system's power and potential; the ability of instructors, particularly in the field of agriculture, to teach and research on relevant subject areas using experimental technique which many tailored on exploring the value of instructional approaches in connection to students learning. There have been few experimental studies on the core psychological principles that instructional strategies are based on in AE, different instructional strategies are rarely employed in a class on their own (Mupa & Chinooneka, 2015). Besides, the idea underpinning AE is experimental in nature, AE researchers require more than survey-based research (McKim & Velez, 2016). Experimental learning is at the heart of AE (Shoulders & Myers, 2013). An analysis of the literature found that experimental or practicality in teaching and research are two of the many aspects that are likely to influence student understanding of abstractions and improve the application of research to policy implementation (Behrendt & Franklin, 2014).

Agricultural education has been tasked with delivering concepts in an agriculturally relevant setting (Afolabi *et al.*, 2017). The most effective teaching strategies for improving student comprehension in AE areas within secondary and postsecondary institutions' curricula need to be evaluated. Agricultural education research should critically assess the curriculum offered and evaluate the efficiency of teaching methods and students learning process in order to discover the most efficient ways to teach various topics (Thoron & Myers, 2011). As agricultural technologies advance, so does curricular integration, and new methods of teaching these subjects should be explored. It is necessary to evaluate experimental or quasi-experimental studies on the effectiveness of curriculum design,

teaching methods, and student learning processes in AE programmes in order to establish a significant body of empirical evidence that can support great teaching and learning practices in agricultural programmes (Thoron & Myers, 2011). It has been established that conducting research to establish a link between academic programme outcomes and student preparedness and achievement is critical for the survival and sustainability of agricultural leadership, education, and extension education (Stripling & Ricketts, 2016). More experimental research on teaching practices that improve student learning is needed (Thoron & Myers, 2011).

Furthermore, experimental research in AE can provide instructors with opportunities for best-practices-based professional development. An experimental or quasi-experimental design in education research attempts to actively evaluate an independent variable (Ary et al., 2014). True experimental designs assign the treatment at random to each participant, allowing for the most control over extraneous variables and the highest internal validity. This study evaluates studies conducted by AE researchers using experimental based researches and published in peer reviewed journals in order to establish the trend of the researches in solving current and future development issues.

Several studies have emphasized the importance of experimental research in AE; thus, an examination of previous experimental studies and evaluation of recommendations is required to improve future experimental-based AE studies. Previous studies will be evaluated to determine what has been done to address this research need, as well as recommendations for future experimental-based AE research. An evaluation of the quality of existing experimental research is also required in order to compose the requirements for experimental research in the discipline. The broad objective of this study was to find and summarize the previous studies in AE that used experimental-type

designs, starting from 2011 to 2021, which were published and of Nigerian extractions. Specifically, the study sought to answer the following research questions: 1. How many studies of Nigerian extraction employed quasi-experimental or experimental research design on topics of AE from 2011-2021? 2. What was the treatment duration used in the quasi experimental or experimental research designs? 3. How many participants were sampled in the quasi-experimental or experimental research? 4. What trends in research foci and research results were common in the quasi-experimental or experimental studies? 5. What trends in research recommendations were made by authors of quasi-experimental or experimental studies?

METHODS

A mixed approach research synthesis design was used in this study. A mixed approach research synthesis enables a researcher to bring together a collection of relevant studies to create an effective overview of knowledge on a specific topic (Dawadi, et al., 2021). The works that were of interest for this study were the articles published of Nigerian extraction between 2011 and 2021, that employed experimental or quasi-experimental designs. The research was limited to studies involving agriculture students in secondary and tertiary institutions. Several academia websites using different search engines such as google.com, ask.com, mamma.com, yahoo.com, universities' subscribed data bases, open data bases, online catalogue and special collections were searched for AE researches. However, four hundred and twelve AE research articles of Nigerian extraction were sourced, only thirty articles met the following underlisted criteria and were used as sample for the study: a) published between 2011-2021; b) used experimental or quasi-experimental design; c) included topics in secondary schools and tertiary AE research; and d) researches

conducted by researchers of Nigerian extraction.

Each publication that met the research criteria was evaluated and the information from each study was organized into a matrix. For each study, a matrix was created in Microsoft Excel that included the following information: (a) the year of the study; (b) the duration of treatment in the study; (c) the title of the study; (d) the authors of the study; (e) the treatment construct; (f) the number of participants in the study; and (g) the study's results based on recommendations of Colclasure and Thoron (2018). To answer question 1 of the study, the total number of studies that met the research parameters per year was used. To answer question 2, the duration of the treatments used in the studies was used. The treatment durations used in this study were 5 days per week, because active student days in Nigeria are 5 days per week, so one week will give 5 instructional days in order to compare the different treatment units between trials and have consideration evaluation of situation. To answer research question 3, the number of participants for whom data were obtained for each study was compared. Participants who dropped out of trials or did not meet the researchers' criteria were not included in the study comparison. To answer research questions 4 and 5, the constant comparative technique of analysis (Glaser, 1965) was used to uncover the central theme for the articles by coding the research data using clear and regular methods and categorizing the objectives of the studies into consistent themes.

