EFFECTS OF RECIPROCAL PEER TUTORING ON STUDENTS' ACADEMIC ACHIEVEMENT IN CHEMICAL EQUILIBRIUM

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Abstract

The purpose of the study was to determine the effect of reciprocal peer tutoring on the academic achievement of senior school students in chemical equilibrium. A quasi-experimental non-randomized control group, pretest-posttest design was adopted for the study. A total of one hundred and ten (110) SS11 science students of both male and female participated in the study. The instrument used for data collection was Chemical Equilibrium Achievement Test (CEAT). Mean and standard deviation were used to analyze the data for answering the research questions. The hypotheses were tested using analysis of covariance (ANCOVA) at 0.05 level of significance. The results show that students taught with reciprocal peer tutoring had higher posttest mean scores in Chemical Equilibrium Achievement Test (CEAT) than those taught with the traditional method of teaching. The result also shows that gender had no effect in the academic achievement of students. Following the findings of the study it was recommended that chemistry teachers should employ the use of reciprocal peer tutoring in the teaching of difficult concepts in chemistry.

Keywords: Chemical-equilibrium, Reciprocal Peer Tutoring, Academic achievement

Introduction

The effective teaching and learning of chemistry is crucial for the overall development of any society. Chemical equilibrium is one of the themes in the chemistry curriculum for Nigeria senior secondary schools. It is one of the basic concepts in chemistry as it is related to other areas of chemistry like solubility, electro-chemistry, and acid-base. By implication, students difficulty in chemical equilibrium can interfere with their subsequent learning in other areas of chemistry. A review of literature reveals that it is one of the concepts that give learners most difficulty (Onwu, 1993; Ogbonna, 1999, Jimoh, 2009). Wheeler & Kass (1978) reported that most students see the concept of chemical equilibrium as very abstract and some daily life terminology are used with different meanings in the concept of chemical equilibrium. Examples of such words include: "equilibrium balance", "equilibrium position". A common misconception among students about these words is that no reaction occurs when a reaction is said to be at equilibrium (Griffiths, 1994). Another cause for the difficulty that learners experience in chemical equilibrium according to Eze (2002) is the method of teaching adopted by teachers for the teaching of the concept. The consequence of this is the continual poor performance of chemistry students in national and international examinations especially in questions related chemical equilibrium concept (Ajeyalemi, 1990; Jimoh, 2004; Njoku, 2007). To efficiently tackle this ugly scenario, researchers have sought to develop various teaching and learning strategies.

Among these strategies is cooperative learning. Cooperative learning is a comprehensive approach to teaching that derives from a theory of education and encompasses key assumptions about what students should learn and how they learn (Duke, 1990). Lessons in the cooperative learning strategy are arranged so that each student, ranging from the fastest to the slowest learner, has a contribution to make (Sapon-Shevin & Schniedewind, 1990).

Various types of cooperative learning strategies exist. One of such is Peer Tutoring. Peer tutoring is a student mediated instructional procedure in which small learning groups work together on learning tasks (Dufrene, Noell, Gilbertson & Duhon 2005). Peer tutoring has been shown to increase significantly students' time spent in academic instruction and engagement (Egbockuku and Obiunu, 2006; Oludipe, 2007, Ogbuanya, Bakare & Igweh, 2009).

Reciprocal Peer Tutoring (RPT), as the name implies, is a form of cooperative learning, in which students function reciprocally as both tutor and tutee (Ogbuanya, Bakare & Igweh, 2009 & Obiunu, 2008). This dual role according to Obiunu (2008) and Griffin & Griffin (1997), is beneficial because it enables students to gain from both the preparation and the instruction in which tutors engage and from the instructions that tutees receive. According to Ogbuanya et al (2009), RPT helps teachers to cope with challenges such as limited instructional time, multiple curricular requirement and appropriate social engagement among learners.

