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Effects of Application of Cultural Practice Approach and Lecture Method on Achievement of Basic Science Students' in Delta State, Nigeria

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Abstract: This study compared effects of cultural practice approach and lecture method as it influences the achievement of junior secondary school students' in basic science across Delta State using specific variables (cultural practice, lecture method as independent variables and achievement as dependent variables). Three research questions and corresponding hypotheses formulated were tested (α = 0.05). Non-randomized pre and post-test, and planned variation quasi experimental design were adopted. Using a sample size of 210 basic science students from six secondary schools within the study area, Basic Science Achievement Test (BSAT) questionnaire was used for data collection with proper validity and reliability test carried out before usage. Descriptive statistics (mean ± standard deviation was carried out, while the stated hypotheses were tested using t-test and ANCOVA at 0.05 level of significance. The findings of the study include: (i) significant difference in the achievement score of students taught with lecture method and cultural practice approach (ii) significant difference in the achievement scores of male and female students taught with cultural practice approach but no significant difference in the performance of male and female students taught with lecture method (iii) significant effect of interaction between sex and method on students' achievement. The study concluded that cultural practice approach is the most effective approach for the teaching of Basic Science and it was recommended that a review of curriculum by the education system be carried out to include cultural practice approach to equip students' and prospective teachers in their quest for knowledge and future profession.

Keywords: *Culture, Cultural Practice, Cultural Practice Approach, Achievement and Sex.*

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I. INTRODUCTION

Science has shown to be the bedrock of development of any nation. Nigeria as a country has made serious efforts towards the achievement of the objectives of acquiring science education. One of such efforts is the giving of high admission quota to science students at the tertiary level of Education. This effort is to make students acquire scientific literacy needed for the development of any country. Scientific literacy equip individuals with informed knowledge and provide satisfactory and convenient culture of techno-scientific lifestyle (Mbajiorgu & Ali, 2003). In order to enable students at all levels of education to achieve this, the Federal Government of Nigeria approved the introduction of Basic Science and Technology at the basic levels of education. Introduction of Basic Science, taught as Integrated Science previously was to include essential topics which was aimed at equipping learners to develop interest in the areas Science, Technology, and apply same in contemporary needs, hereby engaging in activities capable of deterring interest in social vices and other peer related activities (Federal Ministry of Education, 2012). Basic science helps to prepares students at Junior Secondary level for core science subjects such as biology, chemistry and physics at Senior Secondary level. Thus, basic science holds a significant status at the Junior Secondary School curriculum. Basic science has been well taught using lecture methodd instead of the activity based instructional strategies (Ajeyalemi, 2017; Ikeobi, 2019).

Lecture method which is a teacher centred method of teaching is among the oldest most common method adopted in teaching. It was considered most effective way of presenting teaching materials to student's which is mediated by the teacher. Using such method, students have little or no opinion or opportunity for questioning. In lecture method,

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students' involvement is low, making them passively present and they receive information without thinking and interacting with the learning materials. When lecture method is used, contents are delivered to the learners in their final forms. It is useful for the introduction of new concepts, and also helps in dealing with large group of students and coverage of voluminous content area within the shortest period of time.

One of the reasons why lecture method is predominately used is because it enables the teacher to effectively manage time, gives the teachers the opportunity to share their expert knowledge and also provides a starting point for learners to build basic understanding and conceptual framework of the subject matter. During the usage of lecture method, students are passive but they could be involved in various minds on activities which may not involve direct interaction with learning materials. According to Ozaji (2008), learners' inability to interact directly with learning materials leads to poor understanding of Basic science concepts. Some researchers have discovered that Africans hardly understand Science because the science learnt in the classroom is not taught in relation to learners' daily experiences and this make learners shy away from science (Abumchukwu, Eke, Achugbu 2021). The few who study science lack the ability to relate what happens in the classroom with their daily experiences. Bransford, Brown and Cocking (2000) are of the view that students come to the formal classroom with a range of previous knowledge, skills, and beliefs that are capable of influencing their thought and perceptions of the environment and this affect their abilities to remember, reason, and acquire new knowledge. Since new knowledge needs an anchor to be built on as stated by constructivist theorist, instructional strategies which will enable teachers to determine students' prior knowledge in relation to practices that the students are familiar with should be used to teach. Such strategies will give teachers better ways of presenting the new knowledge he/she wants the learners to learn (National Commission for Colleges of Education, 2012).

