
INTERACTIVE EFFECT OF ROUND-ROBIN INSTRUCTIONAL TEACHING AND LEARNING STRATEGY ON STUDENT'S ACADEMIC ACHIEVEMENT AND RETENTION IN CHEMICAL BONDING AND MOLECULAR STRUCTURE IN SENIOR SECONDARY SCHOOLS.

By

Sunday, Brain Edem
Department of Integrated Science
Akwa Ibom State College of Education
Afaha Nsit

And

Asuquo, P. O.
Department of Chemistry
Akwa Ibom State College of Education
Afaha Nsit

ABSTRACT

This research is bent to investigate the effect of Round-Robin Instructional Strategy on Senior Secondary Schools Students Achievement and Retention in Chemical Bonding and Molecular Structure. The research engages a quasi-experimental design. Six research questions, six purpose of study, six hypotheses were used for the study. The area of the study was Uyo Local Government Area, Akwa Ibom State. The hypotheses were tested at 0.05 level of significance. The population for the study was twelve thousand seven hundred and sixty (12760) SSII secondary school students in all public secondary schools in Uyo, Akwa Ibom State. Multistage sample technique was used to select two hundred students (200). SSII Chemistry student were used for the study. Chemistry achievement test and chemistry retention test (CRT) (CAT) were used for the study respectively and the data collected were analyzed using mean standard deviation and analysis of covariance (ANCOVA). The overall findings reveals that there was a significant difference between the mean achievement scores of chemistry student taught chemical bonding and molecular structure using Round-Robin and those taught using lecture method in favour of student in the experimental group, Round-Robin at 0.05 level significance and the main implication of the research was that Round-Robin instructional strategy influences student academic achievement to a very great extent than lecture method enhances as such, this instructional strategy was recommended for the teaching and learning of chemical bonding and molecular structure.

KEYWORDS: Round-Robin Instructional Strategy, Chemical and Molecular Bonding, Retention, Chemical bonding, Academic Achievement and chemistry students.

INTRODUCTION

Available statistical data reveals that the world is a global entity as a results of inventions, innovations and technology which has brought about inventions which is currently invoke which has make life cheap and meaningful for life to strife.

Brain 2023 opine that chemistry is the branch of science which have given birth to everything meaningful that life good behold, he went further to reveal that virtually everything we have around us is chemistry, hanging from the air we breathe, the water we drink, the cloth we wear, the beautiful house that we live, the food we eat, the car we drive, the fuel we use etc.

Brain (2023) define chemistry to be the natural transformation of nature into physical, and chemical composition which metamorphoses into the essential and basic need of man example oxygen which is a natural gas reacts with another invisible natural gas called hydrogen gives water (H_2O) which life as a whole depend on which is chemistry.

A sound knowledge of chemistry is therefore of great importance to many pupils, community and society at large. Considering this critical role of chemistry, it is needful to lay a solid foundation in students to enhance their academic performance, proficiency and in solving mankind's numerous problems (Giginna and Nweze, 2014).

Acquisition of appropriate scientific and technological knowledge and skills are necessary to cope with the challenge presented by the evolving needs of modern work place in our industries and ever growing non-formal sector, Grace, 2019 state that think pair instructional material can best use for learning of chemistry in which the world depend on.

Ogbu (2012), Adeyemi and Owoyemi (2014) suggested a shift from the conventional method of teaching chemistry to some innovative instructional approaches that will improve students interest and achievement in chemistry. The conventional or traditional pedagogical practice which confirmed a transmitting information and involves telling, reading and memorizing and the teacher adopting the fountain of knowledge approach has failed to cope with the problems of scientific knowledge needed for development.

Chemistry is known to be compulsory subject for all senior secondary school students and it's mandated by all students intending to studying scientific or professional courses to have a minimum of a credit pass to secure admission into the University (Brain 2023), hence poor performance in chemistry has been attributed to poor teaching methods adopted by teachers some of this traditional teacher-centered methods which are predominant in our classrooms do not stimulate students innovation critical thinking, creative thinking and collaboration problem solving but rather encouraged students to cram facts which are easily for gotten (Adeyemi, 2008).

