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Effects of Ethno-Science Teaching Strategy on Students' Academic Achievement in Agricultural Sciences in Secondary Schools in Abia State

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Abstract: *The study investigated the effects of ethno-science teaching strategy on the academic achievement of students in Agricultural Sciences in Secondary schools. Two research questions were posed and two null hypotheses were tested at 0.05 level of significance. The Quasi-experimental design was employed. A sample of 132 Agricultural Science students which comprised 63 students randomly assigned to the Control group and 69 students randomly assigned to the Experimental group was used for the study. The 63 Agricultural Science students randomly assigned to the Control (Lecture group) comprised 25 students from schools located in the Urban Areas and 38 students from schools located in the Rural Areas. The 69 students assigned to the Experimental (Ethnoscience) comprised 24 students from schools located in the Urban Areas and 45 students from schools located in the Rural Areas. The sample of the study was drawn from 4 secondary schools selected from two Local Government area from One Education Zone. A content validated Agricultural Science Achievement Test (ASAT) was administered to both groups of students before and after the experiment. The reliability coefficient for the instrument was 0.79 which was derived using the Kuder-Richardson (KR-20) formula. Mean and standard deviations were used to answer research questions and ANCOVA statistics was used to test the null hypotheses. Findings revealed that ethno-science had a significant effect toward enhancing the academic achievement of students in Agricultural Science and school location was not a significant factor on students' academic achievement in Agricultural Science. Based on the findings, it was recommended that ethno-science should be adopted in teaching and learning process of Agricultural Science in secondary, since it was effective in enhancing the academic achievement of students. Also school location should not be a discriminating factor when adopting ethno-science teaching strategy.*

Keywords: Ethno-science, Agricultural Science and Academic achievement

Introduction

The science of cultivating crops and animals for human consumption is known as agricultural science (Madu & Ebere, 2016). Due to the growing importance of agriculture in Nigeria's economy—especially in light of the declining price of oil—the topic is highly valued in both our society and educational system. According to Ebere (2015), agriculture is the foundation of any country's economic and social development. It employs over 68% of Nigeria's labor force and is the country's main source of income (Philip *et al.*, 2009). The expectation that Nigeria will become self-sufficient in food production has not materialized, despite the country's large amount of fertile land, favorable climate, and various agricultural initiatives (Odoemenem & Obinne, 2010). Because of the importance of Agriculture to the Nigerian economy, it

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remains one of the few subjects that is offered at Primary, Junior Secondary, Senior Secondary Schools and Tertiary institution.

According to the National Policy on Education, agricultural science is categorized as a vocational subject (FRN, 2013). A good knowledge of Agricultural science is a pre requisite for the study of Agriculture and its allied Courses such as Agricultural Economics, Animal Science, Crop Science and Production. The objectives of Agricultural Science as stipulated in the Agricultural Science Curriculum to include, stimulating and sustaining student's interest in Agriculture, enabling students to acquire basic knowledge and practical skills, preparing students for future occupations. Teachers of agricultural science in secondary schools are to impart knowledge, skills and attitudes in the key areas of agriculture to the students. However, the achievement of the theses objectives is expected to reflect in improved academic achievement of the students in Agricultural Science. Academic achievement, as determined by evaluation or assessment, demonstrates students' competency in specific areas following exposure to an educational experience. It also refers to how well a pupil has performed in relation to their immediate or long-term learning goals. Academic achievement, according to Chukwu (2019), is the degree of proficiency or accomplishment one has in an academic field as opposed to one's potential. It was also defined by Ebere, Ukachuwku, and Madu (2020) as educational goals attained over time by a leader, an institution, or a student. Academic accomplishment is demonstrated by students' results on achievement tests, their cumulative grade point average, and their completion of advanced degrees like bachelor's and high school. Academic achievement in the context of this study can be seen as a measured and observable behavior of Agricultural Science students. The academic success attained by use of accomplishment tests, which may be administered as standardized or teacher-made exams. However, the teacher-made Agricultural Science Achievement Test was used for this study's purposes.