The observation of UNESCO (2006) show that this vital curricular provision has been neglected and that instructional processes in Nigerian classrooms are lacking the use of relevant practices that are familiar with learner in teaching and that foreign examples, and ideas are used instead. Based on the observation of UNESCO (2006) it can be seen that science instructions are presented in such a way that depict science as a "Whiteman's" affair. This is why students in developing countries like Nigeria have the feeling that school science is foreign. According to Akinhead and Jegede (2002), this feeling has its root from the differences between the culture of the western science and the students' indigenous culture. Teaching Basic Science effectively goes beyond knowledge impartation; it involves teachers carrying out activities in subject areas with which they are well groomed to enhance students' psychomotor, effective, and cognitive development. Tanner and Allen (2003) advised that the strategies that will be used in teaching Basic Science should access and activate the student's prior knowledge.

Cultural practice, also known as ethnoscience, it is the manifestation of a culture or sub – culture, especially in regard to the traditional and customary practices of a particular ethnic or other cultural group (Nizkor.org. archieved 2002). It is one of such teaching approaches that has this ability of relating students' experiences with what is to be taught. It is also defined as practices of an ethnic group that have scientific explanation. It includes activities they indulge in to meet their needs, some of these practices can be used to illustrate scientific principles and teach some specific concepts. Many principles of native knowledge are scientific; therefore, using culturally relevant materials can enhance the scope of science taught (Hobson, 2014). According to Muhammad (2013), using cultural views that spans from students experience will challenge the learners to explore their environment more and also make them ask questions concerning some of their cultural beliefs and there will be a bridge in the gap between their cultural home background and that of the western world thereby de-westernizing science. The contextualization of science within the learner's indigenous cultural practices helps improve learning outcome. This is because, learners will begin to see science as something that happens within and around them arising from their hands -on experiences that is required for meaningful learning to take place at the concrete operation developmental stage.

In order to teach Science using cultural practices some researchers have used the following cultural practices to teach some scientific concepts: fermentation of corn / maize grains (used for teaching production of alcohol), eating of sour taste fruits (used in teaching of acid), pushing and pulling of objects to move (used to teach force). The cultural practices that will be used in this study include: boiling of water (to teach kinetic energy/ convection), heating of metal spoon with palm oil on it (to teach heat flow), and heating of frying pan (to teach conduction). The basic reasons for the use of cultural practices and ideas in the classroom includes: the sensitivity that people have a strong hold for their culture and religion, most of our schools' lack the required laboratory facilities needed to effectively teach Basic Science, and students come to the classrooms with different cultural beliefs that can be misconceptions which are detrimental to the learning of Science. With these reasons, it becomes necessary to use cultural practices that students are familiar with to teach scientific concepts. When this is done, teachers will be able to elicit student's previous knowledge before teaching and present science to students in a more practical way within their world and engaging them actively in the teaching and learning of science irrespective of their sex. This may improve their achievement in of basic science.

Academic achievement can be described as a multifaceted construct that is made up of different domains of learning. It depicts students' performance outcomes which indicates the extent to which a student has accomplished specific goals that were the focused of the activities in instructional environments, specifically in primary and secondary schools, college, polytechnic and university. At the primary and secondary school levels they

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are regarded as positions based on numbers (1^{ST}, 2^{ND} 3^{RD}etc), at the polytechnic and colleges they are graded as distinctions, credit, merit and pass. While at the university, it is graded as first class, second class and third-class based on cumulative grade points average. According to Ugwuanyi, Mwantok, Mbara and Ogbu, (2018) , the ability of a student to retain and afterward commit to memory things learned in the past is described as academic achievement.

