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Effects of Cooperative Learning Strategy (CLS) and Inquiry Teaching Strategy (ITS) On Basic Science (BS) Students' Academic Achievement (AA) In Delta State (DS)

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Abstract: *The study examined how Delta State's BS students' achievement was impacted by CLS and ITS. A 3x2 pretest, posttest, control group quasi-experimental factorial design was used. 174,570 JSII BS students enrolled in public secondary schools in Delta State made up the study's population. 382 JSII students made up the study's sample. Data were collected using the Basic Science Achievement Test (BSAT). Three professionals independently verified its face validity. BSAT has a reliability coefficient of 0.70. Before and after the treatment, the BSAT was given as a pretest and posttest. Analysis of Covariance was used to analyse data. The outcomes revealed a significant difference in students' mean achievement scores among the three teaching methods, but in favour of the ITS group; and a non-significant interaction impact between instructional strategy and sex on achievement. It was determined, among other things, that CLS can be used as an alternative to ITS, which is the most effective teaching strategy for BS. Thus, it was advised that the primary instructional strategy for teaching basic science at the junior secondary level should be ITS.*

Keywords: Cooperative Learning Strategy (CLS), Inquiry Teaching Strategy (ITS), Academic Achievement (AA), Basic Science (BS)

Introduction

Basic science is a junior secondary school scientific subject that prepares students for senior secondary school science study. It is a science that avoids early or excessive attention on the distinction between diverse scientific domains and instead presents concepts and principles to express the core unit of science taught (Akani, 2016). The author also emphasised that basic science is taught as a single science topic in junior secondary schools and consists of the study of fundamental concepts in biology, anatomy, earth/solar system, ecology, genetics, chemistry, and physics. The essential scientific knowledge required for human life, long-term development, and societal change is provided by basic science. The majority of modern technology is based on the principles of fundamental science. Through the use of science and technology, man ensures the continuity of his existence.

The provision of conditions that can encourage the development of positive attitude, skills, and other components of learning is included in the teaching of basic science. We cannot say that teaching has occurred unless learning occurs as a result of some effort. Both the teacher and the student must participate actively in the teaching-learning process. Therefore, basic science teachers must employ different instructional methods to boost students' understanding of basic science concepts. The widely practiced instructional method is the lecture method (LM) (Harman & Nguyen, 2010).

LM entails the teacher offering entire verbal instructions to the students, telling them what they should know without allowing them to actively participate during instruction. The fundamental flaw of LM is that students are passively involved and also lack of student-student interaction, as well as students' interaction with the learning material. Adegoke (2011) attacked the lecture method, claiming that only industrious students can benefit from it. The lecture method is widely used since It is appropriate for instructing a large number of students and provides significant time savings. Additionally, it demands less proficiency from the teachers who use it. Researchers blamed students' low performance in basic science on the lecture method of teaching, claiming that students' passive participation, lack of student-student interaction, and teamwork during the teaching and learning process contributed to their poor performance. Therefore, basic science teachers need to adopt active teaching strategies that have the potency of improving students' achievement. There are various active teaching strategies available to basic science teachers. However, this study only focused on cooperative learning strategy (CLS) and inquiry teaching strategy (ITS) with the aim of isolating the most effective strategy among them with reference to boosting students' achievement and attitude towards basic science.

Students are divided into small groups as part of the CLS teaching strategy so they can work together to make others' learning more successful. CLS to education, in particular, is one in which students are divided into pairs or small groups to assist one another in studying the prescribed content (Ajaja & Mezieobi, 2018). Students of all abilities work together in small groups as part of the CLS learning technique to achieve a common objective. It involves using a range of learning activities to help pupils understand a subject better. A group of students interacts with one another, shares knowledge and ideas, searches for new data, and then decides on a course of action for the class as a whole depending on what they learn. The cooperative learning strategy has four main components. These fundamental components consist of: (1) small groups that are structured for positive interdependence; (2) face-to-face contacts; (3) individual responsibility; and (4) the utilisation of small groups and interpersonal skills. The goal of cooperative learning is to strengthen students' critical thinking, reasoning, and problem-solving skills. It is well known for actively integrating students in the learning process.