Poor academic performance of students has been documented over time in the Agricultural Science external examinations administered by the National Examination Council (NECO) and the West African Examination Council (WAEC). The West African Examination Council has also acknowledged the trend of low performance among secondary school students (WAEC Chief Examiners report, 2020). The analysis of WAEC results for the academic years 2017, 2018, and 2019 showed the following data regarding the performance of Nigerian secondary school students on external examinations. For the West African Senior School Certificate Examination (WASSCE) in 2017, 2018, and 2019, the percentages of students who passed with five credits, including Agricultural Science, were reported to be 25.99%, 29.45%, and 56.01%, respectively (WAEC, 2020).

There are many reasons for the low academic achievement in Agricultural Science at both the internal and external examinations administered by the West African Examination Council (WAEC) and the National Examination Council (NECO). These include inadequate learning environments, ineffective teaching strategies, teachers' work-related attitudes, students' lack of interest in learning Agricultural Science, and students' time management, among other things (Eme, 2017). However, notable efforts have been made to date to raise academic achievement, but not much progress has been made (Madu,Offorma Natrebo & Ebere, 2017). According to Chukwu's (2019) research on the expository approach for enhancing agricultural science, yet the issue of students' poor academic achievement persisted. In a similar vein, Madu and Ebere's (2017) carried out a study on concept mapping and improvement in agriculture also found that expository teaching methods improves students' academic achievement in secondary schools, yet the issue of poor academic performances still persist in our schools. Hence it was on theses bases that the present study sought to investigate the extent to which expository teaching method such as ethnoscience improves academic achievement of students in agricultural science in secondary schools.

Thus far, ethnoscience has focused on how individuals create their own worlds based on the language they use to describe them as stated by Emmanuel and Peter Oluwatosin (2017). According to Brayboy and Maughan (2009), an ethnoscientist must always keep in mind the native person's perspective on life and how it helps him actualize his worldview. Additionally, by connecting culture to cutting-edge scientific

information, ethnoscience—which deals with knowledge that is indigenous to a culture—serves as a foundation for the construction of reality (Peni, 2015). As such, it serves as a transitional state between imagination and factual information or between theater and technology. Ethnoscience, according to Abonyi, Achimugu, and Njoku (2014), directs creativity and both convey the organism's inherent need and conjures up appropriate goals. It creates a background for the successful growth of knowledge in many fields of endeavour by creating a conducive atmosphere for its development.

The information that locals employ to make a living in a certain setting is known as ethnoscience or indigenous knowledge (Ann, 2012). This idea is referred to by a number of words in the field of sustainable development, such as "rural knowledge," "traditional environment knowledge," and "indigenous technical knowledge." Such knowledge is exploratory, creative, and imaginative to adapt to changing circumstances. The integration of ethnoscience with knowledge-based science and technology might enhance scientific and technical endeavors to address issues related to comprehending scientific ideas. It has been discovered that using an ethno-science teaching approach improves students' academic performance. In addition to submitting ethnoscience as a teaching tool, researchers (Abonyi, Achimugu, and Njoku, 2014; Fasasi, 2017; Ugwuanyi, 2015; Abiam, Abonyi, Ugama and Okafor, 2016; Ugwu & Diovu, 2016 and; Okwara & Upu, 2017) have conducted experiments and discovered that when integrated into science teaching, ethnoscience has a significant impact on students' performance, achievement, and interest. Therefore, the goal of the current study was to determine whether teaching Agricultural Science would provide the same outcome.

