

Enhancing Secondary School Students' Achievement in Chemistry Using Peer Tutoring Instructional Strategy in Secondary Schools in Abia State

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ABSTRACT

The study investigated the effect of peer tutoring instructional strategy on the academic achievement of students in secondary schools using quasi-experimental design of pretest posttest non - equivalent control group. The research was carried out in Obingwa LGA in Aba Education Zone of Abia State. The sample of the study consists of 57 (33 male and 24 female) students. Two co-educational schools drawn through simple random sampling technique were used for the study. Each co-educational school had one intact science class which was used for the study. The two intact classes in the two co-educational schools were assigned to experimental group and control group using simple balloting. The experimental group was taught gas laws using peer tutoring while the control group was taught using conventional lecture method. The instrument for data collection was face and content validated by three experts in science education. The reliability coefficient of the instrument was determined to be 0.81 using K-R (20). The research questions were answered using mean and standard deviation while the null hypotheses were tested at .05 level of significance using ANCOVA. The results revealed that students in the experimental group achieved significantly higher than their counterparts in the control group. Again it was found that there was no significant difference in the achievement of male and female students taught using peer tutoring. It was recommended that teachers should adopt the use of peer tutoring instructional strategy in Chemistry classrooms.

Keywords: Peer tutoring, chemistry, students' achievement, secondary schools.

INTRODUCTION

The knowledge of science has been widely applied in solving basic human needs and improving living standards of the people. In Nigeria secondary schools, science is studied as chemistry, physics and biology. Ojokuku in Gongden (2021) stressed that chemistry occupies a central position among the sciences due to its remarkable contribution in medicine, pharmacy, textile industry, engineering and agriculture. The field of chemistry has made major contributions in health care. For instance, chemical knowledge has helped in the preparation and use of materials for surgery. The sutures used in surgeries today do not have to be removed because they dissolve in the body after a period of time. Again, the global nations are presently challenged and threatened by the COVID-19 pandemic. The field of chemistry is playing an undeniable, significant and indispensable role in the development of the vaccine and drugs for the prevention and treatment of the virus. The development of a new drug for any disease involves a complicated chemical analytical process. The chemistry of the disease as well as the chemistry of the human body must be studied to determine how the drug would affect the patients. The role of chemistry in scientific and technological development informs why it is a pre-requisite for studying many science-based courses in Nigeria Universities.

In spite of the importance of chemistry in personal and national development, students' achievement in both internal and external examinations has been consistently poor (Aniodoh & Eze, 2014; Eze & Okorie 2019; Anyanime & Abasifreke, 2019 ; Aniodoh & Eze, 2022). Anyanime and Abasifreke (2019) linked students' low achievement in chemistry to teachers' use of ineffective traditional methods of teaching which do not make room for active learning. Since the method adopted by a teacher can enhance or inhibit learning, it becomes necessary that activity-oriented and learner-centered methods such as peer tutoring should be explored.

Peer tutoring is a cooperative learning approach in which students of varying abilities form pairs or small groups of not more than five (2-5) to perform academic activities as tutors or tutees under the supervision of the teacher. According to Agommuoh (2019), peer tutoring is a method of teaching in which students teach their fellow students under the guidance of the teacher. Ndirika and Ubani (2017) identified frequently used peer tutoring models as; class wide peer tutoring, peer- assisted learning, cross-age peer tutoring and same-age peer tutoring. The role of the teacher includes; selecting the peer tutoring model that best suits the learners' needs, training learners to act as tutors and tutees and monitoring the process of learning. For the purpose of this study, class wide peer tutoring was employed.

In class wide peer tutoring, the whole class is divided into two equal ability teams who are competing to be the winning team by earning the highest points during the tutoring process. In each team high ability students are paired with low ability students to play the roles of a tutor and a tutee. After a stipulated time, they switch roles, that is, the tutor becomes the tutee and vice versa. During tutoring process, the tutor explains the task, asks questions, and provides feedback to the peer while the class teacher monitors the class. Peer tutoring is used for reviewing materials or practicing a skill but should not be used for introducing new content.

Peer tutoring fosters learning by teaching. Experience reveals that students learn and acquire better understanding of concepts when they teach others. Other features of peer tutoring include that it; makes room for more individualized learning, encourages students to be free and open when interacting with peers, student-student interaction promotes learning. An evaluation study by Hartman (2010) reported that peer tutoring increased students motivation to learn. It is widely accepted in literature that motivation has positive impact on academic achievement.

Achievement is a measure of the extent to which the objectives of a course of study has been achieved. It can also be viewed as the learning outcome which includes skills, ideas and knowledge acquired by a child during curricular and extra-curricular activities. According to Udoudo (2011), academic achievement consists of scores obtained from teacher-made tests or examinations and these scores represent the measured amount of learning acquired. Academic achievement could be high, average or low and is said to be low when achievement falls below a desired standard (Eze, Ezenwafor & Molokwu, 2015). One area of controversy in students 'achievement in Chemistry is observed disparity by gender.