ITS on the other hand is an instructional strategy in which the student seeks to discover and create solutions to identified problems by conducting a thorough search, sometimes with little guidance from the teacher. In ITS, students engage in many of the activities and cognitive processes that scientists use to create new knowledge. According to Abdi (2014), teachers should be encouraged to substitute traditional teacher-centered teaching strategies, such as LM, with ITS that engage student interest in science, provide opportunities for students to use appropriate laboratory techniques to collect evidence, require students to solve problems using logic and evidence, and emphasise.

Academic achievement is a term used to describe student outcomes that show how much a person has achieved in relation to particular objectives that were the focus of activities in educational settings, specifically in school, college, and university. The degree to which a student, instructor, or institution has attained their short- or long-term educational goals is known as academic achievement. According to Nurulafizan (2012), academic achievement is what the students have learned or what skills the students have acquired through education. Several factors have been identified to affect students' academic achievement among which is teachers' instructional strategy. Therefore, the study sought to establish which of the following strategies (CLS, ITS and LM) has a greater likelihood of improving students' performance in basic science.

The disparity in the academic achievement of students of varying sexes in basic science has been studied over the years. Sex differences in academic achievement have become a serious issue in education. However, there is little agreement among the reports on whether sex can predict students' academic success. Determining if CLS and ITS will make a distinction between the academic success of male and female students in basic science is another justification for this study. But in this study, sex functions as a moderator variable. In light of this, this study examined the effects of CLS and ITS on the academic achievement of basic science students in Delta State.

Statement of the Problem

BS student's dismal performance in the Basic Education Certificate Examination (BECE) as indicated by the Delta State Ministry of Education reports (2017-2020) may be attributed to various factors including among other things, bad teaching strategies. Due to their lack of active participation during instruction, students in Nigerian secondary schools that utilise LM frequently are forced to memorise basic science concepts. With the increasing emphasis on students' active involvement and self-discovery of knowledge in the teaching and learning process as well as students' active interaction with the learning environment, students and teachers, there is good rationale to explore other teaching strategies (CLS and ITS) for teaching basic science as compare to the lecture method commonly used. Therefore, the problem of the study is to find out if the use of CLS and ITS enhance male and female students' academic achievement better than the LM.

Purpose of the Study

The study's goal was to look at how CLS and ITS affected students' achievement in basic science. The study specifically attempted to:

1. assess the difference in mean achievement scores among students taught basic science using these methods; and
2. determine the interaction effect of instructional methods (CLS, ITS, and LM) and sex on students' achievement in basic science.

Hypotheses

Two hypotheses guided this study:

1. The mean achievement scores of students who were taught basic science utilising CLS, ITS, and LM did not significantly differ.
2. There is no discernible relationship between instructional strategies and sex on students' achievement in basic science.

Methods

The study adopted 3x2 pretest, posttest control group quasi-experimental factorial design. The design consisted of three treatment groups (CLS, ITS AND LM) across two level of sex (male and female). In the design, the independent variable is the instructional methods, the moderating variable is sex, and the dependent variables is students' achievement in BS. The study's population is 174,570. There were 382 JSII BS students in the sample. BSAT was the instrument used to collect the data. Three experts, including an experienced basic science teacher, an integrated science educator, and a test and measurement expert, face validated the instrument. Using the Kuder-Richardson formula 21, the reliability of BSAT was determined, and a reliability coefficient of 0.70 was achieved. Before and after the treatment, the BSAT was given as a pretest and posttest. The results were analysed using analysis of covariance.

Results

- The mean achievement scores of students who were taught basic science utilising CLS, ITS, and LM did not significantly differ.

Table 1: ANCOVA Summary on CLS, ITS and LM Group Students' Achievement

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	20603.455[a]	3	6867.818	63.523	.000
Intercept	93760.893	1	93760.893	867.223	.000
Pretest	12603.306	1	12603.306	116.572	.000

Method	6619.992	2	3309.996	30.615	.000
Error	40867.950	378	108.116		
Total	1195453.000	382			
Corrected Total	61471.406	381			

F(2, 378) = 30.615, P(0.000) 0.05, reveals a significant difference in the mean achievement scores among students taught BS utilising CLS, ITS, and LM. Therefore, HO1 is disregarded. The mean achievement scores of the students who were taught BS utilising CLS, ITS, and LM differed significantly as a result. The Scheffe's post-hoc test, which is presented in table 2, was used to determine the direction of the difference between the three groups.

