EFFECT OF THINK – PAIR – SHARE INSTRUCTIONAL STRATEGY ONSECONDARY SCHOOL STUDENTS' CHEMISTRY ACHIEVEMENT IN ZARIA EDUCATIONAL ZONE, KADUNA STATE

[1]YAKUBU, A. A.,, [1]ABDULKADIR, S. A.,, [1]YERIMA, H., & [2]YAKUBU, N. O.
[1]Department of Science Education,
School of Science and Technology Education,
Federal University of Technology, Minna Niger State.
[2]Department of Science Education and Mathematics,
Faculty of Education,
Ahmadu Bello University, Zaria, Kaduna State.
E-mail:abdullahiyakub74@yahoo.com
Phone No: +234-706-569-9399

Abstract
This study examined the effect of Think – Pair - Share instructional strategy on secondary school students' Chemistry achievement in Zaria educational zone, Kaduna state. Population of the study consist of 2,466 (1,316 Male;1,150 Female) senior secondary school II Chemistry students in Zaria educational zone, Kaduna State. The study employed quasi experimental research design using pretest posttest non randomized control group design. Simple random sampling technique by balloting system was used to select two out of twenty two Government secondary schools in Zaria educational zone of Kaduna State. A sample size of 145 (77 Male: 68 Female) from a population of 2,466 (1,316 Male: 1,150 Female) Chemistry students were selected for the study using an intact class. The instruments used for the study was Chemistry Achievement Test (CAT). The CAT was validated by two experts from Federal University of Technology, Minna respectively. Thus, the CAT gave a reliability Coefficient of 0.78 using Guttmann Split half reliability test. Analysis of Covariance (ANCOVA) was used to test the two null hypotheses at 0.05 levels of significance. Findings from this study revealed that there was significant difference between Think – Pair - Share instructional strategy on secondary school students' achievement in Chemistry. And also there is no significant difference between Think – Pair – Share instructional strategy on senior secondary school male and female students' achievement in Chemistry. Based on research findings for this study, it was further recommended that Chemistry teachers should frequently explore Think – Pair – Share instructional strategy during Chemistry instructions so as to aid better achievement in Chemistry.

Keywords: Think–Pair–Share Instructional Strategy, Achievement in Chemistry, Thermodynam*ics*

Introduction

Chemistry plays a pivotal role in sustainable growth and development of any society (Njoku, 2017) thus, the importance of Chemistry in any society cannot be over - emphasized especially in Nigeria where its major economic base relies on Petroleum and Petrochemical products (Akinsola, 2015; Njoku, 2017). Therefore, any nation that aspires to be great must pay adequate attention to the quality of teaching and learning of chemistry in its institutions of learning especially at secondary school levels where students are expected to pass Chemistry at credit level before being admitted into science base fields of study, such as but not limited to Medicine, Engineering and Pharmacy (Akinsola, 2015; Njoku, 2017).

Despite the importance of Chemistry, the West African Examination Council (WAEC) chief examiners reports have continue to show a decline in Chemistry achievement among secondary school students as revealed in table 1.

Table 1: Kaduna State Senior Secondary School WAEC, 2014 – 2018 Chemistry Result

Year	A1 – C6 (%)	D7 – E8 (%)	F9 (%)	ABS (%)
2014	23.23	33.11	41.88	1.62
2015	21.19	32.79	45.20	0.89
2016	18.32	29.59	50.41	1.63
2017	15.58	27.43	55.30	1.69
2018	10.25	24.24	63.20	2.32

Source: WAEC National Head Quarter, Yaba Lagos (2018)

Table 1 revealed a decrease in percentage pass rate at credit level from23.23% to 10.25% in 2014 to 2018 respectively, while percentage failure rate increases from 41.88% to 63.20%in 2014 to 2018 respectively which implies poor achievement of students in Chemistry from 2014 – 2018 . Moreover, in a seminar contribution organized by the Nigerian Educational Research and Development Council (NERDC, 2018) on "Difficult Concepts in Sciences" were the "Chemistry Group" identified 'Reaction Mechanism, Types of Thermal Reaction, balancing of chemical reactions, entropy and enthalpy of reactions' as some of the concepts students finds difficult to understand in Chemistry, Moreover, these identified concepts are rooted from the concept Chemical Thermodynamics, unfortunately enough one of the major topic students attempt during senior school certificate examinations, which if well treated will help in students understanding other chemistry concepts thereby improving achievement in Chemistry. Thus, these calls for the need to address these failure rates with a view to checkmate its further occurrences. Research findings attributed the cause of difficulty among students on the concept chemical thermodynamics to lack of adequate and effective use of teaching strategy which are students centered to replace teacher centered strategies respectively(Al – Mustapha, 2014; Opara, 2016; Dantani, 2017; Shehu, 2018). Thus, this study examined the extent at which the use of think – Pair – Share instructional strategy will improve secondary school students' achievement in the concept Chemical thermodynamics.

