BSU Journal of Science, Mathematics and Computer Education (BSU-JSMCE) Volume 5, Issue 1, June 2025

EFFECTS OF THINK-PAIR-SHARE STRATEGY ON SENIOR SECONDARY II STUDENTS' PERFORMANCE IN CHEMISTRY IN MAKURDI, BENUE STATE

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Abstract

This study ascertained effect of Think-Pair-Share strategy on senior secondary students' performance in Chemistry in Benue State. The design for this study was quasi-experimental design, that is, a non-randomized post-test control group design. The population of this study consisted of 19,357 (10,237 male and 9,084 female) Senior Secondary II (SS2) students offering Chemistry in 183 government established co-educational senior secondary schools in Benue State in the 2023/2024 academic session. The sample was made up of 215 (110 male and 105 female) SSII students offering Chemistry in four government established schools in Makurdi Local Government Area of Benue State. The researchers used multi-stage sampling sapling procedure to obtain the sample. The researchers constructed Chemistry Performance Test (CPT) for data collection. CPT was trial tested on 30 students in a Secondary School within Makurdi that was not part of the sampled schools. The reliability of CPT was computed using Kuder-Richardson formula 20 (K-R). It yielded a reliability coefficient 0.88. The researcher collected the data with the aid of the research assistants who were the Chemistry teachers. The research questions were answered using mean and standard deviation. Analysis of Co-variance (ANCOVA) was used to test the null hypotheses at 0.05 alpha level. Findings revealed that there was a significant difference in the mean performance scores of students taught Chemistry using Think-Pair-Share strategy and the demonstration strategy; there was no significant difference in the mean performance scores of male and female students taught Chemistry using Think –Pair-Share Strategy. Based on the findings of this study it was recommended among others that Chemistry teachers should teach Chemistry using TPS since the strategy makes use of heterogeneous small groups of students who work together to maximize each other's learning potentials through collaborative learning which enhance students' academic performance.

Key words: Think-pair-share, Academic performance, Chemistry and Gender

Introduction

Science is very critical to technological development of a country. The advances in scientific knowledge have significantly contributed to the development of man and the society at large. It has made it possible for man to harness the many natural resources which are utilized to cure diseases, provide

answers to questions that once defiled understanding and solve simple and complex problems. Helmenstine (2019) states that science has done a great service to human beings. Man, a rational being, has observed problems of environment. This has led to many discoveries in different parts of science. Science is the study of the environment. This includes the study of animals, chemicals, force, earth and plants. This illustration explains the importance of science for national development and the need to improve its teaching at all levels of education.

Basically, the three main branches of science are: Biology, Chemistry and Physics. According to Atkinson (2014) and Swammy (2021) these branches are taught in unity at the basic level of education, but separately at the senior secondary school level in Nigeria. This study focused on Chemistry at senior secondary school level. This is a branch of science that is concerned with the properties of matter. Chemistry refers to the scientific study of matter, its properties, its interaction with other matter and with energy (Helmenstine, 2019). This implies that Chemistry deals with the components of every living thing including man. Chemistry is the science that deals with the properties, composition and structure of substances (elements and compounds), the transformations they undergo and the energy that is released or absorbed during these processes (Rocke, 2021)

Due to the importance of Chemistry, understanding basic chemistry has effect on the environment and our lives because almost everything on the environment is made up of chemicals, products such as the food we eat, drugs desks clothes we wear, and houses we live in. All these are made from chemicals changes we perceived within the environment and as a result of chemical changes for example changing of the air pattern, leaves changing colour, including various processes of preparing meals.

It is almost impossible to study science without the knowledge of Chemistry. Understanding basic Chemistry has effect on the environment and our lives because almost everything on the environment is made up of chemicals, products such as the food we eat, drugs desks clothes we wear, houses we lived in all are made from chemicals changes we perceived within the environment and as a result of chemical changes for example changing of the air pattern, leaves changing colour, including various processes of preparing meals. Okwuduba and Okigbo (2018) state that acquiring basic knowledge of chemistry can enhance decision making regarding day-to-day activities such as what are the right repellents for mosquitoes, what measurement is appropriate for such chemicals. Making of toothpaste, there may be a way in which one's body system is not comfortable with fluoride in toothpaste. The survival and success of nations in the modern world is hindered without advancement in science especially Chemistry. This is because the knowledge of Chemistry has made it possible for Chemist to produce drugs that treat varieties of illnesses. In addition, Chemistry has been utilized by food technologists to research on the composition of different food classes while at the same time improving on genetically modified food (Okwuduba & Okigbo, 2018; Swammy, 2021).