Gender is a concept used to describe the characteristics, behaviors or roles of men and women that are socially or culturally constructed. Whereas sex is biologically determined, that is, the state of being born a male or a female, gender is decided by the society. For example, in some communities in Nigeria, it is a taboo for women to climb palm trees while in some communities it is not. Gender imbalance exists in Chemistry classrooms. For example, Eze, Egbo and Omeje (2018) found a significant difference in favour of female students when taught kinetic theory and gas laws using programmed instruction. Olatunji and Mbanefo (2019) reported a non - significant difference in the achievement and retention of males and females exposed to peer instruction in Basic science. Aniodoh and Eze (2014) shows a significant gender difference in favour of males when taught chemical equilibrium using programmed instruction. The observed controversy makes the present study imperative and the pertinent question which this study sought to answer is " Would the use of peer tutoring instructional strategy enhance the achievement of male and female students better than conventional lecture method?

Purpose of the Study

The general purpose of this study is to investigate the effectiveness of peer tutoring instructional strategy in enhancing students' achievement in gas laws. Specifically, the study sought to;

1. Determine the mean achievement scores of students taught gas laws using peer tutoring instructional strategy and those taught using lecture method.
2. Find out the mean achievement scores of male and female students taught gas laws using peer tutoring instructional strategy.

Research Questions

1. What are the mean achievement scores of students taught gas laws using peer tutoring and those taught using lecture method?
2. What are the mean achievement scores of male and female students taught gas laws using peer tutoring instructional strategy?

Hypotheses

HO₁: There is no significant difference in the mean achievement scores of students taught gas laws using peer tutoring and those taught using lecture method.

HO₂: There is no significant difference in the mean achievement scores of male and female students taught gas laws using peer tutoring instructional strategy.

METHODOLOGY

This study adopted a quasi-experimental design of pre-test, post test, non-equivalent control groups. According to Nworgu (2015), this design is the most suitable because there was no randomization of research subjects into groups as intact classes were used. The study was carried out in Obingwa LGA in Abia Education Zone of Abia State. The population for the study comprised 255 students in 23 public secondary schools in Obingwa LGA of Abia State. The sample of the study consists of 57 (33 male and 24 female) students drawn from two co-educational secondary schools through simple random sampling techniques. Each of the two co-educational schools had one intact science class which was used for the study. The two intact science classes in the two co-educational schools were assigned to experimental and control groups using simple balloting. The regular class teachers were used as research assistants. The researchers prepared detailed lesson notes which the research assistants used for the study. The control group was taught using the conventional lecture method. For the experimental group, the class was divided into two equal ability teams using simple balloting with replacement. In each team, high ability and low ability students were paired. In each pair, one person acted as a tutor while the other acted as a tutee for a stipulated time, at the end of which they switched the roles so that tutor becomes the tutee and vice-versa. The role of the tutor is to explain the task, ask questions, award two points based on the correctness of the answer, if a tutee fails a question, the tutor provides the correct answer for the tutee to model, one point is awarded for any correct answer the tutee correctly practises three times, the tutor posts the scores to the board. At the end of the second round of tutoring, the points earned from all members of the two teams are added together to determine the winning team for the day.

The instrument for data collection, Chemistry Achievement Test, CAT, is made up of 35 multiple choice questions adapted from WAEC past question papers. The CAT was face and content validated by three experts in Science Education Department, Michael OKPARA University of Agriculture, Umudike. The reliability coefficient of the CAT was determined to be 0.86 using K-R (20). The two research questions which guided the study were answered using mean and standard deviation while the three null hypotheses were tested at 0.05 level of significance using ANCOVA. The choice of ANCOVA is justified because it eliminates the

error of nonequivalence arising from non-randomization of research subjects into groups and pretest scores were used as covariates (Nworgu, 2015).

RESULTS

Research Question 1

What are the mean achievement scores of students taught the concept of gas laws using peer tutoring and those taught using lecture method?

Table 1

Mean Achievement Scores of Students Taught the Concept of Gas Laws Using Peer Tutoring Instructional Strategy.

Group	N	Pretest		Post test		Mean Gain
		Mean	SD	Mean	SD	
Experimental	32	9.88	5.70	17.00	6.47	7.12
Control	25	7.20	3.04	12.36	5.63	5.16

Table 1 shows that students in the experimental group taught with peer tutoring instructional strategy achieved higher (Mean =17.00) than those in in the control group (Mean =12.36) exposed to lecture method.

Research Question 2

What are the mean Achievement scores of the male and female students taught with peer tutoring instructional strategy?