Think – Pair – Share was developed by Frank Lyman in University of Maryland in 1981, Lyman revealed that Think – Pair – Share instructional strategy is a cooperative instructional strategy involving students applying critical thinking skills, share ideas among their pairs and takes responsibility of their learning during instruction (Ameh, 2016; Dantani, 2017). Furthermore, Dantani and Opara, (2017) revealed that Think – Pair – Share instructional strategy is a structured Student centered instructional strategy involving students working together as a group or team towards meeting up with the lesson objective. Thus, the use of Think – Pair – Share instructional strategy is being characterized base on "5E's" of science learning which are ability to; Engage, Explore, Explain, Elaborate and Evaluate (Akinsola, 2015, Ocho, 2016 & Eze, 2017), the strategy is constructive in nature which involves learners' active participation, promote skill acquisition and be able to generate interest among students in the learning process thereby making learning meaningful (Timothy, 2013; Ocho, 2016; Dantani, 2017).

Achievement is an evaluative tools use to assess the quality and quantity of instruction delivery in a normal classroom setting (Adegoke 2015; Ameh, 2016) it can also be referred to as the level of success attained by students after being exposed to a particular instructional strategy (Jimoh, 2015 & Dantani, 2017).Thus, base on this study, achievement is the learning outcome after the students have been taught the concept chemical thermodynamics using Think – Pair – Share instructional strategy. Which may also pre – inform teachers and students on effectiveness of the strategy.

Research findings attributed to Abdullahi and Mansoor (2016) in a study on Impact of Think – Pair – Share strategy on achievement and retention in Chemical thermodynamics among secondary school students in Kano municipal revealed that there is significant difference between Think – Pair – Share strategy and achievement on the concept chemical thermodynamics and further recommended that teachers should explore Think – Pair – share strategy to supplement the conventional teaching methods. Moreover, Lukman and Yusuf (2017) also revealed that there is no significant difference between Think – Pair – Share strategy and achievement in the concept Chemical thermodynamics.

Various research findings revealed divergent opinions on the relationship that exists between gender and achievement in some selected concepts in Chemistry (Al- Mustapha, 2014; Jimoh, 2015; Ameh, 2016; Dantani, Olorundare & Olorunyomi, 2017).Findings revealed by Bashir and Mahmud (2017) in a study on impact of Think – pair – Share strategy on gender and achievement in Chemical thermodynamics among secondary school students in kano Municipal, revealed that there is significant difference between male and female students exposed to Think – Pair – Strategy on achievement in Chemical thermodynamics.

This finding disagrees with the findings of Habib and Abdulhakim (2016) on influence of gender on achievement in Chemical thermodynamics using Think – Pair – Share strategy among secondary school students in Funtua, Katsina state. Which revealed that there is no significant difference between male and female students exposed to Think – Pair – Share strategy on Chemistry achievement. Despite the importance of the concept Chemical thermodynamics in Chemistry learning coupled with an increase in failure rate, prompted the need to find out lasting solution to improve achievement in chemical thermodynamics so as to avoid consistence poor result in Chemistry during WASSCE. Thus, this study intends to examine the effect of Think – Pair – Share strategy on achievement in Chemical thermodynamics among secondary school students in Zaria educational zone, Kaduna State.

Objectives of the study

The objectives of this study are to determine the effects of:

(i) Think – Pair – Share instructional strategy on secondary school students' achievement in the concept Chemical thermodynamics.

(ii) Think – Pair – Share instructional strategy on secondary school male and female students' achievement in the concept Chemical thermodynamics.

Research Questions

The following research questions guided the study:

(i) What is the effect of Think – Pair - Share instructional strategy on secondary school students achievement in the concept Chemical thermodynamics?

(ii) What is the effect of Think - Pair - Share instructional strategy on male and female secondary school students achievement in the concept Chemical thermodynamics?

Null Hypotheses

The following null hypotheses were tested in the study;

Ho_1. There is no significant difference betweenThink - Pair - Share instructional strategy on secondary school students achievement in the concept Chemical thermodynamics.

Ho_2. There is no significant difference between Think - Pair - Share instructional strategy on secondary school male and female students achievement in the concept Chemical thermodynamics.

