

**EFFECT OF CO-OPERATIVE AND SCAFFOLDING  
INSTRUCTIONAL STRATEGIES ON ACADEMIC  
ACHIEVEMENT OF SECONDARY SCHOOL  
CHEMISTRY STUDENTS IN IMO STATE NIGERIA.**

**By**

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**Abstract**

The study examined the effect of cooperative and scaffolding instructional strategies on academic achievement of secondary school chemistry students in Imo state the scope of the study is six coeducational secondary schools from the six education zones in Imo state. Three research questions and three hypotheses were posed to guide the study. The design of the study was quasi-experimental design. The area of the study was Imo state. The population of the study was 25,322 SS2 chemistry students. The sampling technique was purposive sampling. The treatments were assigned to the schools by balloting. The sample of the study was 130 students, which was made up of 56 males and 74 females. The instrument for data collection was the researcher made chemistry achievement and retention test (CART). Mean and standard deviation were used to answer the research questions while analysis of covariance (ANCOVA) was use to test the hypotheses. The result of the study revealed that: the mean achievement scores of students taught chemistry using cooperative and scaffolding strategies differ significantly, with scaffolding strategy being more effective and the two instructional strategies used for the study were not gender selective. It was recommended among others that chemistry teachers should use scaffolding strategy often, in teaching chemistry since it was found to be more effective in enhancing students' academic achievement and retention in chemistry.

**Keywords:** Co-operative, scaffolding instructional strategies, academic and mean achievement scores

## **Introduction**

Science is the body of knowledge that deals with the study of nature and natural things around us through observation and experimentation. Science follows a well known systematic procedure generally known as scientific method. According to Ali and Anne (2011), a scientific way of thinking is something that anybody can use, at any time, whether or not they are in the process of developing new knowledge and explanations.

Chemistry is one of the science subjects taught in Nigerian senior secondary schools. According to Anne (2019), Chemistry is the scientific study of matter, its properties, and interactions with other matter and with energy. Alane (2020) defines chemistry as the study of matter, its properties, how and why substances combine or separate to form other compounds. What is in soap and how does it clean? These are all questions that can be answered by applying chemistry (Anne, 2019).

Chemistry has been found very relevant both in physical and biological sciences with the former being composed of physics, chemistry, geology and astronomy and the later consisting of botany and zoology (Anuonye, 2013). Chemistry is the pivot of most life processes, careers and jobs. For instance, Obodo (2005) observed that “life on earth depends on chemistry, chemicals and chemical products not only from cradle, but also to the grave.

Academic achievement also refers to what the student have learned or what skills the students have acquired and is usually measured through assessment using standardized tests, performance assessment and portfolio assessment. Academic achievement, which is measured by the examination results, is one of the major goals of a school. (Ali, Zubair, Fahad, Hamid & Awais, 2013).

In spite of the prime position chemistry occupies in our educational system and previous efforts made by researchers to enhance academic achievement, students’ performance in chemistry are still low. Although, the National Policy on Education has given chemistry education an enhanced status in Nigeria, yet it is faced with numerous problems (FRN, 2013). These problems threaten the realization of the goals of chemistry

education in Nigeria. Ojukwu (2016), in his study revealed that students' performance in external chemistry examinations is very low. Again, Ogunleye (2011) confirmed this in his study by stating that students' performance in WASSCE chemistry is low.

Choosing a teaching method or strategy that result to high academic achievement and retention on the part of learners can be challenging for educators. The approach for teaching can be classified into teacher-centered and student-centered. In a teacher-centered approach to learning, teachers are the main authority figure while the students are passive. In student-centered approach to learning, the teachers are also the main authority figure but both the teachers and students play an equal active role in the learning process. Some commonly used teaching methods are lecture method, project method, demonstration method, sheep and goat method, laboratory method, etc. In this twenty-first century, innovative methods are preferred. Innovation is a phenomenon that carries in itself the essence, method, techniques, technologies and content of the new (Aigerum, Zukhra&Bakhytkul, 2017).