In order to address the low academic achievement in chemistry at Senior Secondary Certificate Examination (SSCE) in Nigeria, there is need for chemistry teachers to use appropriate teaching and learning approaches that are learner centered rather than teacher centered. The learner-centered teaching and learning approaches actively engage the learner in the learning process for effective mastering of the subject content matter, development of skills and positive attitude towards the subject.

Robinson (2003) and Taber (2001), chemical bonding is perceived by students and chemistry to be a complicated concepts. The concepts and structures such as covalent bond, molecules, ions and hydrogen bonds are fundamental topics and need to be given proper attention at senior secondary one (SS1). In order to understand these concept of chemical bonding.

Franz and Harkirat (2010) reported that students often had challenges in comprehending the concept in chemistry and this is based on the method of teaching.

Gender issues in chemistry and science is general and is still controversial. Njoku (2000) and Okeke (2000) found out that there is no significant difference in the achievement in chemistry between boys and girls further studies are required to determine the effect of a different instructional

strategy such as Round-Robin, Jigsaw on academic achievement of boys and girls. Would Round-Robin be effective in enhancing the achievement of male and female students in chemical bonding that so far there is no biological evidence that boys have innate superior, intellectual abilities over girls; the difference in achievement may be caused by other factors such as teaching method. Some studies like Iqwe (2008) and Okeke (2000) shows that males and females respond differently to specific teaching methods. The question then is can Round-Robin instructional strategy delivery yield the same effect on achievement and retention on male and female students in chemical bonding and molecular structure in senior secondary schools in Akwa Ibom State.

STATEMENT OF THE PROBLEM

It is obvious to note with dissatisfaction that the achievement of chemistry in chemical bonding and molecular structure is seen to be poor in WAEC and SSCE according to a WAEC Chief Examiner 2013-2017 report. Irrespective of the fact that chemistry plays a very important role in the actualization of scientific and technological advancement of our society. In spite of the importance of chemistry in technological breakthrough of a nation and the effort of researchers to improve on its teaching and learning, chemical bonding being a key concept, should be taught with appropriate method of instruction in order to enhance a better understanding of other concepts, like separation technology Volumetric Analysis, hydrocarbons, ions, etc.

Therefore, if student's achievement in chemistry are to be enhanced there may be need to improve students understanding in comprehending difficult concepts such as chemical bonding and molecular structure using appropriate teaching methods such as Round-Robin and Jigsaw instructional learning strategy to enhance their achievement in chemical bonding and molecular structure, hence this study is to investigate the relative effectiveness of Round-Robin, Jigsaw on senior secondary school chemistry students' academic performance on the concept of chemical bonding and molecular structure in organic chemistry giving their cognitive styles and school location.

OBJECTIVES

The objective of this study is to investigate the interactive effect of Round-Robin, learning strategy on student academic achievement in chemical bonding and molecular structure: specifically the study sought to.

- Students' mean achievement scores in chemical bonding and molecular structure when using Round-Robin taught and lecture method respectively.
- Students' mean retention scores in chemical bonding and molecular structure when using Round-Robin taught and lecture method.
- Effect of gender on students' mean achievement scores in chemical bonding and molecular structure when taught using Round-Robin instructional strategy.
- Effect of gender on students mean retention scores in chemical bonding and molecular structure when taught using Round-Robin instructional strategy.
- Interaction effects of gender and teaching methods on students mean achievement scores in chemical bonding and molecular structure.
- Interaction effects of gender and teaching methods on students mean retention scores in chemical bonding and molecular structure.