Methodology

Quasi Experimental Research Design. Specifically, Pretest - Posttest Non – equivalent and non-randomized control group design was adopted for this study. The design is considered suitable for the study due to the fact that intact classes were used to avoid disruption of normal class lessons or activities. The Population for this study consists of 2,466 (1,316Fale; 1,150 Female) Class II Chemistry students in Zaria metropolis of Kaduna State as shown in Table 2.

Table 2: Population of SSII Students offering Chemistry in Zaria Educational Zone

S/N	Name of School	Male	Female	Total
1	G.S.S., Zaria (SNR)	80	63	143
2	G.S.S., Muchia (SNR)	100	80	180
3	G.S.S., Chindit (SNR)	51	26	77
4	G.S.S., Tudun Saibu (SNR)	60	40	100
5	G.S.S., Magajiya (SNR)	30	60	90
6	G.S.S., Aminu (SNR)	42	40	82
7	G.S.S., Kaura (SNR)	40	60	100
8	G.S.S., Pada (SNR)	45	23	68
9	G.S.S., DogonBauchi (SNR)	100	80	80
10	G.S.S., K/ Kuyanbana (SNR)	20	15	35
11	G.S.S., Diriya	30	15	45
12	G.S.S., Kugu	25	10	35
13	G.S.S., Dakace	25	18	43
14	G.S.S., Gimba	30	40	70
15	G.S.S., Awai	50	60	110
16	G.S.S., T/Jukun	16	40	56
17	G.S.S., Yakasai	20	40	60
18	G.S.S., Likoro	30	60	90
19	Alhuda Huda, Zaria	300	-	300
20	Science Secondary School	300	-	300
21	G.G.S.S., Zaria	-	200	200
22	G.G.S.S., K/Gayan	-	100	100
	TOTAL	**1316**	**1150**	**2466**

Source: Zaria Zonal Education Office, (2019)

Simple random sampling by balloting technique was used to select two government secondary schools in Zaria educational zone of Kaduna state. A sample size of 145 (96 Male, 49 Female) Chemistry students were used for the study using an intact class as shown in Table 3.

Table3: Sample of the Study

School	Group	Male	Female	Total
G.S.S Chindit	Experimental	51	26	77
G.S.S Pada	Control	45	23	68
	TOTAL	**96**	**49**	**145**

Chemistry Achievement Test (CAT) was used to collect data for this study. The CAT was developed by first constructing a test blue print for the different content specified on the

concept Chemical thermodynamics to generate 25 multiple choice questions options A - D. The CAT was validated by two experts from Ahmadu Bello University, Zaria Kaduna State which gave a reliability coefficient of 0.82 using Guttmann split half reliability test hence, considered reliable and suitable for this study. The CAT was administered to the students in a normal class setting for pretest result.

The experimental group were taught the concept Chemical Kinetics using Think – Pair – Share instructional strategy which involves four stages; lesson introduction, students' exploration, individual test and evaluation respectively, while control group were exposed to lecture method.

The Think – Pair – Share instructional strategy involves the students grouped in pairs as a learning group by the teacher, there after students are given guide or instruction on how to find out the learning cue through critical thinking and share of ideas among the pairs after which they are evaluated or assessed from their trial and error/success session which is then followed by correction where necessary and conclusion. However, after the pretest have been administered before the treatment, a reshuffled version of CAT was later administered to the students as posttest. However, both the pretest and posttest results were then collected and analyzed using Analysis of Variance (ANOVA) to analyze pretest result and Analysis of Covariance (ANCOVA) to test the null hypotheses at 0.05 level of significance. Statistical Package for Social Sciences (version 23.0) was used for the analysis. Thus, the research period lasted for six (6) weeks.

Results

Table: 3 Summary of ANOVA Pretest Results on Achievement Scores in Chemistry.

	Sum of Square	**df**	**Mean Square**	**F**	**Sig**
Between Groups	2887.463	8	360.933	0.9	0.028
Within Groups	43936.822	136	323.065		
Total	46824.286	144			

Significant at P > 0.028

Pretest results presented in table 3 using Analysis of Variance (ANOVA) was used to establish the students' entry level. The table revealed that P value = 0.028, hence 0.028 < 0.05 level of significance. Therefore, there is significant difference between experimental and control groups on pretest. This implies that there is an intervening variable which shows that the students' entry behaviors are not on the same levels before the treatment. Thus, both groups were found to be different before treatment commenced. Hence, justifies the use of Analysis of Covariance (ANCOVA) to test the null hypotheses using pretest results as covariate.

Hypothesis One

There is no significant difference betweenThink - Pair - Share instructional strategy on secondary school students achievement in the concept Chemical thermodynamics.

