



Pair-Share-Repeat Instructional Approach and Academic Performance of Chemistry Students in the Study of Chemical Equation

Aniefiok Iniobong Udoh, PhD
Department of Science Education,
University of Uyo, Akwa Ibom State, Nigeria

Abstract

Science drives the industrial and technological development of every nation. The future of national development, therefore rely heavily on the success and performance of students in science subjects. This study adopted a quasi-experimental pre-test and post-test control group design to examine the effect of pair-share-repeat instructional approach on the academic performance of students in chemical equation. The population of the study consisted of 1,704 Senior Secondary One (SS1) chemistry students in the fourteen (14) public Secondary Schools in Uyo Local Government Area of Akwa Ibom State, Nigeria. Sample size of the study comprised 180 SS1 chemistry students drawn from two schools. The purposive sampling technique was used to select two schools while the random sampling technique was used to select intact classes comprising 72 males and 108 giving a total 180 students who participated in the study. This study made use of two instructional packages of the pair-share-repeat and the conventional talk and chalk approaches, for treatment for the two groups and the study was chemistry performance test (CPT) with a reliability coefficient of .72 indicating that the instrument was reliable for use in the study. Hypotheses were tested at .05, level of significance. Data collected during the pretest and posttest were analysed using the analysis of covariance (ANCOVA). The result showed that the pair-share-repeat approach was effective in enhancing students' performance in chemical equation. Based on the findings of the study recommendations were made among others that teacher should incorporate pair-share-repeat approach into their teaching of chemistry concepts.

Keywords: chemical equation, instructional approach, pair-share-repeat

Introduction

Everything around in the world is a product of chemistry. More than just nutrients, medicines and poisons, everything in chemistry involves all forms of fireworks and explosives. Some students tend erroneously judge chemistry to be a very complicated and boring subject, but in reality it is definitely not a boring science subject. Chemistry has contributed greatly towards providing the basic needs of man and improving the quality of life in the area of food, clothing, housing, medicine, transportation and job creation (Ababio, 2009).

In Science subjects and chemistry in particular, the teaching methods at the secondary school level still remain a serious challenge owing to the abstractness of the subject. This calls for the teacher who is a transforming agent in the educational system to device means to drive the silent point home to the learners. This abstractness in some chemistry concepts has affected the level of learners' general performance in chemistry in the senior secondary examination (WAEC, NECO, GCE) which is also a deciding factor in student's future choice of career. Chemistry as a science subject is experimental in nature and need to be taught using a variety of learning



approaches which are activity based and student centred in order to drive the content to the learner's level of understanding. The level of conceptual understanding in teaching and learning chemistry is to determine to what extent student's learning difficulty in chemistry could be narrowed down. Hence, several authorities have advocated for research based, diverse innovative teaching-learning strategies that will enhance students' performance in science (Aniodoh, 2000).

Studies have offered several reasons for students' poor performance in chemistry to include but not limited to; the learner's interest in the subject and poor study habit (Asagwara & George, 2003). Student's attitude (Njumogu, 2002), the learner's self-concept, gender and the teaching methods adopted by the chemistry teachers (Adams, 2016; Barkley, Cross, and Howell, 2005; Nwagbo, 2001). A number of studies conducted on innovative learning approaches have been tried out and identified by STEM education researchers as effective and enhance learning performance in sciences generally. They include Guided Discovery, Cooperative Learning, Concept-mapping and Analogy (Okafor 2001), generative learning models (Udogu & Njelita, 2010; Ezenduka, Achufus & Okoli, 2014). Other works in Innovative Instructional Strategies include Computer simulation, Blended Learning, Engagement approach and Exploratory-Discovery learning (Idika, Idorenyin & Umobong, 2012); (Udofia, 2016).

Despite the enormous research endeavours students' performance in chemistry is still bedeviled by incessant poor performance. This study therefore utilized the think-share-repeat approach to learning in order to improve the performance of students in chemistry as it has to do with chemical equation. The pair-share-repeat approach has been used with students in other subjects and found to be effective in enhancing learning hence it is expedient chemistry students also benefit from this approach. The pair-share-repeat learning approach is a more practical and advanced form of the Think-Pair-Share method. Think-Pair-Share involves students discussing answers to questions with each other. The teacher asks the class a question and gives students a set amount of time to answer the question individually. The teacher tells the students to turn to someone sitting next to them and discuss their answers. Students are given time to discuss their answers with their partner. If the answers differ, one partner tries to convince the other that his answer is the correct one (Barkley, Cross & Howell, 2005).