RESULTS AND DISCUSSION

Table 1. Number and Percentage of School-Based Studies of Nigerian Extraction That Used Quasi-Experimental or Experimental Research Design on Topics of AE from 2011-2021 ($N=30$)

Year	Number of Publication	% per year
2011	2	6.7
2012	1	3.3
2013	4	13.3
2014	0	0
2015	1	3.3
2016	7	23.3
2017	5	16.7
2018	1	3.3
2019	4	13.3
2020	3	10
2021	2	6.7
Total	30	100

Table 1 elucidates result on the number and percentage of school-based studies of Nigerian extraction that used quasi-experimental or experimental research design on topics of AE from 2011-2021. Four hundred and twelve AE articles of Nigerian extraction were sourced, out of which thirty articles used quasi experimental or experimental design and were published between 2011-2021 which accounted for 7.3% of the total articles. Majority of these articles were published in 2016, amounting to 23.3% of total articles that met the set criteria in the last decade while no article met the criteria for selection in 2014 which is elucidated in table 1. This study corroborates with the finding of Colclasure and Thoron (2018) who asserted that 5% of the studies examined met the set criteria in United States of America.

Table 2. The Number of Experimental Studies by Treatment Duration Described by Instructional Days (5-1 week) (N=25)

Instructional Day	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total
1-5	1	1	0	0	0	0	0	0	0	0	0	2
6-10	0	0	1	0	0	0	0	0	1	0	0	2
11-15	0	0	0	0	0	0	2	0	0	0	0	2
16-20	0	0	2	0	0	5	1	0	1	0	0	9
21-25	0	0	0	0	0	0	2	0	0	1	0	3
26-30	1	0	0	0	0	1	0	0	0	1	0	3
31-35	0	0	0	0	0	0	0	0	0	0	0	0
36-40	0	0	1	0	0	0	0	0	0	1	1	3
41-45	0	0	0	0	0	0	0	0	0	0	0	0
46-50	0	0	0	0	0	0	0	0	1	0	0	1
Total												25

Note: 5 studies were excluded as the number of instructional days were not clearly stated

Table 2 presents result on the duration of treatment method employed in the quasi experimental or experimental research designs. Twenty five of the 30 sampled articles incorporated specific duration of treatment in their experiment, however 5 articles did not include treatment duration in their methodology. Twenty-five of the studies specified treatment duration in terms of days and weeks; however, in order to compare treatment periods, weeks were converted to days; 5 days equals one week because academic activities in Nigeria take place on 5 days per week. Five studies were excluded from the treatment duration comparison

because the duration of treatment was not clearly stated. Nine of the 25 studies employed a treatment duration of 16-20 instructional days, with the majority of these studies taking place in 2016. Three of the studies had treatment duration of 21-25 in instructional days, 3 of the studies also had a treatment duration of 26-30 instructional days. Only one study had a treatment duration of 46-50 instructional days. Preceding study in education showed that the duration of treatment may influence the significance of results (Hillocks, 1984 cited in Colclasure & Thoron, 2018).

Table 3. Number of Studies in Years by The Sample Size

Number of participants	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total
0-50	0	0	0	0	0	0	0	1	0	0	0	1
51-100	0	0	0	0	1	3	3	0	0	1	1	9
101-150	1	0	1	0	0	1	2	0	0	0	0	5
151-200	0	1	1	0	0	2	0	0	2	0	0	6
201-250	0	0	0	0	0	0	0	0	1	2	1	4
251-300	0	0	0	0	0	0	0	0	0	0	0	0
301-350	0	0	0	0	0	0	0	0	1	0	0	1
351-400	1	0	0	0	0	0	0	0	0	1	0	2
401-450	0	0	0	0	0	0	0	0	0	0	0	0
451-500	0	0	0	0	0	1	0	0	0	0	0	1
Total												29

Note: One study was excluded as sample size stated in the study was not specific

Table 3 shows the number of participants that were sampled in the experimental or quasi-experimental research studies. The criterion for statistical significance, level of statistical power, statistical analysis approach, and the size of a meaningful effect should all be considered when establishing sample size in educational research. All research articles selected were based on the criteria drawn, 29 out of the 30 selected research articles selected followed appropriate procedure for sample selection in educational research procedure. The sample size used in the studies selected ranges from

20-480 samples, nine studies had number of participants ranging from 51-100, majority of which were published between 2016-2017. Six of the studies also had a treatment of 151-200, only one study had treatment sample below 50. The highest treatment range used is between 451-500 which was only used by one study. Table 3 elucidates the number of studies by sample size. This finding negates the findings of Colclasure and Thoron (2018) who stated that six studies included between 401 and 450 participants out of the 30 studies that met the criteria for selection.

