EFFECTS OF PEER TUTORING INSTRUCTIONAL STRATEGY ON STUDENTS' ACADEMIC ACHIEVEMENTS IN ORGANIC CHEMISTRY IN ONDO STATE, NIGERIA

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Abstract

The academic achievements of students in examinations are related to numerous factors with instructional strategy being the principal. The research focused on how peer tutoring instructional strategy impacts on the academic achievements of students undertaking organic chemistry in Ondo state, Nigeria. The study population was all the science students in SSS II in Ondo state. A pretest posttest control group quasi-experimental design was employed in which peer tutoring was used as the experimental group and the conventional teaching method as the control group. The study sample composed of 80 students in two intact classes in two secondary schools in Ondo state using multi stage sampling procedure as the sampling method in the study. The experimental group included 40 students and the control 40 students. As the research instrument, Chemistry Achievement Test (CAT) on hydrocarbon was validated. Its reliability test was done using Kuder Richardson 20 and a reliability coefficient of 0.896 was achieved. There was a pre-test and then there was an administration of a post-test after six weeks of treatment. For data analysis, descriptive statistics such as mean and

standard deviation and inferential statistics (independent and paired samples t-test) were used in testing the hypotheses at 0.05 level of significance. The findings indicated that the experimental group that had a post-test mean score of 21.55 (SD = 4.05) achieved better compared with control group that had a post-test mean score of 19.05 (SD = 3.94). A significant difference existed in the academic achievement of the students who were exposed to the experimental and control group (t= 2.849, p= 0.006) but the achievement of the students in terms of gender did not differ significantly. It was established that peer tutoring is an improved method of teaching than the traditional teaching approach. Hence, peer tutoring instructional strategy should be used by chemistry educators in their everyday lesson.

Keywords: Peer tutoring, Academic achievement, hydrocarbons, instructional strategy, organic chemistry.

Introduction

Science, according to the Latin term "scientia", translating to knowledge or fact is a process of investigative actions towards creation of skills and acquiring knowledge of the natural world (Onyeukwu & Enyaosah, 2016). It is an important component of international education, essential to the creation of specialists that would be able to develop the world economically and technologically in a sustainable way (Taber, 2017). This is because scientific literacy which is attained through systematic science education is universally recognised as the means by which a country can survive scientifically and technologically. The instrument of delivering scientific knowledge, attitude, and skill is science education, which applies the educational theories of psychological, sociological, and philosophical perspectives to implement cognition by the use of empirical processes (Igbaji, Bello & Sanus, 2017). It seeks to build the critical thinking of sustainable development (Sani & Ikpe, 2019).

The curricula on science education in Nigeria have been adapted to suit the needs of the country, the government has shown a strong national development belief in science by providing policies such as

the National Policy on Education, and measures that have been taken to enhance it such as the introduction of a 60:40 quota of university admission in favour of science courses and the introduction of special science and technology institutes (Odo, 2013). Chemistry has a privileged place in the development of science in the world, it is an applied, methodical subject that instils scientific disciplines and is the basis to such disciplines as medicine, engineering and environmental science (Ibrahim *et al.,* 2017). Its connexion to national development is commonly known, and is a mandatory science course in the Nigerian science curriculum (Ayodele, 2018; Agogo & Onda, 2014; Bugaje, 2013).

Although this is important, the performance of students in Chemistry is poor and mediocre. The results of the analysis of West African Senior School Certificate Examination (WASSCE) indicate a negative trend; the average score in Chemistry Paper 2 dropped to 29 in 2018 (compared to 47 in 2017) (Nwankwo & Okigbo, 2021), which is also supported by other reports of poor performance (Uchegbu *et al*., 2015). This is due to a number of factors, students view Chemistry as a subject that is abstract and troublesome, and such issues as hydrocarbons, gas laws are perceived to be challenging (Uchegbu et al., 2016; Agogo & Onda, 2014). It is also mentioned that poor, faulty, or traditional teaching techniques are big contributors to the situation (Nja et al., 2020;Kabutu, Oloyede & Bandele, 2015). In organic chemistry, in particular, the barriers are the lack of solid conceptual grounding, lack of interest among the students, excessive class sizes, and lack of connexion between the representational levels of matter (Hanson, 2017, 2016; Coll, 2014). Although low achievement in students may be attributed to low motivation, the teachers play a significant role in the attitudes and more interactive settings may lead to better academic performance (Hanson, 2017).

Academic achievement can be defined as the performance of learners in accordance with scores, as well as acquiring skills and knowledge (Anderson, 2020; Eze, 2013). Issues associated with low

achievement are lack of motivation, the use of poor instructional materials, styles of instruction, and psychological factors such as culture of the society, peer group and gender (Duze, 2011). The concept of gender, as the difference and expectations of society regarding the sexes (Flu, 2017; Ovaum, 2013), can have an effect on the achievement, and the assumptions of society tend to deter females majoring in the so-called rigorous disciplines, such as sciences, which impacts subject choice and achievement. Moreover, the strategies in pedagogy which increase achievement also increase retention, the ability to store and recall learned information which cannot be achieved with rote memorisation only (Anderson, 2020).