Using Think-Pair-Share helps a student get the correct answer even if neither student nor his partner knew the correct answer to start with. Smith, Wood, Adams, Wieman, Knight, Guild and Su (2009) conducted a study to determine if students were really learning information from Think-Pair-Share or if they were just picking the most popular answer to a question. This study involved 350 students in an introductory genetics class. Students were presented with a question during the course of a lecture and were instructed to respond to it by using a clicker; this is a student response system used in promoting active learning. In this study students were asked to turn to a student next to them and discuss their answer to the question. Students were then given the option to change the answer to the question but were not given the correct answer. Later in the lecture the students were given a similar question and again asked to answer it by using a clicker. Students were given the correct answer to both questions. The results showed that students benefited from discussing the answer to the first question with a partner. Fifty-two percent of the students got the answer correct before the discussion. After discussing the question, 68% correctly answered the question. In addition, 73% of students were able to answer a similar question correctly (Smith *et al.*, 2009).



It is also expedient to examine the effect of gender in the study of chemistry and how effective this pair-share-repeat approach can be with male and female students. Different research has demonstrated the existence of different attribution patterns in boys and girls, such that while girls tend to give more emphasis to effort when explaining their performance, boys appeal more to ability and luck as causes of their academic achievement. Researchers in the field of education to unravel gender gap (inequality) in academic performance have recorded much. Observations had shown that there are differences between male and female in the pattern of education. These difference in participation and performance between male and female were found in several different subjects examined at the secondary school level.

It is therefore necessary that attention be concentrated on the teaching of science concept such as chemical equation in addressing misconceptions that learners may hold regarding chemistry concepts or other content and apply the constructivist thinking strategy to help teachers facilitate conceptual change in the classroom. Although many approaches have been put to use with the aim of achieving high performance in chemistry, there still exist such a noticeable and worrisome gap in the performance of students in both internal and external examinations. In order to bridge this gap for a better performance this study tends to examine the effect of pair-share-repeat approach in the teaching of chemistry to senior secondary school students.

Statement of the Problem

Poor performance of students in chemistry both in internal and external examination is becoming more alarming by the day and this cannot be unconnected with the inability of students to solve chemical equations. It is unfortunate that students nowadays cannot walk boldly and confidently into chemistry examination without carrying unwanted materials from which to copy in order to pass the examination. Much of this problem stem from the fact that the method of instructional delivery in a conventional classroom at best leaves the student in confusion and perplexity about chemistry concepts especially solving chemical equation.

Without a student friendly and student centred instructional approach students will continue to lag behind in ability to solve chemical equations and consequently perform poorly in chemistry examination. This tends to cripple the nation's pursuit towards the development of science and indigenous technology hence it spells doom for the nation's industrial and technological development. It is on this premise that this study sought to find out the effectiveness of pair share repeat instructional strategy on students' academic performance of senior secondary one (SS1) chemistry students

Research Questions

1. What is the mean score difference between students taught using pair share repeat approach and those taught using the talk and chalk approach?
2. What is the mean score difference between of male and female students taught using the Pair-Share-Repeat learning approach

Null Hypotheses



3. There is no significant difference between the mean score of students taught using the Pair-Share-Repeat instructional approach and those taught using the conventional approach.
4. There is no significant difference between the mean score of male and female students taught using the Pair-Share-Repeat Approach

Methodology

The study adopted a quasi-experimental pretest, posttest, control group design. It is an empirical interventional study used to estimate the causal impact of an intervention. The design is represented schematically as follows:

E: $O_1 X_1 O_2$

C: $O_3 X_2 O_4$

Where: E = Experimental Group (taught using Pair-Share-Repeat learning approach);

C = Control group (taught using talk and chalk approach);

O_1 and O_3 = Pre-test scores of the experimental (E) and the control (C) groups respectively;

O_2 and O_4 = Post test scores of the experimental (E) and the control (C) groups respectively;

X_1 = Treatment (pair-share-repeat learning approach)

X_2 = Conventional approach (the talk-chalk teaching approach)

The research was conducted in Uyo Local Government Area of Akwa Ibom State, Nigeria. Uyo Local Government Area is bounded by Abak, Itu, Uruan, Ibesikpo Asutan and Etinan Local Government Areas respectively. Uyo is the capital of Akwa Ibom State located in the coastal southern part of the country, lying between latitudes $4^{\circ}32'N$ and $5^{\circ}33'N$, and longitudes $7^{\circ}25'E$ and $8^{\circ}25'E$

The population of the study consisted of 1,704 Senior Secondary One (SS1) chemistry students in the fourteen (14) public Secondary Schools in Uyo Local Government Area of Akwa Ibom State, Nigeria

The sample for this study comprise of 180 SS1 chemistry students made up of 78 males and 102 females. The Purposive sampling technique was used to select schools from the area of study. The criteria for selection were:

- i) Schools with at least one specialised chemistry teacher.
- ii) Schools with at least two (2) streams of SS1 chemistry students.
- iii) A co-educational school.