➢ *Statement of Problem*

This study was necessitated by the observed poor performances of Basic Science students and the need to search for alternative methods of teaching. The academic success of students is determined by their understanding of the concepts that they have learnt and this is determined by their gained scores after examination. When these scores are above average it can be said that the aims and objectives of teaching was achieved and if lesser, it is said that the objectives of teaching are not achieved. The poor performances of students in basic science shows that the aims and objectives of teaching basic science have not been achieved over the years. The following were identified as the causes of students poor performances from literature :(i) science learning is still teacher dependent (ii) classroom learning does not elicit students prior knowledge, and this can hinder understanding (iii) Classroom learning is devoid of variety of activities even if the concept to be taught can be practicalized. From these identified reasons one can say that the poor performance of students in sciences and particularly basic science is caused by the teaching process which is not in line with the constructivist theory of learning.

Based on social constructivist theory of learning, meaningful learning occurs when learners interacts among themselves, the environment and their prior knowledge. What is already known serves as an anchor to the new knowledge and their interactions makes learning occur easily and meaningful. In order to achieve this, it has been advocated that indigenous knowledge and practices of the society should be used to teach science curriculum concept because this type of teaching strategy may enhance the understanding of Basic Science. When cultural practices are used to teach, the students are made to see the relationship between their daily activities and scientific concept. This act will give the students the opportunity to carry out hands-on activities since most of our secondary schools do not have functional laboratories. When students are actively involved and their previous knowledge elicited, it is believed that students will understand better of the study of basic science. Based on this, the statement of the problem is "will the use of lecture method and cultural practices instructional approach have varying effects on Basic Science students' achievement a? Will there be variation in achievement based on sex?

➢ *Research Questions and Hypothesis*

The study is was hinged on the following questions:

- Is there any difference in achievement scores of students offering basic science who were taught with cultural practices approach to those who were taught using lecture method?
- Is there any difference in achievement scores of male and female students offering basic science who were taught using cultural practices approach to those taught using lecture method?
- Is there any effect of interaction between methods of teaching and sex on students' achievement?

➢ *Hypotheses*

- H_{01}: There is no difference in achievement scores of students offering basic science who were taught with cultural practices approach to those who were taught using lecture method.
- H_{02}: There is no difference in achievement scores of male and female students offering basic science who were taught using cultural practices approach to those taught using lecture method.
- H_{03}: There is no effect of interaction between methods of teaching and sex on students' achievement.

II. METHODOLOGY

➢ *Research Design*

The study adopted a correlational design approach using non-randomized pre and post-test, non-equivalent planned variation group and quasi -experimental design. It consisted of cultural practice approach and lecture method.

➢ *Population and Sample for the Study*

The study population included class 11 basic science students across mixed Junior Secondary in Delta State. The state has a total of 386 secondary schools (386) (Delta State Ministry of Education, 2024). To select the samples, schools within same senatorial district were placed in separate bags. Withdrawal method with replacement model was used for balloting and 2 mixed secondary schools from each senatorial district were selected alongside 6 basic science teachers from the selected schools.

➢ *Research Instrument*

The instrument used for data collection is the Basic Science Achievement Test (BSAT). On the other hand, an intervention package was used for training of teachers on the use of cultural practice approach.

- *Basic Science Achievement Test (BSAT)*

The Basic Science Achievement Test (BSAT) is made up of two sections. Section A contains questions asked on students bio-data while section B contains 50 items with one correct answer and four distracters (Option A-E) drawn from 2011 to 2021 past J.S.S III question papers on Basic Science on kinetic energy, heat flow, heat transfer (conduction), convection, radiation and light energy (reflection and refraction). The items were picked from the past Junior school examination past question papers.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25sep719

- *Cultural Practice Approach Intervention Package*

This is made up of three sections, section A of the teachers training manual deals on the concept of cultural practice approach, the specific step to be followed in using cultural practices. Section B shows the steps to be followed in using cultural practice approach and section C is a lesson plan showing the topics to be taught, objectives to be achieved, students and teachers' activities.