Table 2: Scheffe's Post-Hoc Test on CLS, ITS and LM Group Students' Achievement

(I) Teaching methods	(J) Teaching methods	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
ITS	CLS	5.055*	1.546	.005	1.26	8.85
	LM	11.183*	1.498	.000	7.50	14.86
CLS	ITS	-5.055*	1.546	.005	-8.85	-1.26
	LM	6.127*	1.447	.000	2.57	9.68
LM	ITS	-11.183*	1.498	.000	-14.86	-7.50
	CLS	-6.127*	1.447	.000	-9.68	-2.57

As shown in table 2, students taught BS using ITS and CLS outscored their counterparts taught using lecture method. Nevertheless, students taught BS with ITS outperformed those taught with CLS.

- There is no discernible relationship between instructional strategies and sex on students' achievement in basic science.

Table 3: ANCOVA Summary on Interaction Between Strategies and Sex on Achievement

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	20912.710[a]	6	3485.452	32.226	.000
Intercept	91595.584	1	91595.584	846.880	.000
Method	6466.829	2	3233.414	29.896	.000
Sex	86.523	1	86.523	.800	.372
Strategy * Sex	236.760	2	118.380	1.095	.336
Error	40558.696	375	108.157		
Total	1195453.000	382			
Corrected Total	61471.406	381			

The results of table 3 show that there is no substantial interaction between instructional strategies and sex on students' achievement in BS, F(2,375) = 1.095, P(0.336)>0.05. Thus, HO_2 is not rejected. As a result, the link between teaching strategies and sex and students' achievement in BS is not particularly significant.

Discussion

The study found a substantial difference between students who were taught basic science using CLS, ITS, and LM in terms of their mean achievement scores. The results of the post hoc analysis used to determine the direction of significance showed that students in the ITS group significantly differed from those in CLS group in their favour, that there was a significant difference in achievement scores between students in the ITS group and those in the LM group in their favour, and that there was a significant difference in achievement scores between students in the CLS group and those in the LM group in their favour. The order of effectiveness with reference to achievement scores established using the three instructional methods are: ITS came first, CLS came second, and LM came third. By implication, the most effective instructional strategy is ITS.

The conclusion that ITS and CLS are superior to LM concurs with Chibueze and Okoye (2021) and Nkok (2019), who discovered that students in ITS and CLS groups fared better than other students in the LM group. It's possible that increasing student engagement in learning activities and bringing everyone along contributed to the much-improved success scores of students in the ITS and CLS groups. The ability to care for all group members tends to enhance everyone's critical thinking, reasoning, and problem-solving abilities, which led to higher achievement for all. There is no collaborative teamwork with a goal and direction in the LM group. The group members each worked at their own pace. This could be the reason why the LM group's BS accomplishment scores were lower.

According to the study, students in the ITS group did better than those in the CLS group. This observation may be due to the fact that ITS encompasses all the steps scientist used in scientific investigation. The students in this group in addition to group work carried out physical experiments to confirm hypotheses in the quest of finding solutions to basic science problem. Thus, the students in the ITS tend to be more involved during instruction. The superiority of ITS over CLS agrees with the findings of Nkok (2019), who discovered that CLS positively influences students' performance and active participation in biology teaching and

learning, but ITS was more effective. However, this finding disagrees with that of Chibueze and Okoye (2021) who reported that students in CLS group outscored their counterparts in ITS group.

Additionally, there was no discernible connection between instructional strategies and sex on students' achievement in BS, according to the study. This suggests that the achievement levels of the BS students were not the result of the interaction between sex and instructional strategy. A dependent variable is influenced by the combined effects of two or more factors when there is an interaction. The independent variables and sex did not combine to influence students' achievement scores in BS.

Conclusion

The study's findings led to the conclusion that CLS, ITS and LM enhance students' academic achievement in BS positively. However, ITS had greater effect on students' academic achievement in BS than CLS and LM. Again, it was concluded once more that each teaching strategy had a distinct impact on the achievement levels of BS students.

Recommendations

The study's conclusions led to the following recommendations:

1. In order to improve students' knowledge of BS concepts, ITS and CLS should be employed as the primary instructional strategies for teaching BS at the junior secondary level of education. LM should be used as an alternative when ITS and CLS are not practical.
2. BS teachers should ensure students' active participation during instruction for both male and female students.

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