Eight (8) schools satisfied the criteria for selection. Random sampling using balloting was used to select two (2) schools out of the eight that met the criteria. From these two schools intact classes comprising 92 and 88 students made up of 72 males and 108 females offering chemistry were selected respectively. The two schools were randomly assigned experimental and control group respectively. The experimental group were taught using pair-share-repeat approach (PSRA) while the control group was taught using the conventional talk and chalk approach

The instrument used for the study was Chemistry Performance Test (CPT) and was developed by the researcher. Specifically, the questions were drawn from chemical equation content. The CPT was designed to measure the students' pre-test and post-test performance in the content investigated. The Chemistry Performance Test was a twenty-five item multiple choice objective questions. Each of these questions in the chemistry performance test (CPT) has four options (A, B, C, and D). This test was designed to measure students' performance in chemical



equation. The reliability of the chemistry performance test was carried out with a trial testing on a sample of thirty (30) senior secondary one (SS1) chemistry students in a school outside the study area which were not part of the main study. The data obtained was analysed using the Cronbach Alpha method which gave a reliability index of 0.74 indicating a high reliability of the instrument. Instructional packages used for treatment during the pair-share-repeat and the conventional talk and chalk treatments were designed by the researcher. Before treatment for each group commenced a pretest was administered to each group and at the end of the treatment a posttest was also administered. Data collected were analysed using the mean and standard deviation to answer the research questions while the hypotheses were tested at .05 level of significance using Analysis of Covariance (ANCOVA).

Results

The results are presented in tables according to the research questions and hypotheses.

Research Question 1: What is the mean score difference between students taught using pair share repeat approach and those taught using the talk and chalk approach?

Table 1: pretest-posttest mean score difference students taught using pair share repeat approach and those taught using the talk and chalk approach

Approach	Pre-test		Post-test		Mean difference	Mean Gain
	N	\bar{X}	SD	\bar{X}		
Pair-share-repeat Learning	92	45.58	11.42	49.58	12.81	4.00
Conventional Talk-Chalk	88	38.01	11.74	40.91	11.94	2.90

Table 1 showed the pretest and post test mean score difference of students taught using pair-share-repeat learning approach (4.00) while that of those taught using the conventional talk-chalk method (2.90). The mean difference between the experimental group (pair-share-repeat learning approach) and control group (conventional talk-chalk method) was 1.10. It can be inferred from the mean scores that those taught using pair-share-repeat learning approach performed better than those taught using the conventional talk-chalk method. Table 1 also showed the standard deviations of students taught using pair-share-repeat learning approach and those taught using the conventional talk-chalk method as (pretest 11.42 and 11.74) and (posttest 12.81 and 11.94) respectively. This indicates that the scores of students taught using pair-share-repeat learning approach centre more closely to their mean score than those taught using the conventional talk-chalk method. It can also be inferred from the standard deviations that the mean score of students taught using pair-share-repeat learning approach was greater than those taught using the conventional talk-chalk method.

Research Question 2: What is the mean score difference between of male and female students taught using the Pair-Share-Repeat learning approach?

**Table 2:** pre-test, post-test mean score difference between of male and female students taught using the Pair-Share-Repeat learning approach

Gender	N	Pre-test		Post-test		Mean difference	Mean Gain
		\bar{X}	SD	\bar{X}	SD		
Male	30	45.70	10.18	47.32	11.23	1.62	2.98
Female	62	46.66	12.04	51.26	14.34	4.60	

Table 2 showed the pretest and post test mean score difference of male female taught using pair-share-repeat learning approach 1.62 and 4.60 respectively The mean gain difference between male and female was 2.98. It can be inferred from the mean difference that female students taught using pair-share-repeat learning approach performed better than their male counterparts.

Table 2 also showed the standard deviations of male and female students taught using pair-share-repeat learning approach as (pre-test 10.12 and 12.04 and post-test 11.23, 14.34) respectively. This indicates that the scores of male students taught using pair-share-repeat learning approach centre more closely to their mean score than their female counterparts. It can be inferred from the standard deviations that the mean score of female students taught using pair-share-repeat learning approach may not be greater than that of the male counterparts.

Null Hypothesis 1: There is no significant difference between the mean score of students taught using pair-shared-repeat learning approach and those taught using the conventional talk-chalk method.