A flowchart on the general steps involved in the instructional process are highlighted below.

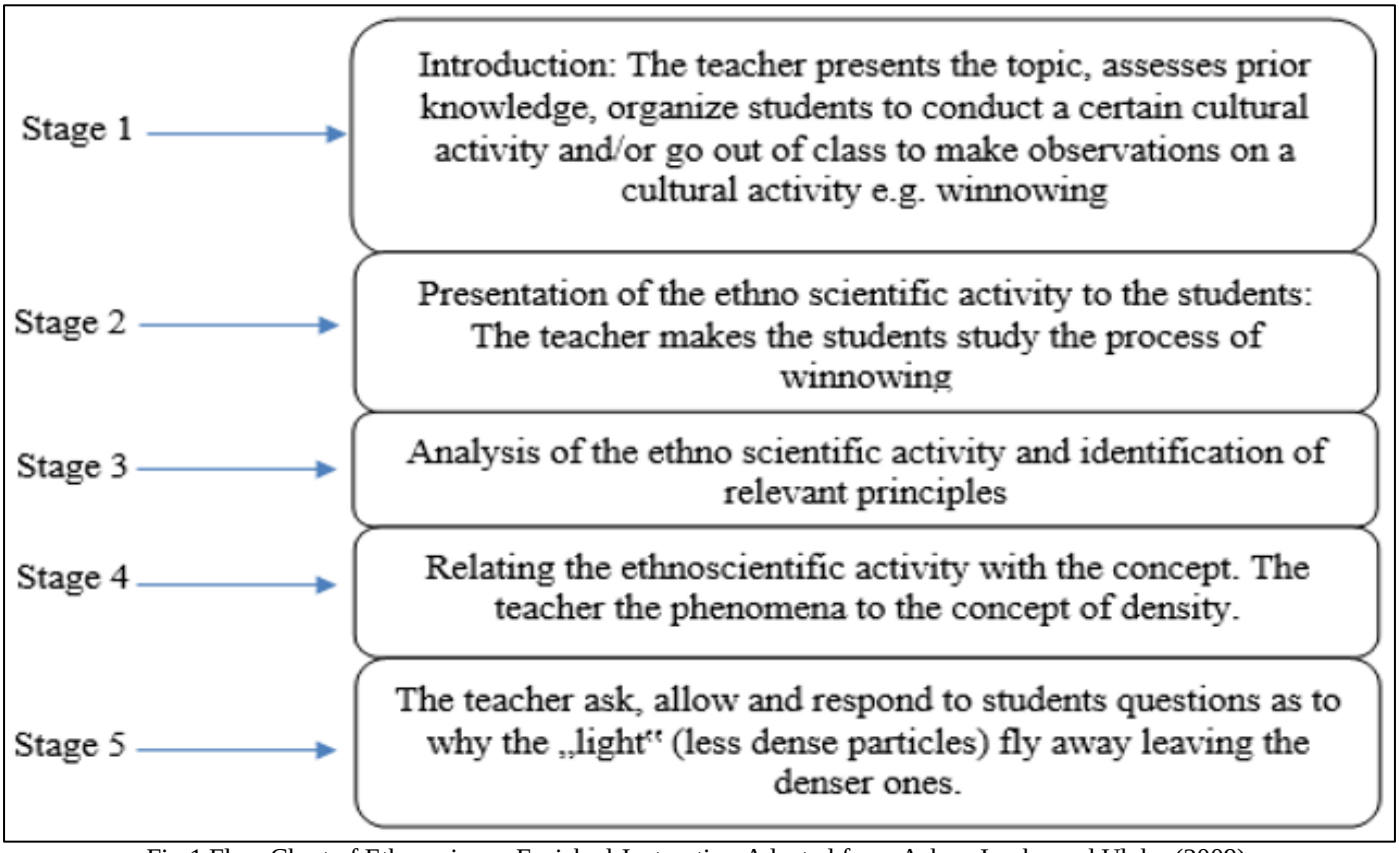

Fig 1 Flow Chart of Ethnoscience-Enriched-Instruction Adapted from Achor, Imoko and Uloko (2009).