The effectiveness of RPT in the teaching and learning process has largely been documented. For instance Oludipe (2007) reported a significant improvement in achievement of students in physics in a large class after the students were exposed to RPT. Also in another study by Ogbuanya et al (2009), there was a significant effect on students' achievement in electronics technology after the students were also exposed to Reciprocal Peer Tutoring. Similarly (Slavin, 1991 and Magolda & Rogers, 1987) have shown that RPT is an effective technique for increasing students' academic achievement. Considering the findings of these studies vis-à-vis the continual decline in academic achievement of students offering chemistry at the senior secondary level, the researcher thought it pertinent to explore the applicability of this technique in the teaching and learning of chemistry-chemical equilibrium concept. The purpose of this study therefore was to find out the effect of Reciprocal Peer Tutoring on the academic achievement of students in chemical equilibrium.

Research Questions

(i). What is the difference between post test scores of students taught with reciprocal peer tutoring and traditional teaching method in chemical equilibrium?

(ii). What is the difference in mean scores of male and female students exposed to reciprocal peer tutoring?

Hypotheses

Ho_1: There is no significant mean difference between the achievement scores of students taught with RPT and the traditional teaching method in chemical equilibrium.

Ho_2: There is no significant difference in the mean scores in chemical equilibrium achievement test of male and female students taught chemical equilibrium using reciprocal peer tutoring.

Methodology

The study adopted a quasi-experimental research design using a pre-test, post-test non randomized (intact classes) control group. This design was used because it allows utmost control of extraneous variables (Nworgu, 2006). More so, a true experimental design will disrupt academic activities of the schools used for the study since it will involve subjects' randomization, which is hardly permitted by school authorities (Ezeudu & Ezeh, 2008).

The population of this study was the entire Senior Secondary School II (SSII) chemistry students in government schools within Gwagwalada Area Council of the Federal Capital Territory (FCT)-Abuja. Four schools were selected by stratified and purposeful sampling techniques. Two of the schools were randomly assigned to the experimental group while the other two schools constituted the control group. A total of 110 students were involved in the study. Students in the experimental group were taught chemical equilibrium concepts using the RPT while the control group was taught the same concepts using the traditional method. The teaching was done by the regular chemistry teachers of the sample schools. While the teachers of the experimental group used RPT lesson plan prepared by the researcher for their teaching, the control used their usual (traditional) lesson plan. The teachers who participated in experimental group were given training on the use of RPT in a science class. The study lasted for four weeks; one week was used to train the teachers of the experimental group while three weeks was used for the actual experiment. Chemical Equilibrium Achievement Test (CEAT) was used as the test instrument for the study. CEAT is a 45 multiple choice item adapted by the researcher from past WAEC and NECO question papers. The reliability of the instrument was gotten using the test-retest technique with the product moment correlation coefficient of $r = 0.76$. CEAT was administered to the students (experimental and control) before

and after the experiment as pre-test and post-test. Data collected were analyzed using mean score and standard deviation to answer the research questions and analysis of covariance (ANCOVA) to test the hypothesis.

Results

Results of the data analysis are presented below in tables 1 and 2 and 3 according to the research questions and the hypothesis.

Table 1: Pretest and post-test mean achievement and standard deviation scores of students in Chemical Equilibrium Achievement Test (CEAT) due to teaching method

Groups	N	Teaching method	Pretest $\bar{X}$	SD	Posttest $\bar{X}$	SD	Mean gain in achievement
Experimental	59	RPT	18.34	6.25	36.93	5.55	18.59
Control	51	Traditional	17.94	5.90	24.33	5.93	6.39

Table 1 show the mean difference between the experimental and control group. The data indicate that the experimental group had a mean of 18.34 and a standard deviation of 6.25 in the pretest. In the posttest, as also indicated in the data, the experimental group had a mean of 36.93 with standard deviation of 5.55. This shows a pretest, posttest gain of 18.59 in the experimental group. On the other hand, the control group had a mean of 17.94 and a standard deviation of 5.90 in the pretest and a mean of 24.33 and a standard deviation of 5.93 in the posttest making a pretest, post test gain of 6.39. This reveals that there was a significant gain in achievement by the experimental group, indicating that the experimental group performed better than the control group in CEAT.