Despite the importance of Chemistry, Nigerian students have had a persistent low academic performance in the subject in external examinations (Rimso & Nja, 2017). Analysis of Senior School Certificate Examination (SSCE) conducted by the West African Examinations Council (WAEC) shows that students' performance has been inconsistent and unsatisfactory over the years (The Chief Examiner's Report, WAEC, 2016).

An analysis of students' performance in Chemistry has revealed that there has never been a year where students have recorded a 50% pass rate in Nigeria. Chief Examiner's Report (WAEC, 2016) particularly shows that Chemistry students' poor performance in Chemistry paper 2 (theory) over the years, arose from students' having difficulties in tackling questions which required explanations, making logical deductions, calculations, in chemical reactions periodic table, chemical symbols and formulae. These could be indications of the use of ineffective teacher-centered instructional strategies on the part of teachers. The unsatisfactory and inconsistent academic performance in Chemistry may have negative implications for a country like Nigeria which aims to produce scientists for national development in line with the National Policy on Education (FRN, 2014).

There is therefore the need for the chemistry teacher to discontinue the use of the ineffective teaching methods that may have negative effects on students' learning and use strategies that accommodate the interest of the learners (Bastian, 2021). This revealed that on an average, the chemistry teacher uses most of the time to talk in the class, while the students are given very little time to interact, ask questions as well as provide answers to questions asked by the teacher. Thus, little learning takes place which may result to low interest and poor performance in a subject like Chemistry which is activity-oriented. As such, there is need to adopt teaching strategies that may give room for students to enhance performance in Chemistry. One teaching strategy that could engage students' activities in learning Chemistry is think-Pair-Share teaching strategy.

Think-Pair-Share (TPS) is a cooperative instructional strategy of teaching that was developed and popularized by Frank Lyman and colleagues in 1981. TPS is a cooperative instructional strategy whereby students are expected to work together in groups of four to seven students under the supervision of the teacher who serves as a facilitator. The strategy was named after the stage at which students are expected to undergo when using the strategy. At the initial stage, students are put in a group of four or five regards on mixed gender and ability status (low-achieving students are mixed in same group with high achieving students) and are motivated to think about the solution to a problem and share the solution with team or group members. They are guided to share their ideas with others and discuss same. This helps them to maximize participation in the classroom. This also helps them to focus their attention on the material while at the same time, helping their group members to understand an elusive content (Akanmu, 2019).

Think-Pair-Share strategy involves three steps of: thinking, pairing and sharing. Yusuf, Owede and Bello (2018) opined that at the thinking stage, the teacher allows the students to think about the solution or answer to a given question. The students at this stage are first allowed to solve the problem individually. At the sharing stage, the teacher puts students in groups and asked them to share their thinking with members of the group. The teacher also makes the students understand that the success of an individual student depends on the success of the entire group at the plenary session. This rule often forces students who are obstinate with knowledge to share what they know with group members as the teacher may decide to choose anyone to represent the group. Think-Pair-Share, according to Napitupulu and Surya (2017), is a cooperative instructional strategy that arouses students' interest and make students more active and socialize,

encourage cooperation among male and female students in learning the material so as to enhance performance.

Gender is a crucial discourse in the academia and it is considered in this study. Since chemistry could be for both male and female students in the class, gender has been observed as a determinant of students' interest and academic performance. It is also a factor to be considered when preparing for teaching since Chemistry students are made up of male and female. Gender is a common term that refers to male and female. Adesoji and Kenni (2013) observe that gender has significant influence on Chemistry students' interest ad academic performance in examinations. Since contemporary focus is on how students learn cooperatively, it is vital for the teacher to use strategies that consider the gender disposition of the class and how students can cooperate across gender (mixing of male and female in same group). From the foregoing, the present status quo regarding poor academic performance of students in Chemistry is a source of concern. This cannot be allowed to continue. The desire to reverse the trend could be actualized with the use of effective teaching strategies. Strategies that consider the gender composition of the class and their interactions. It is in regard with this premise that this study investigated the effects of Think-Pair-Share (TPS) strategy on students' performance in Chemistry.