➢ *Validity of the Instruments*

- *Basic Science Achievement Test (BSAT)*

Two types of validation were conducted for the instrument: face and content validity. Face validity involved three experts—one in Science Education, an experienced Basic Science teacher, and a Measurement and Evaluation specialist—who independently assessed the instrument against the research questions and hypotheses. Based on their recommendation, the items were increased from 25 to 50. Content validity was ensured through a table of specifications guided by Bloom's Taxonomy, confirming that the concepts were adequately covered.

- *Reliability of the Instrument*

To determine the reliability of the BSAT, the instrument was administered to thirty-five students from a mixed secondary school who were not part of the main study, after they had been taught the relevant concepts. The responses were analyzed using the Kuder-Richardson Formula 21 (KR-21), which provides an estimate of the instrument's internal consistency. The reliability coefficient obtained was $r = 0.79$. According to Wiseman (1999), a reliability value of 0.70 or above indicates that a test is reliable and effectively measures the characteristics it was designed to assess.

- *Treatment Procedure*

The study employed two groups: a Cultural Practice Approach group and a Lecture Method group, over an eight-week period with six weeks devoted to treatment. Six Basic Science teachers (two from each senatorial district) were assigned to the groups. Those in the Cultural Practice Approach group were trained on relevant instructional strategies, while research assistants were guided with teaching manuals to ensure consistent application of both methods in teaching the selected concepts.

- *Step IV: Post - Testing*

At the end of six weeks of instruction, the groups (i.e. cultural practice approach and lecture method) were given a post- achievement test to respond to. The responses of the students of both groups to the items in the Basic Science Achievement test.

- *Method of Data Analysis*

To analyze the data collected, three statistical procedures were used as follow: All research questions were

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answered using descriptive statistics of the mean and standard deviation, .H_{01} was tested using independent sample t-test to determine if there was a significant difference between the cultural practice approach and the lecture method group students' achievement. H_{02} was tested using independent sample t-test to determine if there is a difference in the mean achievement of male and female students taught with cultural approach and lecture method on students' and H_{03} tested using ANCOVA (Analysis of covariance) to determine if there is an effect of interaction of method and sex on achievement respectively.

III. RESULTS

➢ *Research Question One:*

What is the difference between the mean achievement score of basic science students taught using cultural practice approach and those taught using lecture method?

In order to answer research question 2, descriptive statistics of mean and standard deviation was used to analyze data collected, and the result is shown in Table 1.

Table 1 Descriptive Statistics of Mean and Standard Deviation Showing the Difference in the Mean Score of Students Taught using Cultural Practice Approach and Lecture Method

Methods	N	Mean	Mean Diff	SD
Cultural Practice	99	48.54		10.34
			6.14	
Lecture Method	111	42.40		14.21

Table 1 shows that taught with cultural practice approach have a mean score of 48.54 with a standard deviation of 10.34, while students taught with lecture method had a mean score of 42.40 with a standard deviation of 14.21, it can be seen that there exist a mean difference of -6.14, in favour of the cultural practice group. To determine if this difference is significant, independent sample t test was used to test hypotheses 1.

➢ *Hypotheses One:*

There is no significant difference between the mean achievement score of basic science students taught using cultural practice approach and lecture method in testing hypotheses 2, independent sample t-test was used to analyze the data collected, and the result is shown in Table 3.

To determine the statistics to be used to test $H0_2$, independent sample t-test was used to analyze the pre-test scores collected and the result is shown in Table 2.

Table 2 Independent Sample T-Test Showing the Difference in Basic Science Student Achievement at Pretest.