Table 4. Trends in Research Foci Common in The Experimental or Quasi-Experimental Designs

Year	Curriculum Issue	Method of Active Learning	Laboratory Approach	Technology	Academic Performance
2011	0	1	0	0	1
2012	0	0	0	1	1
2013	0	1	0	0	3
2014	0	0	0	0	0
2015	0	0	0	1	0
2016	0	4	0	5	1
2017	0	2	0	1	3
2018	0	1	0	0	1
2019	0	4	0	0	1
2020	0	2	0	1	1
2021	0	2	0	1	1
Total	0	17	0	10	13

Table 4 elucidates information on trends in research foci common in the experimental or quasi-experimental designs. To provide trends in research results and research foci common in the experimental or quasi-experimental studies. The studies selected were thematized and categorized into one or two of: (a) studies that investigated curriculum issues; (b) studies that examined method of active learning; (c) studies that experimented laboratory approach; and (d) studies that experimented method of active learning. Some studies were found to fall between two themes and were entered into the two themes. No study was conducted on curriculum issues, this negates the finding of Colclasure and Thoron, (2018), in a literature synthesis of agricultural

education research in United States of America which reports that 14 out of 35 studies were conducted on curriculum issues. Seventeen of the total studies selected were conducted on method of active learning out of which six shared themes with either of technology and academic performance. Example of studies conducted on active learning include: Onanuga, et al. (2021) researched on constructivist-based learning on students psycho-productive skills performance in agricultural science; Famiwole and Ajibare (2021) conducted a research on the effects of computer-based and jigsaw methods on senior secondary school students' learning outcomes in agricultural science; Sobowale, et al. (2020) reports that A Tutor Platform enhanced

undergraduate students' academic achievement, the study concludes that ATutor Platform use enhance teaching and learning process. The selected studies assert that ICT and innovative methods application in teaching enhance learning.

Ten of the studies chosen looked into the use of technology, with four of them sharing themes related to academic performance or active learning approaches. Technology-related studies include, for example: Olori, and Igboanu (2016) investigated the effect of computer-based multimedia presentation on senior secondary students' achievement in agricultural science, according to the study, computer-based multimedia had a significant effect on the mean achievement scores of agricultural science students.; The influence of computer-based multimedia presentation on senior secondary students' accomplishment in agricultural science was explored by Famiwole and Ajibare, (2021). The study found that using ICT-based education increased students' achievement in a real sense compared to the traditional technique. Eze and Asogwa (2016) conducted a study on the effects of actual field trips for environmental influence and video instruction methods on undergraduate students' achievement in agriculture science. According to the study, teaching practical agricultural science well entails exposing the learners to the actual experience that is typically gained on the field. When direct farm experience is unavailable, an audiovisual trail can be used to learn some of the skills. All of the researches show that using ICT promotes learning.

Thirteen of the selected studies experimented on academic performance of students, out of which five shared themes with either of, method of active learning or technology. Lawal et al. (2017) opined that there is no significant difference in academic performance between male and female agricultural science students, ; The study of Beshel, *et al.* (2019) investigated autonomous learning strategy and academic performance of

senior secondary two students in agricultural science; and Bada, et al. (2012) indicates that students taught agricultural science using an animated agricultural science educational package had a substantial difference in attitude and performance. All studies related to academic performance have found that creative teaching strategies improve student performance. None of the studies looked at how to teach or learn agriculture in a lab setting.

Recommendations made by authors of experimental or quasi-experimental studies were synthesized. Five common themes in research recommendations were discovered by coding the recommendations section of each publication: i. Recruiting and retraining professionals to be conversant with trends in agricultural education; ii. Teachers should make use of video technology to enhance teaching and learning; iii. Teachers should use more of innovative methods in teaching agriculture; iv. Need for curriculum adjustment to incorporate new innovative studies; and v. Provision of technological devices in schools to enhance the use of technology effectively.