There are so many innovative strategies a teacher can employ for effective teaching and learning. These include: collaborative methods, computer simulation, guided discovery, scaffolding, peer-to-peer strategy, cooperative, problem solving, etc. But a teaching strategy can only be said to be innovative, if it is student centered.

Cooperative learning, a form of collaborative learning, is an instructional technique in which students work in groups to achieve a common goal, to which each of them contributes in individually accountable ways (Ibe, 2009). Cooperative learning is a successful strategy in which small teams, each with students of different levels of ability, use a variety of learning activities to improve their understanding of a subject.

Scaffolding is another type of innovative instructional strategy. Scaffolding involves the teacher controlling the learning task so that the child is able to solve a problem or perform a task, which would not have been possible without assistance. It is a technique of changing the level of support for learning. It means that over the course of the teaching session, a more skilled person (teacher or more advanced peer of the child) adjusts the amount of guidance to fit the students current performance level, (Duru,2011).

It is obvious that the study of chemistry cannot be effectively carried out without an empirical analysis of some of the factors that affect the study of chemistry. Studies have revealed that in science (chemistry), male students perform better than female students (Nnamani & Oyibe, 2016). The poor achievement of students in chemistry has continued to be a major concern to all particularly to those in the main stream of science education (Ghuluzé & Joda, 2021).

Gender refers to the social attribute and opportunities associated with being male and female and the relationship between men and women, girls and boys (Young, 2011). The enrolment of female students in chemistry and science subjects in general is very poor. However, if females are well prepared, feel confident in themselves and do well in introductory chemistry, they may be inclined to study chemistry further.

This study is therefore set to examine the interplay between genders, innovative strategies: cooperative and scaffolding, and academic achievement of secondary school chemistry students in Imo State.

The main purpose of the study is to determine the effect of cooperative and scaffolding instructional strategies on academic achievement and retention of secondary school chemistry students in Imo State.

The following research questions were posed by the researcher to guide the study:

1. What are the mean achievement scores of students taught chemistry using scaffolding and co-operative strategies?
2. What are the mean achievement scores of male and female students taught chemistry using cooperative strategies?
3. What are the mean achievement scores of male and female students taught chemistry using scaffolding strategy?

The following hypotheses were formulated to guide the study, and were tested at  $\alpha = 0.05$  level of significance:

1. There is no significant difference between the mean achievement scores of students taught chemistry using scaffolding and co-operative strategies

## **Method**

The research design that was adopted for this study was the quasi-experimental design. The study can be represented graphically:

Group	Pretest	Treatment	Posttest
Group 1	MB <sub>1</sub>	CTS	MA <sub>1</sub>
Group 2	MB <sub>2</sub>	STS	MA <sub>2</sub>

## **Where**

MB<sub>1</sub>&MB<sub>2</sub>= measurement taken before treatment (pretest)

MA = measurement taken after treatment (posttest)

CTS= Cooperative Teaching Strategy (group 1)

STS= Scaffolding Teaching Strategy (Group 11)

The study was carried out in Imo State. It comprises six (6) educational zones: Okigwe zone 1, Okigwe zone 11, Orlu zone 1, Orlu zone 11, Owerri zone 1 and Owerri zone 11.

The population of the study consists of 25,322 senior secondary two (SS2) chemistry students in 296 public secondary schools in Imo State (Secondary Education Management Board, SEMB Owerri, 2021). SS2 students were chosen because the topic of the study falls under SS2 chemistry curriculum. The population comprises 12,513 females and 12,806 males.