West African Senior School Certificate Examination (WASSCE) results of 2022 indicated that the performance of students was declining and those states in the southern part of the nation like Ondo have indicated a negative trend in terms of ranking (News Agency of Nigeria). Specifically, research in Ondo State reveals that students achieve the lowest results in Chemistry as contrasted with Biology and Physics (Akinnodi, 2020). The analysis of literature and data of the state ministry of education proves that there is a poor and unstable trend in Chemistry performance between 2015 and 2022.

Since long-term low achievement is multifactorial and the teaching strategy is the major one, and since traditional, chalk and talk techniques result in the memorisation of the information, it is strongly suggested that student-centred, activity-based teaching methods should be considered. One of the instructional strategies is peer-tutoring, when students can teach their peers in groups under the supervision of the teacher to provide a supportive learning experience with a high number of feedbacks (Okechukwu, Uyin & Nonye, 2019; Okoye, 2016; Worley & Naresh, 2014). It connects the high-ability students and the low-ability students to study together (Rohrbeek, 2013). Although studies have demonstrated its effectiveness, no studies have implemented it to organic chemistry, which is a challenging aspect to students (Uchegbu et al., 2016; Oladejo et al., 2023). It is therefore necessary to review the effect of

the Peer Tutoring Instructional Strategy on the academic achievements of students who are studying Organic Chemistry in secondary schools in Ondo State.

Purpose of the Study

The main purpose of this study is to assess the effect of peer tutoring instructional strategy on students' academic achievements in Chemistry in Ondo State. Specifically, the study sets to:

1. assess the difference in the academic achievement of students taught hydrocarbons in organic chemistry using peer tutoring instructional strategy and those taught using the conventional teaching method in Ondo State;
2. examine the effects of gender (male and female) on the academic achievement of students taught using peer tutoring instructional strategyin hydrocarbon concept of organic chemistry in Ondo State;

Research Hypotheses

The following hypotheses were formulated to guide this research. The level of significance was set at 0.05:

$H_0$1: There is no significant difference in the mean achievement scores of students taught hydrocarbon in organic chemistry using peer tutoring instructional strategy and those taught using the conventional teaching method in Ondo State.

H_o2: There is no significant difference in the mean achievement scores of male and female students taught hydrocarbons using peer tutoring instructional strategy in hydrocarbon concept of organic chemistry in Ondo State.

Methodology

In this study, a pre-test post-test control group quasi-experimental design was embraced to determine the causal and effectual relationships of academic performance and retention capacity of students who were subjected to peer tutoring instructional strategy

and those who were subjected to conventional teaching method.

This study population was made up of the entire science students of senior secondary school II in the public secondary schools in Ondo state. The target population of students was identified since they would not be undertaking any certificate or external examination that may interfere with smooth running of the research processes.

The sample size used was 80 students in two intact science classes in SS2 in two public secondary schools that were chosen in Owo Local Government Area. The schools and the study sample were chosen with the use of a multistage sampling procedure. The inclusion criteria of schools into the research were as follows: (i) a co-educational school (ii) must be approved by Ondo state ministry of education (iii) must offer at least one teacher in Chemistry with a degree in Chemistry education or any other relevant field with a Post Graduate Diploma in Education and a minimum of five years teaching experience. In order to ensure this objective, the researcher communicated with the Zonal office of the Ministry of Education in Owo and Teaching Service Commission, Owo Zone, Owo.

The researcher developed an achievement test tagged as Chemistry Achievement Test on Hydrocarbons (CAT). The topics selected under hydrocarbons included: introduction to hydrocarbon, structure and valency of carbon, hydrocarbon meaning and examples, homologous series, saturated hydrocarbons, isomerism and unsaturated hydrocarbons. Chemistry Achievement Test on Hydrocarbons entailed 30-itemed multiple choice achievement tests with choices A-D based on past standardised evaluation questions of the West African Examination Council (WAEC) between the years 2010-2022 and the participants needed to select the suitable option between the multiple choices. Hydrocarbon Chemistry Achievement Test was utilised as pre-test instrument, re-numbered and used as post-test instrument, to measure the achievement and retention capacity of the participants who have gone through both the Peer Tutoring and the conventional instruction method.

Face and content validity of the instrument were done by three Professors of Science Education, corrections, alterations and input were considered before the final instrument was produced. Hydrocarbons Chemistry Achievement Test (CAT) was pre tested on 20 students who were not involved in the study. The reliability test was done using Kuder Richardson 20 and a reliability coefficient of 0.896 was achieved. This demonstrates that the tool is very reliable and it may be involved in conducting the research.

The Zonal Education Officer at the Owo Zonal office of the Ministry of Education, Ondo State gave an approval to conduct the research in the schools which were under his jurisdiction and verbal approval was received on the same by the principals of the schools that were selected. The researcher noted that he has considered all the ethical considerations raised by the chosen schools as having been obtained in the Ondo state ministry of education manual. The study was conducted over a period of eight weeks; it was carried out in two stages; pre- treatment and treatment stages.