In order to conduct a thorough investigation into the degree to which the ethnoscience teaching style enhances students' academic performance, it is imperative to scrutinize the impact of the moderating variable of school location. Therefore, a school's location affects how well its scientific students perform academically. Nworgu, Ugwuanyi, and Nworgu (2014) define school location as an urban or rural area. The term "school location" describes the specific placement of the school in relation to other rural or urban areas of the physical environment. According to Ntibi and Edoho (2017), a school's location is a specific spot in relation to other urban and rural physical environments where the school is situated. This also holds true for the allocation of instructors and educational resources. According to these prevalent conditions, there are differences in the learning possibilities offered by Nigerian schools. This led Allahnana, Akande, Vintseh, Attah, and Alaku (2018) to conclude that geography matters when learning mathematical concepts involving angles, with rural students showing greater learning challenges than their urban counterparts. Alokan (2010) looked into how students' performance on the SSC examination differed depending on where their school was located. She discovered that while failure rates were higher in rural schools, students studying chemistry in urban schools outperformed their peers in rural ones, receiving superior grades. According to certain research (Bosede, 2010; Okorie & Ezeh, 2016), student academic achievement was not affected by a student's location. According to Igwebuike and Ikponmwosa (2013), students in rural areas displayed more interest and performed better on practical skills in chemistry than their urban counterparts did. The influence of location on students' academic achievement remains controversial and inconclusive.

Despite the fact that a career in agricultural science helps the country's economy grow, students' academic performance in the subject matter is still lacking, which has led to low student enrollment in courses connected to the field in postsecondary institutions. In light of this, it is vital to investigate how students' academic performance in the agricultural sciences is impacted by the use of ethno-science teaching strategies.

Research Questions

Two research questions were posed for study which were as follows;

1. What is the mean achievement scores of the senior secondary school students in Agricultural Science when taught using ethno-science teaching strategy and lecture method?
2. What is the mean achievement scores of students in Agricultural Science in senior secondary schools located in Urban and Rural areas when taught using ethno-science teaching strategy and lecture method?

Hypotheses

The two null hypotheses were tested at 0.05 level of significance.

1. Mean achievement scores of the senior secondary school students in Agricultural Science when taught using ethno-science teaching strategy and lecture method does not significantly differ.
2. Mean achievement scores of secondary students in schools located in urban and rural area in Agricultural Science when taught using ethno-science teaching strategy and lecture method.

Methodology

The quasi-experimental research design was adopted which included a pretest-posttest non- equivalent control group design. This study was carried out in Abia State. The population of the study was 12,458 senior secondary school two (SS2) students in all 251 Government owned Secondary schools in Abia State. The population also comprised 8,483 students in schools located in the Rural Areas and 3975 students in schools located in the urban areas (Secondary Education Management Board, 2021). For the study, a sample of 132 students majoring in agricultural science was selected, with 69 students randomly assigned to the experimental group and 63 students randomly assigned to the control group. 25 students from urban areas and 38 students from rural areas made up the 63 Agricultural Science students who were randomly assigned to the Control (Lecture group). The 69 Students assigned to the Experimental (Ethnoscience) comprised 24 students from schools located in the Urban Areas and 45 students from schools located in the Rural Areas. The sample of the study was collected from 4 secondary schools selected from two Local Government area from One Education Zone. The Four secondary schools were drawn through a stratified random sampling. In each school one intact class was drawn for the study through simple random sampling. Out of the four schools, two schools were assigned to the treatment group while the remaining two schools were assigned to the control group. From the two Local Government Areas, Four Government schools which two was located in Urban Area and the other two located in the Rural Area.The assignment of the schools to the treatment and control groups was done through a stratified random sampling. In each school one intact class was drawn for the study through a simple random sampling.