RESEARCH QUESTIONS

- What are the mean achievement scores of students' in chemical bonding and molecular structure when taught using Round-Robin instructional strategy and lecture method?
- What are the mean intention scores of students' in chemical bonding and molecular structure when taught using Round-Robin instructional strategy and lecture method?
- What is the effect of gender on students' mean achievement scores in chemical bonding and molecular structure when taught using Round-Robin instructional strategy?
- What are the effect of gender on students' mean retention scores in chemical bonding and molecular structure when taught using Round-Robin instructional strategy?
- What is the interaction effect of gender and teaching methods on students mean achievement scores in chemical bonding and molecular structure?
- What is the interaction effect of gender and teaching methods on students mean intention scores in chemical bonding and molecular structure?

HYPOTHESES

The following hypotheses were formulated to guide the study and were tested at 0.05 level of significance.

- **H₀₁:** There is no significant difference between the mean achievements scores of students chemistry taught chemical bonding using Round-Robin and those taught with lecture method.
- **H₀₂:** There is no significant difference between the mean retention scores of chemistry students' taught chemical bonding and molecular structure using Round-Robin and those taught using lecture method.
- **H₀₃:** There is no significant difference between achievement mean scores of male and female students in chemical bonding and molecular structure when taught using Round-Robin instructional strategy.
- **H₀₄:** There is no significant difference between the mean retention scores of male and female students in chemical bonding and molecular structure when taught using Round-Robin instructional strategy.
- **H₀₅:** There is no significant interaction effect of gender and teaching methods on students' mean achievement scores in chemical bonding and molecular structure.
- **H₀₆:** There is no significant interaction effect of gender and teaching methods on students' mean retention scores in chemical and molecular structure.

SIGNIFICANCE OF THE STUDY

This research will be beneficial to students, nation, chemistry teachers, curriculum planners or developers. It is believed that when the findings is presented in seminars, workshops, conferences when implemented. The following may be achieved also. It will enhance students' achievement and retention in chemistry and increase the number of students who will go into the study.

RESEARCH METHOD

The study adopted quasi-experimental design. This design according to (Nworgu, 2006) is a non-randomization of research subject. The design involves the pretest, post-test non-equivalent control design, this design was adopted because it was impossible for the researcher to randomly sample the subjects and assign them to groups without interrupting the academic schedules of the school learning activities.

- I = control group
- II = experimental group
- O₂ = posttest score
- X₂ = Round-Robin strategy
- X₁ = Lecture method
- X₃ = Jigsaw

The population used for the study consisted of all the Senior Secondary Two (SSII) chemistry students in Akwa Ibom State. There are twelve thousand seven hundred and sixty students in two hundred and fifty four public secondary school in Akwa Ibom State according to education management board in 2019.

The instrument used for data collection was Chemistry Achievement Test (CAT) and Chemistry Retention Test (CRT). These instruments were developed by the researcher and used for data collection. The CAT consisted of five three (53) multiple choice question, six hypothesis were adopted for the study and at the end of the research it was discovered that Round-Robin, instructional strategy enhance students' academic achievement in chemical bonding and also that school location and gender, do not statistically have any significant effect on students' achievement in chemistry.

RESULTS

The results of the study is presented according to the research questions and hypotheses that guided the study.

Research Question 1

What are the mean achievement scores of students in chemical bonding and molecule structure when taught using Round-Robin strategy and lecture method.

Teaching Method	N	Pretest Mean	SD	Posttest Mean	SD	Gain Score
• Round-Robin	120	28.19	5.30	33.18	4.66	10.10
• Lecture	120	23.00	5.22	26.71	4.86	3.61
• Mean Difference				17.67		

In the data in the table above the students taught chemical bonding and molecule structure using Round-Robin recorded a mean achievement score of 28.19 and standard deviation of 5.30 and a mean score of 33.18 and 4.66 respectively in a posttest. The data equally shows that students taught with lecture method had a mean achievement score of 23.00 with standard deviation of 5.22 in a pretest and as well recorded mean achievement of 26.71 and standard deviation of 4.86 and achievement score of 3.61. The table further showed that students taught using Round-Robin had a higher mean score than students taught using lecture method.