Statement of the Problem

Chemistry is very important due to the contributions it has to technology and industries globally which plays a significant role in national development. Despite the importance of Chemistry, students' performance in the subject has been poor. These reports (WAEC Chief Examiners, 2016, 2017, 2018 & 2019) are a disturbing trend for the government, teachers, school administrators, parents and senior secondary students. This is particularly disturbing because the SSS level of education constitutes the foundation of future carrier in Chemistry such as, Medicine, Pharmacy, Lecturing, Engineering, Nursing, Radiology and radiation science, Architecture, Food and nutrition. It is also a worrisome trend because it hinders students from achieving their goals of attaining higher education and thereby hinder Nigeria's dream of sustainable economic and technological sustainability. It is vital to explore possible solutions to this problem. It is against this backdrop that this study examined if Think-Pair-Share (TPS) strategy could improve students' performance in Chemistry in Benue State, Nigeria.

Purpose of the Study

The purpose of this study was to investigate effect of Think-Pair-Share strategy on senior secondary students' performance in Chemistry in Benue State. The study specifically:

1. investigated the difference between the performance scores of students taught Chemistry using Think-Pair-Share strategy and the demonstration strategy.
2. determined the difference between the performance scores of male and female students taught Chemistry using Think-Pair-Share strategy.

Research Questions

The following research questions guided this study:

1. What is the difference between the mean performance scores of students taught Chemistry using Think-Pair-Share Strategy and demonstration strategy?
2. What is the difference between the mean performance scores of male and female students taught Chemistry using Think-Pair-Share strategy?

Hypotheses

The following null hypotheses were formulated and tested at 0.05 level of significance:

1. There is no significance difference between the mean performance scores of students taught Chemistry using Think-Pair-Share Strategy and demonstration strategy.
2. There is no significance difference between the mean performance scores of male and female students taught Chemistry using Think –Pair-Share strategy.

Methodology

The design for this study was quasi-experimental design, that is, a non-randomized post-test control group design. The population of this study consisted of 19,357 (10,237 male and 9,084 female) Senior Secondary II (SS2) students offering Chemistry in 183 government established co-educational senior secondary schools in Benue State in the 2023/2024 academic session (Benue State Teaching Service Board, Makurdi, 2024).The sample was made up of 215 (110 male and 105 female) SSII students offering Chemistry in four government established schools in Makurdi Local Government Area of Benue State. The researchers used multi-stage sampling sapling procedure to obtain the sample. The researchers constructed Chemistry Performance Test (CPT) covering periodic table, stoichiometry chemical reactions, quantitative and volumetric analysis. The 40 CPT questions were multiple choice items with four options (lettered A to D). Copies of the instrument were given to three experts from Science and Mathematics Education, Benue State University for validation. The validators suggested that the items be restructured, not ambiguous and appropriate for the study. Ten items were not selected out of the 40 items in CPT (3, 7, 13, 17, 21, 23, 25, 27, 32 and 39) after psychometric analyses. The remaining 30 items were used for trial test. To ascertain the reliability of the instrument. CPT was trial tested on 30 students in a Secondary School within Makurdi that was not part of the sampled schools. The reliability of CPT was computed using Kuder-Richardson formula 20 (K-R). It yielded a reliability coefficient 0.88. The researcher collected the data with the aid of the research assistants who were the Chemistry teachers. Each of the teachers was trained as research assistants to teach Chemistry to their respective students. The study took six weeks. The pre-test was administered to the three groups during the first week of the study before treatment. The researcher has conducted experimental treatments and the tests within a school academic session to guard against experimental mortality as a result of transfer of Chemistry teacher at the end of the session. The Experimental treatment involved the following: thinking- The teacher posed a question or an issue associated with the lesson and asks students to spend a minute thinking alone about the answer or the issue. Students need to be taught that talking is not part of thinking time. During this time, students are encouraged to maintain absolute silence in order to promote their thinking. They were also asked to think independently on the possible answer to the question posed by the classroom teacher.