The researcher created a 20-Item Multi-choice Agricultural Science Achievement Test (ASAT) as the data collection tool. Three experts—two from the Department of Agricultural and Vocational Education and one from the Department of Science Education (Educational Measurement and Evaluation)—validated the instrument's face and content, and their adjustments and recommendations were fully implemented. The Kuder-Richardson (KR-20) test revealed that the Agricultural Science Achievement Test (ASAT) had an internal consistency of 0.79. Given that the instrument only required one right answer per scenario, it was appropriate for assessing its reliability. Both the experimental and control groups in the study included the normal Agricultural Science teachers. The researchers arranged a one-week training program for the research assistant. They received the necessary training to administer the ASAT and teach utilizing the ethno-science instructional style. During the week-long training, the instructors practiced their teaching techniques by utilizing lesson plans developed by the researchers, which included all the procedures required for an ethno-science instructional approach in the form of micro-teaching. Before the experiment started, students took the ASAT as a pre-test to determine their beginning achievement level and interest in Agricultural Science. Following the pre-test, the Research Assistants instructed the experimental group for 30 minutes for each day in adhering to ethno-science instructional approach lesson plans; procedures prepared by the researchers. The period for the instruction lasted 6 weeks with two days each in a week. Based on the researchers' planned methods and lesson plans for the ethno-science pedagogical approach.

Lesson plans utilizing the lecture teaching method were also used to teach the identical material to the control group. Six weeks were spent on the treatment. Every teacher in the experimental and control groups finished the assigned material according to the guidelines provided by the researchers. The ASAT was given a post-test right after the lesson, and the results were noted. The teachers scored the scripts after compiling the results of the two tests. The scores for each test ranged from 1-100marks as each correct answer for each question attracts 5marks. The mean and standard deviation scores were utilized to answer the research questions, while analysis of covariance (ANCOVA) was employed to test the hypotheses at the 0.05 alpha levels.

Results

Research Question 1: What is the mean achievement scores of the senior secondary school students in Agricultural Science when taught using ethno-science teaching strategy and lecture method?

Table 1 : Mean and Standard deviation scores of Pretest and Post test scores of students achievement in Agricultural Science when taught using ethno-science teaching strategy and lecture method.

Teaching Method	Number of Students	Types of Test				Achievement Gains
		Pre-test		Post test		
		$\bar{X}$	S.D	$\bar{X}$	S.D	
Ethno-science (Experimental)	69	32.89	10.95	85.79	6.38	52.90
Lecture Method (Control)	63	32.70	12.60	60.13	11.84	27.43

The data presented in Table 1 indicated that students Agricultural science taught using the ethno-science teaching strategy had a mean achievement score of 32.89 and a standard derivation of 10.95 in the pre-test and a mean score of 85.79 and a standard deviation of 6.38 in the post test, making a pre-test posttest gain to 52.90. The Table also shows students taught using lecture method had a mean score of 32.70 and a standard deviation of 12.60 in the pre-test and a mean of 60.13 and a standard deviation of 11.84 in the post-test with a pre-test post-test gain of 27.43. Hence the students taught Agricultural Science using the Ethno-Science teaching strategy had a better mean achievement scores than the students taught using lecture method, thus there is an improvement in the mean achievement score of students in Agricultural Science achievement test when taught with Ethno-Science teaching Strategy than the lecture method.

Research Question 2. What is the mean achievement scores of students in Agricultural Science in senior secondary schools located in Urban and Rural areas when taught using ethno-science teaching strategy and lecture method?

Table 2: Mean and Standard deviation scores of Pretest and Post test scores of student's achievement for the senior secondary school students in Agricultural Science located in Urban and Rural areas.

Teaching method	**Types of test**	**School Location**							
		Urban				**Rural**			
		No. of Student			**Achievement gain**	**No. of students**			**Achievement gain**
			$\bar{X}$	**S.D**	$\bar{X}$		$\bar{X}$	**S.D**	$\bar{X}$
Ethno-science	Pre-test	24	33.00	11.87	53.17	45	32.80	10.57	52.80
	Post test		86.17	6.01			85.60	6.62	
Lecture Method (Control)	Pre-test	25	29.76	12.97	30.40	38	34.63	12.14	25.47
	Post test		60.16	11.28			60.10	12.35	