Methods	N	Mean	Mean Diff	SD	df	tcal	Sig (2tail)
Cultural Practice	99	20.37		2.53			
			0.15		208	458	0.647
Lecture Method	111	20.22		2.45			

Table 2 shows that there is no significant difference in the achievement score of basic science students of both groups at pretest when the data collected yielded a sig value of 0.647 which is higher than the critical sig value 0.05 when analyze using independent sample t-test. With this, independent sample test become the appropriate statistics to be used to test $H0_1$. The post - test scores were analyzed and the result is shown in Table 3

Table 3 Independent Sample T-Test Statistics Comparing the Difference in the Mean Achievement Score of Students Taught using Cultural Practice Approach and Lecture Method.

Methods	N	Mean	Mean Diff	SD	df	tcal	Sig (2-tail)
Cultural Practice	99	48.54		10.34			
			6.14		208	3.542	0.000
Lecture Method	111	42.40		14.21			

Table 3 shows that the observed difference is significant since the calculated significant value of 0.00 is less than the critical significant value of 0.05.With this, $H0_2$ which states that there is no significant difference in the mean score of basic science students taught with cultural practice approach and lecture method is rejected.

➢ *Research Question Two:*

What is the difference between the mean achievement score of male and female basic science students taught using cultural practice approach and lecture method?

To answer this research question, descriptive statistics of mean and standard deviation were used to analyze the data collected and the result is shown in Table 4.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25sep719

Table 4 Descriptive Statistics of Mean and Standard Deviation Comparing the Difference in the Achievement Score of Male and Female Basic Science Students Taught with Cultural Practice Approach and Lecture Method

Methods	Sex	N	Mean	Mean Diff	SD
Cultural Practice	Male	44	28.40		4.57
				0.91	
	Female	55	27.49		4.92
Total		99			
Lecture Method	Male	57	22.15		4.67
				1.95	
	Female	54	20.20		4.03
Total		111			

Table 4 shows that the male in cultural practice approach group had a mean score of 28.40, with a standard deviation of 4.57, while their female counterpart had a mean score of 27.49, with a standard deviation of 4.92, from the mean scores there exist a mean difference of 0.91 in favour of the females. On the other hand, the male students taught with lecture method had a mean score of 22.15, with a standard deviation of 4.67, while their female counterparts had a mean score of 20.20, with a standard deviation of 4.03. From the mean scores, it can be seen that the male student had the highest mean score with a mean difference of 1.95. To determine if this difference is significant, independent sample t-test was used to test hypotheses 2.

- *Research Question Three:*

What is the effect of interaction between method and sex on achievement?

To answer research question seven, descriptive statistics of mean and standard deviation were used to analyze the data collected, and the result is shown in Table 5.

Table 5 Descriptive Statistics of Mean and Standard Deviation Comparing Interaction Effect Mean Between Method and Sex on Achievement.

Methods	Sex	N	Mean	Mean Diff	SD
Cultural Practice		99	48.54		10.34
				6.14	
Lecture Method		111	42.40		14.21
Cultural Practice	Male	44	28.40		4.57
				0.91	
	Female	55	27.49		4.92
Total		99			
Lecture Method	Male	57	22.15		4.67
				1.95	
	Female	54	20.20		4.03
Total		111			

Table 5 shows that taught with cultural practice approach have a mean score of 48.54 with a standard deviation of 10.34, while students taught with lecture method had a mean score of 42.40 with a standard deviation of 14.21, it can be seen that there exist a mean difference of -6.14, in favour of the cultural practice group Table 5 also

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shows that the male in cultural practice approach group had a mean score of 28.40, with a standard deviation of 4.57, while their female counterpart had a mean score of 27.49, with a standard deviation of 4.92, from the mean scores there exist a mean difference of 0.91 in favour of the females. On the other hand, the male students taught with lecture method had a mean score of 22.15, with a standard deviation of 4.67, while their female counterparts had a mean score of 20.20, with a standard deviation of 4.03. From the mean scores, it can be seen that the male student had the highest mean score with a mean difference of 1.95. This shows that there is an interaction effect. To determine if the interaction effect is significant, Analysis of Covariance (ANCOVA) was used to test hypothesis 3.