Eight studies suggest that recruiting and retraining professionals who are conversant with trends in agricultural education will ensure effective teaching thereby improving the standard of education (Olori & Igboanu, 2016; Onanuga, et al., 2021; Yusuf, 2018; Adekoya & Olatoye, 2011; Auwal, 2013; Daluba, 2013; Beshel, et al., 2019). According to Nsa et al. (2013) teachers should be obligated to update their knowledge and skills in instructional material improvisation through seminars, workshops, and conferences organized by governments and professional bodies. Professional development for teachers will make the research design more effective, and it may have a good influence on instructors and students in ways unrelated to the study. This finding is in line with Guardian Nigeria (2022) which affirmed that training and retraining of teachers improve learning outcome. The finding also corroborates with

Beddie (2022) who asserted that training and retraining of teachers is beneficiary to both learners and the employers. Rodriguez, et al. (2020) stated that teachers professional development affords them the opportunity to solve current school problems.

Two studies suggest that teachers should make use of video technology to enhance teaching and learning of agriculture. Eze and Asogwa (2016) argues that videotape should be used as an instructional method for teaching practical agriculture, particularly to girls who are stimulated by watching videos. In another study, Ofoegbu (2015) recommends creating a conducive environment for the effective use of videotape as an instructional procedure when teaching practical agriculture in secondary schools. This is in line with recommendation of Bel-Ann (2021) who asserted that the use of audio-visual materials improves learning. The finding also agrees with Gyang et al. (2020) who discovered that the use of various types of visual aids, such as real objects, improves the teaching and learning process.

Five studies suggest that teachers should use more of innovative methods in teaching agriculture (Olori & Igboanu, 2016; Famiwole & Ajibare, 2021; Daluba, 2013; Onanuga, et al., 2021; Beshel, et al., 2019) Beshel, et al. (2019) suggests that a favorable atmosphere be developed for the successful use of videotape as an instructional method when teaching practical agriculture in secondary schools. Five studies recommend the need for curriculum adjustment to incorporate new innovative strategies or ICT use in teaching agricultural science (Usanga, et al., 2015; Nzeribe, et al., 2013; Famiwole, & Ajibare, 2021; Sobowale, et al., 2020). According to Olori and Igboanu (2016), ministries of education, curriculum planners, and developers should outline an appropriate computer-based demonstration mode for teachers to use when teaching any topic highlighted in the agricultural science curriculum. This is consistent with Naz and Murad (2017), who stated that in order to

accommodate students with personal differences under the same roof, a teacher must adapt curriculum and lesson plans while introducing new teaching methods. Puranik (2020) also believes that the only way to improve educational quality is to adopt innovative teaching practices that make the content interesting and motivate the students.

Lastly, four studies recommend that government and school administrators should ensure adequate provision of technological devices in schools to make the use of technology effective in teaching (Yusuf, 2018; Eze & Asogwa, 2016; Adekoya & Olatoye, 2011). Beshel et al. (2019) recommends that government should provide students in secondary schools with technological devices that allow them to access learning materials that encourage independent learning. This is in line with Voogt et al. (2013) who stated that supplying and maintaining the requisite infrastructure, and warranting investments are harmonized with teacher support and other policies intended at effective ICT use will improve quality of teaching. This finding also corroborates with that of Saini (2019) who stated that apart from the need for every educator to be versed in use of ICT it also necessary that it is available. Some of the selected articles made no recommendation, one of these studies is a study conducted by Bada, et al. (2012).

CONCLUSION

Four hundred and twelve AE articles of Nigerian extraction were sourced but only thirty articles used experimental or quasi experimental design and were found to have been published between 2011-2021, these accounted for 7.3% of the total articles. This is low when compared to the need for experimental studies is AE. The pertinent question is that, are researchers in this field not grounded in scientific approach or they don't have interest in such approach? Twenty-five of the thirty publications sampled included a particular treatment length in their

experiment, whereas, five articles did not disclose treatment duration in their methodology. Treatment duration is important in scientific approaches; some agricultural concepts are better taught with a longer treatment duration. Majority of the studies examined used a shorter treatment duration. The number of participants in nine studies ranged from 51 to 100; in experimental research, the bigger the number of participants, the more likely the randomization will be effective. Because each published article is regarded to be a separate research, averages for concepts like treatment time and number of participants could be dramatically skewed depending on interpretation.

It is recommended that scientific approach to teaching and researches be encouraged by various research bodies in the country; researchers should increase treatment duration in future studies to achieve more accurate results; professionals should be recruited and retrained to keep up with agricultural developmental trends; teachers should use video technology to enhance teaching and learning; curriculum should be adjusted to include new innovative technique, and schools should be encouraged to get technological devices and encourage students to use them; future studies should indicate sample size clearly, one study stated two classes as the sample size, any number might be a representative of a class; curriculum analysis and laboratory methodologies should be investigated further, as none of the selected studies focused on either and; academics should synthesize various designs to agricultural education research in order to ensure comprehensive reporting and harmonization of findings.

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