The sample consists of 130 SS2 Chemistry students from the six schools that were sampled by the researcher. 56 students were males while 74 were females. 130 students constitute the intact classes of SS2 chemistry students in the six (6) schools. The sample technique was purposive. Co-educational secondary schools were sampled because the boys and girls study together under the same learning environment. The teaching strategies were assigned to the schools by balloting: (Cooperative Teaching Strategy -CTS) and (Scaffolding Teaching Strategy- STS) ieCTS, CTS, CTS, STS, STS and STS. And they were taught according to what they picked. This amounted to a total of three schools for cooperative strategy and three schools for scaffolding strategy.

The instrument for data collection for the research was Chemistry Achievement and Retention Test (CART) made by the researcher. The instrument consists of 40 multiple choice objective test with options

lettered A to D. The students were requested to tick one answer. The objective test was based on the contents of the periodic table. After six weeks of treatment, Post test was administered to the students by their regular teacher, but was marked and recorded by the researcher. Then, the teacher proceeded with the next topic in their curriculum.

One regular chemistry teacher in each of the selected schools was employed in the research process. The teachers were given adequate orientation on the use of the two instructional strategies (cooperative and scaffolding). Lesson plans were also given to the teachers based on the two strategies. The aim of one teacher teaching in one school with a strategy is to avoid contamination of the treatment. Their usual chemistry timetable was used for this purpose. Prior to the first day of the experiment, pretest was administered to the research subjects (students) in the two groups. Later, the students were taught the Development of periodic table, periodic law, etc using cooperative and scaffolding strategy according to what their chemistry teacher picked during orientation.

Based on the six weeks lesson plans given to them, the Post test (achievement test) was administered to the students at the end of the six weeks. The pretest and posttest contained the same items but were rearranged so that the students would not discover that these instruments are the same. The whole research processes lasted for six weeks.

Mean and standard deviation was used to answer the research questions while analysis of covariance (ANCOVA) was used to test the hypotheses.

## Results

**Research Question One:** What are the mean achievement scores of students taught Chemistry using Scaffolding and Co-operative teaching strategies?

**Table 1**

**Mean of Scores of Students exposed to Scaffolding Teaching Strategy (STS) and Co-operative Teaching Strategy (CTS)**

Group <sup>n</sup>	Pre-test		Post-test	
	$\bar{X}$	S.D	$\bar{X}$	S. D.
Scaffolding	67	17.78	30.69	5.03
Co-operative	63	15.41	27.24	6.70

From Table 1, the mean achievement scores of the students exposed to the Scaffolding and Co-operative teaching strategies in the pre-treatment test are 17.78 and 15.41 respectively. Their respective standard deviations are 3.01 and 3.71 which shows that the achievement scores are close to the mean scor... On the other hand, in the post-treatment test the mean achievement scores of secondary school students taught Chemistry using scaffolding teaching strategy (STS) and Co-operative teaching strategy (CTS) are 30.69 and 27.24 respectively. Their respective standard deviations are 5.03 and 6.70. The mean achievement scores of the students in the post-treatment test for both STS and CTS are approximately twice their respective mean scores in the pre-treatment test. The mean achievement scores of the students exposed to STS is greater than the mean achievement scores of the students exposed to the CTS. This may suggest that Scaffolding teaching strategy (STS) improved students' achievement in Chemistry than Co-operative teaching method (CTS).

**Hypothesis One:** There is no significant difference in the mean achievement scores of students taught Chemistry using Scaffolding and Co-operative teaching strategies.

**Table 2**  
**ANCOVA Summary Table**  
**Tests of Between-Subjects Effects**

Dependent Variable: PostTest

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	749.647 <sup>a</sup>	4	187.412	5.727	.000	.155
Intercept	2647.338	1	2647.338	80.902	.000	.393
Pretest	198.153	1	198.153	6.056	.015	.046
Treatment	235.938	1	235.938	7.210	.008	.055
Gender	78.221	1	78.221	2.390	.125	.019
Treatment * Gender	82.971	1	82.971	2.536	.114	.020
Error	4090.322	125	32.723			
Total	114286.000	130				
Corrected Total	4839.969	129				

a. R Squared = .155 (Adjusted R Squared = .128)