Table 2: Mean achievement and standard deviation scores in Chemical Equilibrium Achievement Test (CEAT) of male and female students exposed to RPT

Gender	Mean	Std. Deviation	N
Male	31.4638	8.78096	69
Female	30.4634	8.09351	41
Total	31.0909	8.50747	110

Table 2 shows that there is no significant difference in the mean achievement scores of male and female students exposed to reciprocal peer tutoring technique.

Table 3: Analysis of covariance (ANCOVA) of students' overall achievement scores by teaching method and gender

Source	Sum of Squares	df	Mean Square	F	Significance	Decision
Model	4443.905[a]	2	2221.952	69.009	.000	Significant
Intercept	13488.071	1	13488.071	418.910	.000	Significant
Gender	101.876	1	101.876	3.164	.078	Not significant
Method	4418.169	1	4418.169	137.219	*.000	Significant
Error	3445.186	107	32.198			
Total	114220.000	110				

*Significant at P<0.05

As indicated by the data in table 3, Method is a significant factor on students achievement in chemical equilibrium concepts at P<0.05. The F –value of 0.00 at 1 degree of freedom was less than 0.05. On this premise the null hypothesis Ho1 is rejected. This implies that there is significant mean difference between the achievement scores of students taught with RPT and those taught with the traditional teaching method in chemical equilibrium. Table 3 also shows that there is no

significant difference in the achievement of male and female students exposed to Reciprocal Peer Tutoring technique (F-value 0.078 > 0.05).

Ho_2: Is therefore accepted. The implication of this is that gender has no effect on students' achievement when taught chemical equilibrium concepts with RPT.

Discussion

The findings of this study clearly indicate that Reciprocal Peer Tutoring has significant effect on students' achievement in chemical equilibrium concepts. In the first instance, as shown in table 1, there was a significant gain in achievement by the experimental group compared to the control group. This significant gain in achievement by the experimental group was a result of the treatment given. Furthermore, the results in table 2 reveal that the Method (RPT) was a significant factor in students' achievement in chemical equilibrium concept. The implication of this is that reciprocal peer tutoring has a positive effective on students' academic achievement and, by extension, is more effective than the traditional method of teaching, comparatively. The finding of this study is in line with that of Ogbuanya et al (2009) who reported that RPT imparted positively on students' achievement in introduction to electronics. This also corroborates the finding of Slavin (1991) that RPT increases students' engagement and achievement in the teaching and learning process.

The effect of gender on students' achievement in chemical equilibrium concepts was obtained using ANCOVA in table 2. According to the table, it was obvious that gender has no significant effect on students' achievement in chemical equilibrium concepts when taught with reciprocal peer tutoring. This finding supports the findings of Abonyi (1998), Fatokun & Yalams (2007) and Ugwuanyi (2008) that the effects of teaching methods did not change as function of variation in gender. Generally therefore, according the findings of this study, reciprocal peer tutoring has a positive effect on students' achievement in chemical equilibrium concepts and this is irrespective of students' gender.

Conclusion

The study was designed to ascertain the effectiveness of Reciprocal Peer Tutoring technique in the teaching and learning of chemical equilibrium concepts. The result of the study indicated students taught with RPT showed good mastery of the concepts taught than their counterparts who were taught with the traditional method of teaching. Following the findings, it appears that RPT could bring solution to the recurrent problem of students' poor performance in chemical equilibrium and physical chemistry, generally.

Recommendations

Following the findings of the study, it is recommended that:

1. Science teachers should incorporate the use of reciprocal peer tutoring in the teaching and learning of difficult concepts in chemistry.
2. Relevant agencies and associations like STAN should initiate programmes to build the capacities of science teachers on the effective use of this method in the teaching and learning of science.
3. Teacher educators should expose pre-service science teachers to RTP by incorporating it in the science method course.

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