- *Hypotheses Three:*

There is no significant effect of interaction between method and sex on achievement.

To test this hypothesis, analysis of covariance (ANCOVA) statistics was used to analyze data collected and the result is shown in table 8.

Table 6 Analysis of Covariance Statistics Showing the Effect of Interaction on Achievement.

source	Type III sum of squar	df	Mean square	F	Sig
Corrected model	3697.877	4	924.469	6.121	.000
Intercept	2971.635	1	2971.635	19.679	.000
Pre-test-score	623.900	1	623.900	4.144	.043
Method	1732.527	1	1732.527	11.47	.001
Sex	28.647	1	28.647	.190	.664
Method *Sex	1174.820	1	1174.820	7.779	.066
Error	30963.404	205	151.041		
Total	465419.00	210			
Corrected total	34661.281	209			

Table 6 shows that the observed interaction effect is not significant since the calculated significant value of 0.066 is greater than the critical significant value of 0.05. With this $H0_3$ which states that there is no significant effect of interaction between method and sex on achievement is not rejected.

IV. DISCUSSION

This study which determined the effects of cultural practice approach and lecture method on students' achievement is quite timely, considering the problems encountered by science teachers and students in the teaching and learning of science. And also considering the emphases laid on the importance of active participation of learners and adequate preparation of teachers in the teaching and learning process for effective learning.

Comparing the achievement test scores in basic Science between the students taught with cultural practice approach and lecture method, the first finding of the study showed that basic science students who were taught using cultural practice approach scored more marks than those with the lecture method. This is shown in Table 1, a significant difference was found between both groups for basic science students as shown in Table 3. The significant difference in achievement test scores in favour of students in cultural practice approach group may be due to the usage of the practices that the students are familiar with in teaching the concepts. This act enabled the students to interact among themselves and the teachers thereby gaining more insights and understanding of the concepts studied. Also, these activities that the students were engaged in during the use of cultural practice approach acted as prior knowledge and as an anchor for which the knowledge of new concept was built. This made the concepts studied to be concrete and not abstract. The finding agrees with findings of earlier researchers on the effectiveness of cultural practice approach in teaching. An example of such findings is that of Agboro-Eravwoke (2022), who indicated a significant difference in the performance of chemistry students taught with ethno chemistry and lecture method.

Furthermore, on comparing the male and female students' achievement scores, the second finding of the study showed that the male students taught with cultural practice approach and lecture methods had better post achievement scores when compared with their female counterparts. This noticeable difference was however found not to be significant. Table 5 shows that the difference in the mean scores between the males and females students' was not significant. This therefore means that the males and females were positively influenced by the use of the methods. This implies that the method is not sex biased. This finding is in agreement with that of Agboro-Eravwoke (2022) and Salihu, Usman and Buhari (2020) whose study showed a non- significant difference in the performance of male and female students taught with ethno-chemistry.

In addition, the third finding of the study showed non-significant interaction effect between method and sex on achievement as shown in Table 6.This implies that the combined effects of method and sex did not influence students' achievements in basic science. This therefore means that the cultural practice approach has influenced students' basic science achievement independent of sex. This agrees with the findings of Agboro – Eravwoke (2022) and Ajaja (2013) who found no significant interaction of method and sex on achievement but in disagreement with

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that of Obodo and Ani (2023) who found significant interaction effects of teaching method and gender on the mean achievement in basic science.

V. CONCLUSION

➢ *Based on the Finding of the Study, the Following Conclusions Emerged*

- Cultural practice approached improved Basic Science student's achievement more than Lecture method.
- Cultural practice approached and Lecture method improved male and female Basic Science students achievement without sex bias.

RECOMMENDATION

The study recommend that a review of curriculum by the education system be carried out to include cultural practice approach to equip students' and prospective teachers in their quest for knowledge and future profession.

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