The data presented on the table 2, indicated that the students in schools located in the urban areas in the experimental group had a mean achievement score of 33.00 and a standard deviation of 11.87 in the pre-test while in the post-test, they had a mean achievement score of 86.17 and a standard deviation of 6.01. The result also shows that the students in schools located in the Rural areas in the experimental group had a mean achievement score of 32.80 and a standard deviation of 10.57 in the pre-test of experimental group which is lower than that of urban students in the pre-test of experimental group, while the rural students also had a mean achievement score of 85.60 and a standard deviation of 6.62 in the post-test of the experimental group, which is lower than that of the urban students in the post-test score in the experimental group. Thus the students in senior secondary schools located in Urban Areas had a better mean achievement scores than their rural counterparts when taught using the Ethno-science teaching strategy. The data presented in table 2 also indicated that the students located in Urban schools had a mean achievement score of 29.76 and a standard deviation of 12.97 in the pre-test of the control group which was lower than the pre-test of the experimental group, while in the post-test, the urban students had a mean achievement score of 60.16 and a standard deviation of 11.28 which was lower than the experimental group. The result also shows that the Rural students had a mean achievement score of 34.63 and a standard deviation of 12.14 in the pre-test of the control group which is higher than that of the urban students score in the pre-test of the control group, while the Rural students had a mean achievement score of 60.10 and a standard deviation of 12.35 which is higher than that of the Urban students in the post-test of the control group. In summary, the students in the schools located in the urban areas had better mean achievement scores in Agricultural Science than their rural counterparts when taught using Ethno-science teaching strategy.

Hypothesis 1: Mean achievement scores of the senior secondary school students in Agricultural Science when taught using ethno-science teaching strategy and lecture method does not significantly differ

Table 3: Analysis of Covariance (ANCOVA) of the significant difference in the mean achievement scores of the senior secondary school students in Agricultural Science when taught using Ethno-Science teaching strategy and lecture method

Sources of Variation	Type III sum of square	Df.	Mean sum of square	F.Cal	Significance
Correlated model	21723.243[a]	2.	10861.621	122.377	0.000
Intercept	76585.047	1	76585.047	862.875	0.000
Pre-test	22.659	1	22.659	0.255	0.614
Teaching method	21689.155	1	21689.155	244.369	0.000
Error	11449.485	129	88.756		
Total	747152.000	132			
Corrected total	33172.727	131			

a R square = .655 (adjusted R squared = 0.650)

The data on table 3 shows that the teaching method (lecture method and Ethno-science) is a significant factor in the mean achievement scores of the students in the Agricultural Science Achievement Test, this is because the p-value of 0.000 is less than 0.05. This indicates that we reject the null hypotheses which state that there is no significant difference between the mean achievement scores of the senior secondary school students in Agricultural Science when taught using ethno-science teaching strategy and lecture method. Thus, this implies that there is a significant difference between the mean achievement scores of the senior secondary school students in Agricultural Science when taught using ethno-science teaching strategy and lecture method, as the students taught Agricultural Science using ethno-science teaching strategy had a better achievement mean score in Agriculture than the students taught with lecture method.

Hypothesis 2: Mean achievement scores of secondary students in schools located in urban and rural area in Agricultural Science do not differ when taught using ethno-science teaching strategy and lecture method

Table 4: The analysis of covariance (ANCOVA) of the significant difference between the mean achievement scores of secondary school students in schools located in urban and rural area in Agricultural Science when taught using ethno-science teaching strategy and lecture method

Source of variation	**Type III sum of square**	**Df.**	**Mean sum of square**	**F.**	**Significance**
Correlated model	22190.513[a]	4	5547.628	64.154	.000
Intercept	76424.562	1	76424.562	883.785	.000
Pre-test	5.877	1	5.877	0.068	.795
Teaching Method	20269.751	1	20269.751	234.402	.000
School location	190.87	1	190.877	2.207	.140
Teaching Method * School Location	309.212	1	309.212	3.576	.061
Error	10982.214	127	86.474		
Total	747152.000	132			
Corrected total	33172.727	131			

a. R square = .669 (adjusted R squared = 0.659)

The data on table 4 shows that school location is not a significant factor in the mean achievement scores of the students in the Agricultural Science achievement test when taught using the ethno-science teaching strategy and lecture method. This was indicated by the p-value of 0.140 which is greater than 0.05 at 0.05 level of significance, this indicate that we retain the null hypotheses which implies that there is no significant difference between the mean achievement scores of secondary school students in schools located in urban and rural area in Agricultural Science when taught using ethno-science teaching strategy and

lecture method. The data also show the interactional effect of school location and teaching method is not significant with p value of 0.06 which is greater than 0.05, this indicates that there is no significant interactional effect in the mean achievement scores of secondary school students in schools located in urban and rural area in Agricultural Science when taught using ethno-science teaching strategy and lecture method.