Table 3: Analysis of Covariance showing the mean score of students taught using pair-shared-repeat learning approach and those taught using the conventional talk-chalk method.

Source of Variation	SS	df	MS	F _{cal}	P-value _{cal}
Treatment (pretest and posttest)	6967.71	1	6967.71	68.13*	.000
Gender	2532.46	1	2532.46	24.76*	.000
Residual	18101.14	177	102.27		
Total	27601.31	179	154.20		

Table 3 indicates that the pre-test result is significant since the calculated P-value .000 is less than the alpha (.05), indicating the groups were not comparable. The comparability of the groups is however taken by analysis of covariance that would regress, the pre-test and post-test scores. Table 3 also showed that the calculated P-values (.000) of approach are less than the alpha level (.05). Therefore, the null hypothesis is rejected. This implies that there exists significant difference in the academic performance mean score of students taught using pair-shared-repeat learning approach and those taught using the conventional talk-chalk method.



Null Hypotheses 2: There is no significant difference in the academic performance score of male and female chemistry students taught using pair-shared-repeat learning approach.

Table 4: Analysis of Covariance of Male and Female Students' Academic Performance Taught Using Pair-share-repeat Learning Approach with pretest and Posttest Scores as Covariate

Source of Variation	SS	df	MS	F _{cal}	P-value _{cal}
Treatment (pretest and posttest)	2202.15	1	2202.15	20.33	.000
Gender	18.46	1	18.46	0.17	.681
Residual	9640.26	89	108.32		
Total	11860.87	91	130.34		

Table 4 shows that the pre-test is significant since the calculated P-value .000 is less than the alpha (.05), indicating the groups were not comparable. The comparability of the groups is however taken by analysis of covariance that would regress the pretest and posttest scores. Table 4 also showed that the calculated P-values (.681) of approach is greater than the alpha level (.05). Therefore, the null hypothesis is retained. This implies that there exists no significant difference in the academic performance mean score of male and female chemistry students taught using pair-shared-repeat learning approach.

Discussion of Findings

The findings from the results on the difference in the academic performance mean score of students taught using pair-shared-repeat learning approach and those taught conventionally indicated that a significant difference between the two groups. It was found that students taught using pair-shared-repeat learning approach had a significantly better academic performance than those taught using the conventional talk-chalk method. The findings could be attributed to participating in class discussion by the students.

The approach provides the opportunity for students' participation in class discussion, increase the number of long explanations students gave, and increase their comfort when sharing their thoughts and ideas. The discussion in the classroom positively affected students' confidence in their chemistry abilities and their confidence in their ability to contribute to discussion in the class. Furthermore, the approach provides the opportunity for students to learn from each other, practice using and developing their chemistry vocabulary, practice using chemistry reasoning skills, and provide opportunity for form of formative assessment. The findings of the study is in line with that of Smith, Wood, Adams, Wieman, Knight, Guild and Su (2009), who found that students benefited from discussing answers to questions. The finding is also in agreement with that of Cartright, Collins and DiCarlo (2005), who found that students who used think-share instruction answered questions on the lesson correctly 59% of the time while those who did not questions correctly 44% of the time.



The findings from the results on the difference in the academic performance mean score of male and female students taught using pair-shared-repeat learning approach was not significant. The findings may have resulted from both male and female students' equal participation. The females mean score was slightly high because of their being more fluent than the males. The findings are also in agreement with that of Nwagbo (2001) who found no significant gender difference in external locus of control in academic self-concept. The finding of the study is contrary to that of Amuda, Ali and Durkwa (2016), who found that male students had better grades than their female counterparts in Economics in 2006-2010 sessions.

Conclusion

It can be concluded from the findings that pair-shared-repeat learning approach is more effective in teaching chemical equations than the conventional talk-chalk method. The approach leads students to feeling more comfortable and confident with the content of the lesson and enjoys the class thereby making it easier for them to understand the lesson. The approach does not discriminate between male and female students.

The findings of the study have provided substantial evidence for the effectiveness of the Pair-Share-Repeat Learning Approach to enhance students' self-confidence through interaction and sharing of ideas with peers thereby increasing their understanding of the abstract concept in Chemistry. The result therefore indicates that the Pair-Share-Repeat Learning Strategy has not only enhanced students understanding of chemical equations but also increased their performance during and after the lesson.

Recommendations

The following recommendations were made based on the findings of the study:

1. Chemistry teachers should use pair-shared-repeat learning approach in teaching chemical equations in chemistry.
2. Principals should endeavour to provide conducive classrooms that can enhance the use of pair-shared-repeat learning approach.
3. Government should organise workshops for teachers, where they could be trained on the use of pair-shared-repeat learning approach.

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