Table 2 showed that the calculated F-ratio of 7.210 is greater than the critical F-ratio of 3.84. Also, the observed probability (p-value) value of 0.008 is less than the hypothesized probability (p-value) value of 0.05. Based on the results, the researcher fails to accept hypothesis one which states that “there is no significant difference in the mean achievement scores of students taught Chemistry using Scaffolding and Co-operative teaching strategies” and therefore accept the alternative hypothesis. Therefore, there is significant difference in the mean achievement scores of students taught Chemistry using Scaffolding and those taught chemistry using Co-operative teaching strategies.

**Research Question Two:** What are mean achievement scores of male and female students taught Chemistry using Co-operative teaching strategy?

**Table 3**  
**Mean Scores of Male and Female Students exposed to Co-operative Teaching Strategy (CTS)**

Group	n	Pre-test		Post-test	
		$\bar{X}$	S.D	$\bar{X}$	S.D.
Male	27	15.86	3.54	27.38	6.74
Female	40	15.03	3.86	27.12	6.76

From Table 3, the mean achievement scores of male and female students taught Chemistry using Co-operative teaching strategy (STS) in the pre-treatment tests are 15.86 and 15.03. Their respective standard deviations are 3.54 and 3.86. For the male and female students taught Chemistry using STS in the post-treatment test, the mean achievement scores are 27.38 and 27.12 respectively. Their respective standard deviations are 6.74 and 6.76. The results showed that the mean achievement score of male students exposed to Co-operative teaching strategy in both pre-treatment and post-treatment tests are slightly higher than that of their female counterparts.

**Research Question Three:** What are mean achievement scores of male and female students taught Chemistry using Scaffolding teaching strategy?



**Table 4**  
**Mean Scores of Male and Female Students exposed to Scaffolding Teaching Strategy (STS)**

Group	n	Pre-test		Post-test	
		$\bar{X}$	S.D	$\bar{X}$	S.D
Male	27	17.78	2.94	32.59	3.79
Female	40	17.78	3.10	29.40	5.40

From Table 5, the mean achievement scores of male and female students taught Chemistry using Scaffolding teaching strategy (STS) in the pre-treatment test are 17.78 and 17.78. Their respective standard deviations are 2.94 and 3.10. For the male and female students taught Chemistry using STS in the post-treatment test, the mean achievement scores are 32.59 and 29.40 respectively. Their respective standard deviations are 3.79 and 5.40. The results showed that the mean achievement score of male and female students exposed to Co-operative teaching strategy in pre-treatment do not differ at all, while in post-treatment tests the mean achievement score of male students is slightly higher than that of their female counterparts.

### **Discussion of findings**

Table one showed that the mean achievement scores of students exposed to scaffolding teaching strategy is greater than the mean achievement scores of the students exposed to co-operative teaching method. This is in line with the finding of Egeruo (2017) , Benjamin (2019), Okpeh (2014), Alake and Ogunseemi (2013) which revealed that students taught using scaffolding method perform better than their counterparts.

Table three showed that the mean achievement scores of male students exposed to cooperative teaching strategy in both pre-treatment and post-treatment tests are slightly higher than that of their female counterparts. This is in line with the findings of Ikemezie (2016) which revealed that there is no significant difference between the mean achievement scores of male and female students taught using cooperative learning method.

Table five showed that the mean achievement score of female students taught using scaffolding strategy is slightly higher than that of the male students. This is in line with the findings of Benjamin (2019) which revealed that there is no significant effect of gender on the academic achievement of students taught the concepts of genetics.

### **Recommendations:**

1. Based on the findings of this study, it is recommended that: students should show interest whenever the teachers are teaching them with any of the two strategies, mostly scaffolding, since they are learner – centered strategy.
2. Also, science teachers should try to explore and use teaching strategies that are learner-centered, example, cooperative, scaffolding etc as they enhance the academic achievement and retention of the students

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