Hypothesis One

There is no significant difference between the mean achievement scores of chemistry students taught chemical bonding and molecular structure using Round-Robin instructional strategy and those taught using lecture method.

Table 4.2: Analysis of Covariance of Chemistry Students Achievement, Using Round Robin Instructional Strategy and Lecture Method.

Source	Type III Sum of Square	df	Mean Square	F	Sig.
• Corrected Modal	23.727	2	11.358	1.302	303
• Intercept	3197.793	1	3397.773	377.913	000
• Pretest	20.647	1	20646	3.387	132
• Group	470	1	19323	2.910	120
• Error	547	208	547	2.61	024
• Total	2792.505	200	9.645		
• Corrected Total	2802.100	200			

Data in table 4.2 shows that calculate value of 2.61 and significant p value of 0.24. Since the significant p value is less than the 0.05 level of significant, the null hypothesis stated is reflected. Therefore, there is a significant difference between the mean achievement scores of chemistry students taught chemical bonding and molecule structure using Round-Robin and those taught using lecture method. This is in the favour of student taught using Round-Robin instructional strategy.

Hypothesis Two

What are the mean retention scores of students in chemical bonding and molecular structure when taught using Round-Robin instructional strategy and lecture method? The mean retention of students taught using Round-Robin and Lecture method.

Method	N	Post Test Mean	SD	Retention Mean	SD
• Round drobin	120	35.18	3.59	36.60	4.01
• Lecture	120	28.67	3.59	27.98	2.87
• Mean Difference		7.55		9.72	

Data in above table reveals that the students taught with Round-Robin had a mean retention of 36.60 with standard deviation of 4.01 while those taught with lecture method had a mean retention of 28.67 with standard deviation of 2.87. The table further showed that students with Round-Robin had 9.72 mean retention score is higher than others in the lecture method.

Table 4.4: Analysis of Covariance of Chemistry Students Mean Retention when Taught Using Round-Robin and Lecture Method.

Source	Type III Sum of Square	df	Mean Square	F	Sig.
• Corrected Modal	33.488	2	16.740	1.186	.312
• Intercept	956.422	1	956.421	71.326	.000
• Protest	.005	1	.005	.000	.984
• Retention	32.471	1	32.476	2.362	.028
• Error	2646.102	198	13.391		
• Total	191350.000	200			
• Corrected Total	2668.580	200			

The data in above table reveals an f-calculated value of 2.36 and a significant p-value of 0.004. Since the significant p-value is less than 0.005 level of significant, the null hypothesis stated is not accepted. Therefore, there is significant difference between the hypotheses stated is not accepted. Therefore, there is significant difference between the mean retention of chemistry students taught chemistry using Round-Robin and students taught using lecture method. The result was in the favour of student taught using Round-Robin with higher mean retention.

Research Question Three

What is the effect of student's mean achievement scores in chemical bonding and molecular structure using Round-Robin instructional strategy delivery? Effect of gender on students mean achievement score in chemical bonding and molecular structure when taught using Round-Robin strategy is shown in the table below.

Table 4.5: Mean Achievement Score of Male and Female Students Taught Using Round Robin Instructional Strategy

Gender	N	Pretest Mean	SD	Pretest Mean	SD
• Male	70	25.97	4.23	30.24	4.00
• Female	32	26.09	4.47	28.22	3.58

Data in table 4.5 indicate that male students taught using Round-Robin had a pretest mean score and standard deviation of 25.97 and 4.23 mean score and standard deviation of 24.97 and 2.23 respectively and posttest mean and standard deviation scores of 30.24 and 4.00 respectively. The table also showed that the female students had a pretest mean and standard deviation scores of 25.7 and 4.47 respectively 30.22 and 4.60 for the posttest mean achievement and standard deviation respectively. This implies that males recorded a slightly higher posttest mean achievement scores than their female counter parts.