Pairing- The teacher asked students to pair up and discuss what they have been thinking about. Interaction during this period can be sharing answers if a question has been posed or sharing ideas if a specific issue was identified. Teachers allowed not more than four or five minutes for pairing. The teacher also decided to pair students across gender

and across achievement levels. The teacher also ensured that during the pairing process, the class did not become uncontrollably rowdy and difficult to manage. The pairs were encouraged to discuss the subject cooperatively.

Sharing- In this step, the teachers asked the pairs to share what they have been talking about with the whole class. It is effective to simply go around the classroom from one pair to another and continue until about a fourth or half of the pairs have had a chance to report. The teacher asked any member of the group to brief the class. The teacher also asked a student from each group to do the briefing. Post-test took place in the 6th week.

The research questions were answered using mean and standard deviation. Analysis of Co-variance (ANCOVA) was used to test the null hypotheses at 0.05 alpha level. ANCOVA was considered appropriate because intact classes were used for this study. ANCOVA was used to to control extraneous variables (Emaikwu, 2018).

Results

Research Question One

What is the difference between the mean performance scores of students taught Chemistry using Think-Pair-Share Strategy and the Demonstration strategy?

Table 1: *Mean and Standard Deviation of Mean Performance Scores of Students Taught Chemistry Using Think-Pair-Share Strategy and Demonstration Strategy*

Approach		Pre-Test	Post-Test	Mean Gain
Think-Pair-Share strategy	Mean	1.91	3.37	1.46
	Std. Deviation	0.42	0.30	
	N	98	98	
Demonstration strategy	Mean	1.90	1.98	0.08
	Std. Deviation	0.24	0.39	
	N	117	117	
Mean Difference		**0.01**	**1.39**	**1.38**

Table 1 reveals that the mean performance scores of students taught Chemistry using Think-Pair-Share strategy was 1.91 with standard deviation of 0.42 at pre-test. It also shows mean value of 3.37 with standard deviation of 0.30 in post-test. The mean performance of students taught Chemistry using Demonstration strategy was 1.90 with standard deviation of 0.22 during pre-test. It also shows mean value of 1.98 with standard deviation of 0.39 in post-test. Table 5 also reveals that the mean gain of students taught Chemistry using Think-Pair-Share strategy was 1.46, while those taught using Demonstration strategy had a mean gain of 0.08. The mean difference between the groups is 1.38 in favour of Think-Pair-Share strategy.

Research Question Two

What is the difference between the mean performance scores of male and female students taught Chemistry using Think –Pair-Share Strategy?

Table 2: *Mean, Standard Deviation of Mean Performance Scores of Male and Female Students Taught Using Think –Pair-Share Strategy in Chemistry*

Gender		Pre-test	Post-test	Mean Gain
Male	Mean	8.05	17.90	9.85
	Std. Deviation	1.72	1.32	
	N	56	56	
Female	Mean	8.04	17.41	9.37
	Std. Deviation	1.51	1.41	
	N	42	42	
Mean Difference		**0.01**	**0.49**	**0.48**

Table 2 indicates that the performance scores of male students taught Chemistry using Think-Pair-Share strategy was 8.05 with standard deviation of 1.72 at pre-test while that of post-test was 17.90 with standard deviation of 1.32. The mean performance scores of female students taught was 8.04 with standard deviation of 1.51 during pre-test. It also reveals mean value 17.41 with standard deviation of 1.41 in post-test. Table 8 also reveals that the mean gain of male students taught Chemistry using Think-Pair-Share strategy was 9.85, while that of female students was 9.37. The mean difference between the groups is 0.48 in favour of male students taught using Think –Pair-Share strategy.