Pre-treatment Phase

Week 1: A –day training session was organized for the research assistants who helped the researcher on the administration of the research instruments. After the completion of the training, the Chemistry Achievement Test on Hydrocarbons was administered to the students as pre-test.

Treatment Phase

Week 2 – week 7: Students were taught hydrocarbons using peer tutoring instructional strategy and the conventional teaching method for six weeks. Thereafter, the Chemistry Achievement Test on Hydrocarbons was re-arranged and served as post- test. Treatment was observed for a 2-period of eighty minutes in the various schools twice weekly.

Week 8: Data collected were analysed using descriptive and inferential statistics. The questions were answered using means and

standard deviation while the hypotheses were tested using t-test.

Results

Testing of Research Hypotheses

$H_0$1: There is no significant difference in the mean achievement scores of students taught hydrocarbon in organic chemistry using peer tutoring instructional strategy and those taught using the conventional teaching method in Ondo State.

Table 1: Independent sample t-test of the difference in the mean achievement scores of students taught hydrocarbon in organic chemistry using peer tutoring instructional strategy and those taught using the conventional teaching method in Ondo State

	Teaching Methods	N	$\overline{x}$	SD	df	t-calc.
Achievement	Per Tutoring	38	21.55	4.05	76	2.849
	Conventional	40	19.05	3.94		

$p < 0.05$

Table 1 reveals that the achievement mean score of students exposed to peer tutoring instructional strategy was 21.55 (SD = 4.05), while those taught using conventional teaching method was 19.05 (SD = 3.94). This reveals that students taught using peer tutoring had higher achievement scores than those taught using conventional teaching method. Moreover, since the p-value obtained (0.006) is less than the level of significance (0.05), the null hypothesis 1 is rejected (t-calc. = 2.847, df = 76, $p<0.05$).

H_o2: There is no significant difference in the mean achievement scores of male and female students taught hydrocarbons using peer tutoring instructional strategy in hydrocarbon concept of organic chemistry in Ondo State.

Table 2: Independent sample t-test of the difference in the mean achievement scores of male and female students taught hydrocarbons using peer tutoring instructional strategy in hydrocarbon concept of organic chemistry in Ondo State

	Gender	N	$\overline{x}$	SD	df	t-calc.	p-value
Achievement	Male	21	22.14	5.15	37	1.098	0.279
	Female	17	20.38	4.61			

$p > 0.05$

Table 2 reveals that the achievement mean score of male students after being exposed to peer tutoring instructional strategy was 22.14 (SD = 5.14), while that of female students after being exposed to peer tutoring instructional strategy was 20.38 (SD = 4.61). This reveals that both male and female students performed equally after being exposed to peer tutoring instructional strategy. Moreover, since the p-value obtained (0.279) is greater than the level of significance (0.05), the null hypothesis 2 is not rejected (t-calc. = 1.098, df = 37, p>0.05).

Discussion of Findings

The finding of this study registered a difference in the academic achievements of students who were subjected to peer tutoring instructional strategy and those who were subjected to the conventional teaching method. The peer tutoring group recorded to be better than those in the conventional teaching method group, the observation is consistent with Agu and Samuel (2018) and Abdulrahim, Yususf and Odutayo (2017) that reported a higher achievement among students who were exposed to peer tutoring than those that were exposed to conventional teaching method. Peer tutoring strategy provided the students with the chance to connect with one another on the level that was agreeable to the participants with their problems being aired and addressed in a manner that did

not require official procedures. This finding is also supported by Agu and Samuel (2018) and Ullah, Tabassum, and Kaleem (2018), which showed that there was a big difference between the traditional teaching approach and peer tutoring instructional strategy in secondary schools.

The finding of this study revealed that there was no significant difference in the mean achievement scores of male and female students taught hydrocarbons using peer tutoring instructional strategy in hydrocarbon concept of organic chemistry in Ondo State. This is in agreement with the studies conducted by Fatokun and Omenesa (2015) which did not show any significant differences in the performance of male and female students who received peer tutoring. This means that the gender of science students could not negatively affect their academic achievements, hence, the hypothesis which stated that there is no significant difference between the mean scores of the subjects taught hydrocarbons using peer-tutoring and normal teaching method is supported. Ajayi and Ogbeba (2017), and Okorie and Eze (2016) also agreed with this observation.

Conclusion

This study showed that peer tutoring instructional strategy was found potent in enhancing the academic achievement of students in Chemistry. The results of the study also demonstrated that gender has no statistically significant impact on students' academic achievement.

Recommendations

1. Chemistry teachers should incorporate the use of peer tutoring instructional strategy in teaching chemistry in their classroom.
2. Ministry of education should organize workshop for teachers on the use of peer tutoring and other activity-based instructional strategies for teachers in their secondary schools.

3. The school administrators and head teachers should be encouraged to institute regular peer-tutoring sessions in the school-based schedule, particularly in abstract and challenging subjects such as Organic Chemistry.
4. Teachers and educators are advised to utilise gender-neutral practice such as peer tutoring to support the establishment of a collaborative and equal classroom atmosphere that enables every learner equally.

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