Hypothesis Three

There is no significant difference between the mean achievement scores of male and female students in chemical bonding and molecular structure when taught using Round-Robin instructional strategy.

Table 4.5: Analysis of Covariance on the Mean Achievement Scores of Male and Female Chemistry Students Taught Using Round-Robin.

Source	Type III Sum of Square	df	Mean Square	F	Sig.
• Corrected Modal	13.132	2	6.575	489	.616
• Intercept	5358.393	1	5358.392	398.800	.000
• Pretest	.064	1	.064	.005	.947
• Gender	13.126	1	13.126	.975	.326
• Error	2655.449	198	13.475		
• Total	181361.000	200			
• Corrected Total	2668.581	199			

S R squared = .005 (Adjusted R Squared = -.005)

Research Question Four

What is the effect of gender on students mean retention scores in chemical bonding and molecular structure when taught using Round-Robin? The effect of gender on students mean retention scores in chemical bonding and molecular structure when taught using Round-Robin is shown in the table below.

Table 4.6: Mean Retention Scores of Male and Female Students Taught Using Round-Robin

Gender	N	Pre-test Mean	SD	Retention Mean	SD
• Male	70	30.24	4.00	35.60	3.09
• Female	32	27.20	4.00	34.57	3.10

Table 4.6 shows that male students exposed to Round-Robin had a mean retention score of 35.60 and standard deviation of 3.09. They imply that male students exposed to Round-Robin had slightly higher mean retention scores than females.

Hypothesis Four

There is no significant difference between the mean retention scores of male and female students in chemical bonding and molecular structure in when taught using Round-Robin.

Research Question Five

What is the interaction effect of gender and teaching methods on students mean achievement scores in chemical bonding and molecular structure?

Table 4.7: Mean interaction effect of Gender and Method on Students' Mean Achievement Scores in Chemical Bonding and Molecular Structure.

Group	Gender	N	Mean
• Experimental	Male	70	33.23
	Female	32	30.00
• Control	Male	57	27.92
	Female	45	26.26

Summary of results presented in table 4.7 revealed that there is no interaction between gender and method on students' achievement scores in chemical bonding and molecular structure. This is because the mean achievement scores of male and female are higher with Round-Robin strategy than with the lecturer method. This indicate that Round-Robin is superior to lecture method at two level gender (male and female).

Hypothesis Five

There is no significant difference in the interaction effect of gender and lecture methods mean achievement scores to chemical bonding and molecular structure.

Table 4.8: Analysis of Covariance for Test of Significant of Interaction Effect of Gender and Lecture Methods on Students Mean Achievement.

Source	Type III Sum of Square	df	Mean Square	F	Sig.
• Corrected Modal	27.502	4	6.725	.489	.744
• Intercepts	5364.681	1	5364.681	397093	.000
• Protest	.015	1	.014	.001	.984
• Group	13.094	1	13.094	.977	.328
• Gender	9.137	1	9.137	.676	.328
• Group	9.136	1	9.138	.685	.413
• Error	2641.089	196	2.096	.156	.615
• Total	181350.000	199			
• Corrected Total	2668.580	200			

R squared = 0.10 (Adjusted R Squared = 0.10)

The result presented in table 4.8 shows that calculated value of 0.156 and significant p-value of 0.614. Since the significant p-value of 0.615 is greater than 0.05 level of significant, the null hypothesis stated is accepted. Therefore, there is no significant interaction effect of gender and the

teaching method on students mean achievement scores on chemical bonding and molecular structure.

Research Question Six

What is the interaction effect of gender and teaching methods on students mean retention scores in chemical bonding and molecular structure? The interaction effects of gender and teaching method on students mean retention scores in chemistry is shown below.

Table 4:9: Mean Interaction Effect of Gender and Round-Robin on Students Mean Retention Scores in Chemistry

Group	Gender	N	Mean
• Experimental	Male	70	35.60
	Female	32	34.59
• Control	Male	56	28.38
	Female	45	27.54

The breakdown of the above table shows that there is no interaction effect between gender and methods on students' retention score in chemistry.