Table 2

Mean Achievement Scores of Male and Female Students Taught With Peer Tutoring Instructional Strategy.

Group	N	Pretest		Post test		Mean Gain
		Mean	SD	Mean	SD	
Male	19	9.74	6.12	16.84	5.97	7.10
Female	13	10.08	5.25	17.23	7.38	7.15

Table 2 indicates that female students with a mean score of 17.23 achieved slightly higher than their male counterparts who obtained a mean score of 16.84 when both groups were exposed to peer tutoring.

Hypothesis 1

There is no significant difference in the mean achievement scores of students taught gas laws using peer tutoring and those taught using conventional lecture method.

Table 3

Analysis of Covariance in the Mean Achievement Scores of Students Exposed to Peer Tutoring and Those Supposed to Conventional Lecture Method

Source of Variation	Sum of squares	Df	Mean Square	F	Sig	Decision
Corrected Model	302.470	2	151.235	3.969	.025	
Intercept	2741.194	1	2741.194	71.945	.000	
Pretest.	.300	1	.300	.008	.930	
Method*	274.302	1	274.302	7.199	.010	Rejected
Error	2057.460	54	38.101			
Total	15125.000	57				
Corrected Total	2359.930	56				

Table 3 shows the analysis of Covariance on the mean achievement scores of students exposed to peer tutoring instructional strategy and those taught using lecture method. p-value of .010 being less than .05 level of significance set for the study indicates a significant

difference in the mean achievement scores of experimental and control groups in favour of those exposed to peer tutoring instructional strategy. Hypothesis one was therefore rejected.

Hypothesis 2

There is no significant difference in the mean achievement scores of male and female students taught gas laws using peer tutoring instructional strategy

Table 4

ANCOVA On The Mean Achievement Scores Of Male and Female Students Exposed To Peer Tutoring Instructional Strategy

Source of Variation	Sum of squares	Df	Mean Square	F	Sig	Decision
Corrected Model	20.393 ^a	2	10.196	.232	.795	
Intercept	1886.617	1	1886.617	42.891	.000	
Pretest	19.227	1	19.227	.437	.514	
Gender*	.900	1	.900	.020	.887	Not Rejected
Error	1275.607	29	43.986			
Total	10544.000	32				
Corrected Total	1296.000	31				

The result in table 4 reveals a p-value of .887 for gender which is greater than .05 level of significance set for the study. This implies a non-significant difference in the mean achievement scores of male and female groups. Hypothesis two was therefore not rejected.

Discussion

Result in Table one shows a significant difference in the mean achievement scores of students in the experimental group exposed to peer tutoring instructional strategy and those in the control group taught using lecture method. The difference in achievement was in favour of the peer tutoring group. This finding is an indication that peer tutoring engages students actively and direct interaction between tutor and tutee allows for better understanding of concepts and therefore enhances achievement. This finding is congruent with Ogunleye and Bamidele (2014) who reported a significant effect of treatment on students' concept attainment and achievement in practical chemistry in favour of the peer tutoring group. It also corroborates the findings of Gongden (2021) who found out that students exposed to peer tutoring learning approach achieved significantly higher than their counterparts taught with conventional method.

Results in Table 2 indicates a non - significant difference in the mean achievement scores of male and female students exposed to peer tutoring instructional strategy. This finding shows that peer tutoring instructional strategy has the capacity to close up the gender disparity in achievement observed in chemistry/science classrooms. Tutor- tutee interaction allows openness to learning and hence students are motivated to learn. This gives credence to Hartman (2010) who reported that peer tutoring increased students' motivation to learn. This finding corroborates the report of Gongden (2021) which revealed a non - significant gender difference in the achievement of students exposed to peer tutoring when taught chemical kinetics. It is also consistent with Ndirika and Ubani (2017) as well as Olatunji and Mbanefo (2019) who in their independent studies reported a non-significant difference in the achievement of male and female students exposed to peer tutoring. However, this result is in contrast with the finding of Agommuoh (2019) who reported a significant gender difference in favour of females when exposed to peer tutoring learning approach.

CONCLUSION

The major findings of this study revealed a significant effect of treatment on the achievement of experimental and control groups in favour of students exposed to peer tutoring instructional strategy. Again, there was no significant difference in the achievement of males and females exposed to peer tutoring instructional strategy. This implies that peer tutoring has the capacity to close the observed gender gap in chemistry/science classrooms.

RECOMMENDATIONS

Based on the findings of the present study, the following recommendations are made.

1. Teachers should adopt the use of peer tutoring instructional strategy in chemistry and science classrooms.
2. Science Teachers Association of Nigeria and other professional bodies should organize seminars and workshops on the use of peer tutoring instructional strategy.
3. Ministries of Education and school authorities should sponsor teachers to attend conferences, seminars and workshops to update their knowledge on current pedagogies in science classrooms.

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