Hypothesis One

There is no significance difference between the mean performance scores of students taught Chemistry using Think-Pair-Share Strategy and the Demonstration strategy

Table 3: *ANCOVA Result of the Difference between the Mean Performance Scores of Students Taught Chemistry Using Think-Pair-Share Strategy and the Demonstration Strategy*

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	104.124[a]	2	51.565	374.810	.000
Intercept	53.044	1	53.044	386.381	.000
Pretest	.051	1	.051	.354	.555
Method	**104.126**	**1**	**104.126**	**750.598**	**.000**
Error	28.654	212	.142		
Total	1571.157	215			
Corrected Total	**133.781**	**214**			

R Squared = .780 (Adjusted Squared = .778)

Table 3 reveals that F (1,214) = 750.598; p=0.000<0.05. Since p<0.05, the null hypothesis was therefore, rejected. It implies that there is a significant difference in the mean performance scores of students taught Chemistry using Think-Pair-Share strategy and the demonstration strategy. Based on evidence from data analysis, Think-Pair-Share Strategy significantly enhanced students' performance in Chemistry more than the use of demonstration strategy.

Hypothesis Two

There is no significant difference between the mean performance scores of male and female students taught using Think –Pair-Share Strategy in Chemistry.

Table 4: *ANCOVA Result of the Difference between the Mean Performance Scores of Male and Female Students Taught Using Think –Pair-Share Strategy in Chemistry*

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	8.111[a]	2	4.056	2.153	.122
Intercept	1251.006	1	1251.006	664.241	.000
Pretest	2.253	1	2.253	1.196	.277
Gender	**5.885**	**1**	**5.885**	**3.125**	**.080**
Error	178.919	95	1.883		
Total	30621.000	98			
Corrected Total	**187.031**	**97**			

R Squared = .043 (Adjusted R Squared = .023)

Table 4 reveals that F (1,97) =3.125; p=0.080>0.05. Since p>0.05, the null hypothesis was not rejected. It therefore, implies that, there is no significant difference in the mean performance scores of male and female students taught using Think –Pair-Share Strategy in Chemistry**.** Based on evidence from data analysis, there was no significance difference in the performance of male and female students when taught Chemistry using TPS strategy.

Discussion of Findings

The finding also revealed significant difference in the mean performance scores of students taught Chemistry using Think-Pair-Share Strategy and demonstration strategy. The finding agrees with , Napitupulu and Surya (2017), Yusuf, Owede and Bello (2018) who found that there is a significant difference in the mean performance scores of students taught Chemistry using Think-Pair-Share Strategy and demonstration strategy. The use of Think-Pair-Share strategy could have facilitated active learning as it appeals to one's senses of touch/feel, smell, hear, see, or taste.

The result also indicated no significant difference exists in the mean performance scores of male and female students taught using Think-Pair-Share strategy in Chemistry. This finding disagrees with the finding of Adesoji and Kenni (2013), Egolum, Samuel and Okonkwo (2019) who reveals that, interest is a positive feeling which one has for something he/her valued and is beneficial. TPS induces curiosity in chemistry students as they collaborate or interact with each other in their group or pairs toward the subject matter. This could be because Think-pair-share (TPS) instructional strategy is a learner-center technique that

encourages individual student to involve in critical thinking and work with other student in the process of knowledge building

Conclusion and Recommendations

Based on the findings of this study, TPS enhanced students' performance in Chemistry and it is gender friendly. It was recommended that:

1. Chemistry teachers should teach Chemistry using TPS since the strategy makes use of heterogeneous small groups of students who work together to maximize each other's learning potentials through collaborative learning which enhance students' academic performance.
2. Government through the Ministries of Education and teacher training institutions in Nigeria should ensure in-service training and retraining of teachers on TPS strategies because it utilises the principle of learning in groups in which students actively engage in learning, interact with themselves and materials and create knowledge.
3. Teacher training institutions in Nigeria should include collaborative teaching strategies such as Think-Pair-Share strategy in teacher training programmes to learn how to use collaborative learning strategies
4. TPS should be embraced by teachers to teach chemistry since it is gender friendly. Male students could work with female counterparts and work cooperatively by sharing ideas, discussing, clarifying and challenging one another towards arriving at a reasonable answer to be finally shared with the entire class.

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