Hypothesis Six

There is no significant interaction effect of gender and Round-Robin method on students mean retention scores in chemical bonding.

Table 4.10: Analysis of Covariance for Test of Significant of Interaction Effects of Gender and Round-Robin on Students Mean Retention Scores.

Source	Type III Sum of Square	df	Mean Square	F	Sig.
• Corrected Modal	2.733	5	.709	.082	.989
• Intercept	5472.498	1	5472.498	628.66	.000
• Pretest	1.134	1	1.132	.130	.720
• Group	.680	1	.680	.078	.781
• Gender	.225	1	.225	.026	.874
• Group Gender	421	1	422	1.28	.107
• Error	1699.087	196	8.713		
• Total	187996.000	200			
• Corrected Total	1701.920	200			

R squared = 002 (Adjusted R Squared = - 019)

The data in table 4.10 reveals the f-calculated value of 1.28 and significant p-value of 0.105 level of significant. The null hypotheses stated is accepted. Therefore, there is no significant interaction effect of gender and teaching method on students mean retention scores in chemical bonding and molecular structure.

CONCLUSION

The research reveals that the mean retention scores of male students taught chemical bonding using Round-Robin was slightly higher than this of the females taught using lecture method, however, there was no significant difference between the mean retention scores of male and female students in chemical bonding structure when taught using Round-Robin and there was no interaction between gender and method of teaching on the mean achievement scores than lecture method.

There was no interaction between gender and method of teaching on the mean retention scores of student taught chemical bonding and molecular structure.

Round-Robin students had a positive impact on male and female students mean retention than lecture method.

RECOMMENDATIONS

Since Round-Robin strategy was found to be an effective teaching strategy for improving students mean achievement scores and mean retention scores in chemical bonding, chemistry teacher's in collaboration with researchers should adopt the strategies.

REFERENCES

- Adeyemi (2014), Personal Factors as Predictors on Students Academic Achievement in *Colleges of Education Academic Journals* <https://academicjournals.org>.
- Adeyemi, T. O. (2008), Predicting Students Performance in Senior Secondary Schools. Scientific Research Publishing <https://sciporgreferencepaper>.
- Brain, E. S. (2023), Correlative effect of Teaching Strategy and Lecture Method on Students Achievement and Interest in Separation technique in Secondary Schools in Ikot Ekpene Senatorial District. Unpublished Ph.D Article in Chemistry Education, University of Uyo, Uyo.
- Brain, E. S. (2023), Influence of Think Pair Share Teaching Strategy on Senior Secondary School Students Achievement and Retention in Science Subjects in Akwa Ibom North East Senatorial District, Nigeria. *International Journal of Advancement in Education, Management Science and Technology*, Vol.6, No. 2, Sept. 2023, USA.
- Brain, E. S. (2023), Mind Mapping Based Instructional Strategy Delivery and Student Academic Achievement in Science Subject in Secondary School in Itu, Akwa Ibom State. *Texas Journal of Agriculture and Biological Sciences*.
- Brain, Sambo, Mary (2021), Effect of co-Operative Collaboration Interaction in Problem-Based Learning (PBL) Context on Students Achievement and Interest in Basic Science. *International Journal of Research Education and Management Science*, Vol, No.1, New York.
- Giginna and Nweze (2014), Factors Affecting the Effective Implementation of Senior Secondary School. *International Journal of Scientific Research*.
- Grace, N. (2019), Effects of Think Pair Share Instructional Strategy on Senior Secondary Students Achievement in Akwa Ibom State. M.Sc (Ed) Dissertation submitted to the dept of Science Education, Michael Okpara University of Agriculture Umudike.
- Okeke (2007), Effect of Class size on Students Academic Performance, *African Journal Online*.
- Taber, (2001), View of Assessment of Hands on Activities on Students Achievement and Attitude. *International Journal Corner*. <https://www.internationaljournalcorner.com>.