Discussion of Findings

When students were taught using an ethno-science teaching strategy instead of a lecture method, their mean achievement scores on the Agricultural Science Achievement Test improved. This is the conclusion drawn from the analysis of research question one. Additionally, the matching null hypothesis was tested, and the results showed that the mean achievement scores of senior secondary school students in Agricultural Science when taught using the lecture technique and the ethno-science teaching strategy differed significantly. The results of Ajayi, Achor, and Agogo (2017), who found that students taught mixture separation techniques utilizing an ethnochemistry approach had considerably higher mean achievement scores than those taught using a discussion method, are consistent with this conclusion. Also corroborating the findings, Okwara and Upu (2017) in their study revealed that there is a significant difference in the mean achievement scores of students taught Basic Science and Technology using ethno-science instructional approach and those taught using demonstration teaching method. In a similar way, the finding also agrees with Ugwuanyi (2015) whose findings revealed that the ethnoscience based instructional model is superior to the lecture method in fostering interest and achievement among the students. The finding also corroborates the finding of Damayanti, Sigit and Rusdi (2018) whose finding showed that learning approach had an influence toward learning outcomes. Similarly it also agrees with Fasasi(2017) whose study revealed significant main effect of treatment was recorded on cognitive achievement in science with Ethnoscience instruction group performing better than the control group. The finding is also in line with Sudarmin (2017) whose finding concluded that the ethnoscience approach and module theme substance additives based ethnoscience effective to improve learning outcomes and students' entrepreneurship. The significant improvement in achievement made by ethnoscience teaching strategy is because it made it possible for learners to engage in critical comparison between the two knowledge systems. Such exercise develops the cognitive structure and understanding of the learner. It is a better approach that clearly removes the assumption or pretence that indigenous knowledge has nothing to offer in the teaching and learning of science. There is no doubt that psychological and sociological approaches are useful in education but the inclusion of the elements of indigenous knowledge in classroom activities through ethnoscience instruction has provided fresh insight into and solutions to problems associated with students learning science.

The analysis of research question two showed that the students in the schools located in the urban areas had better mean achievement scores in Agricultural Science than their rural counterparts when taught using Ethno-science teaching strategy. Furthermore the testing of the corresponding null hypothesis revealed that there is no significant difference between the mean achievement scores of secondary school students in schools located in urban and rural area in Agricultural Science when taught using Ethno-science teaching strategy and lecture method. This finding is in agreement with the findings of Peni (2017) whose findings revealed that urban and rural students in the experimental groups performed better than those in the control groups but was not significant. Corroborating this, Fasasi (2017) in his findings revealed that there is no significant main effect of school location on students' cognitive achievement in science. This implication is that there is no difference in the cognitive achievement of urban and rural students with the use of ethnoscience instruction. It supports the work of Reeves (2005) whose results do not support the claim that rural students achieve less well than their non-rural peers in mathematics and science. Despite the seeming disadvantaged position of students in rural schools in terms of infrastructure, they still marched students from the urban centre in terms of cognitive achievement.

Recommendations

1. Teachers should be taught how to utilize the ethnoscience teaching strategy in the teaching and learning process of Agricultural Science since it has been found to improve the interest, academic Achievement and retention of students in Agricultural Science.
2. The students in the schools located in the urban areas had better mean achievement scores in Agricultural Science than their rural counterparts when taught using Ethno-science teaching strategy.

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