Table 3: Summary of ANCOVA Test Results of Groups with Achievement

Source	Type III Sum of Square	df	Ms	F_{cal}	p_{value}
Corrected Model	8012.212[a]	2	4006.106	19.157	0.000
Intercept	30229.081	1	30229.081	144.555	0.000
Pretest	545.886	1	545.886	2.610	0.108
Groups	7116.645	1	7116.645	34.032	0.008
Error	29694.753	142	209.118		
Total	202618.000	145			
Corrected Total	37706.966	144			

Significant at P > 0.008

Table 3 revealed that $F_{(1,144)} = 34.032$, with P = 0.008 at 0.05 level of significance. This shows that p value is less than 0.05 (0.008 < 0.05). Therefore, the null hypothesis one is rejected. This implies that there is significant difference between Think – Pair – Share instructional strategyon senior secondary school students' achievement in the concept Chemical Thermodynamics.

Hypothesis Two

There is no significant difference between Think - Pair - Share instructional strategy on secondary school male and female students achievement in the concept Chemical thermodynamics.

Table 4: Summary of ANCOVA Test Results of Groups with Achievement and Gender

Source	Type III Sum of Square	df	Ms	F_{cal}	p_{value}
Corrected Model	8746.427[a]	2	2186.607	10.5700.000	
Intercept	25438.787	1	25438.787	122.9750.000	
Pretest	730.220	1	730.220	3.5300.062	
Groups	5904.863	1	5904.863	28.5450.008	
Gender659.121 1	659.121		3.186	0.786	
Error	28960.539	140	206.861		
Total	202618.000	145			
Corrected Total	37706.966	144			

Not Significant at P < 0.786

Table 4 revealed that $F_{(1,144)} = 3.186$, with P = 0.786 at 0.05 level of significance. This shows that P value is greater than 0.05 (0.786 > 0.05). Therefore, null hypothesis two is retained. This means that there is no significant difference between Think – Pair – Share instructional strategy on senior secondary school students achievement in the concept Chemical thermodynamics.

Summary of findings

The following Submissions are the summary of findings for this study:

i. There is significant difference between Think – Pair – Share instructional strategy on senior secondary school students' achievement in the concept Chemical thermodynamics.
ii. There is no significant difference between Think – Pair instructional strategy on senior secondary school male and female students' achievement in the concept Chemical thermodynamics.

Discussion of Findings

There is significant difference between Think – Pair – Share instructional strategy on senior secondary school students' achievement in the concept Chemical thermodynamics. These finding agrees with Abdullahi and Mansoor (2016) in a study on Impact of Think – Pair – Share instructional strategy on achievement and retention among secondary school students in Kano municipal,which revealed that there is significant difference between Think – Pair – Share instructional strategy and achievement in the concept Chemical thermodynamics. The findings also disagrees with findings revealed by Lukman and Yusuf (2017) which shows that there is no significant difference between Think – Pair – Share strategy and achievement in Chemical Thermodynamics. Therefore, the use of Think - Pair – Share strategy is in no doubt an instructional strategy which improves achievement in the concept Chemical thermodynamics if well explored by Chemistry teachers and students respectively in all institutions of learning.

There is no significant difference between Think – Pair instructional strategy on senior secondary school male and female students' achievement in the concept Chemical thermodynamics. This finding disagrees with the findings of Bashir and Mahmud (2017) in a study on impact of Think – pair – Share strategy on gender and achievement in Chemical Thermodynamics among secondary school students in kano Municipal, which shows that there is significant difference between male and female students exposed to Think – Pair – Strategy on achievement in Chemical Thermodynamics. Moreover, the study agrees with the findings of Habib and Abdulhakim (2016) on influence of gender on achievement in Chemical Thermodynamics using Think – Pair – Share strategy among secondary school students in Funtua, Katsina state. Which revealed that there is no significant difference between male and female students exposed to Think – Pair – Share strategy on achievement in Chemical Thermodynamics.Thus, the use of think – Pair – Share instructional strategy have shown to be gender friendly on achievement in Chemical Thermodynamics irrespective of being a male or female, respectively.

Conclusion

Think – Pair – Share Instructional Strategy improves secondary school students' achievement in Chemical Thermodynamics and also shown to be gender friendly. Thereby, improves students performance in SSCE Chemistry examinations.

Recommendations

Based on research findings for this study, it was further recommended that Chemistry teachers should frequently explore Think – Pair – Share instructional strategy during Chemistry instructions so as to aid better achievement in Chemistry.

References

Abdullahi, A. Y., & Mansoor, A. (2016). Impact of Think – Pair – Share strategy on retention and achievement in chemical thermodynamics among secondary school students in Dutse, Jigawa State. *Journal of research and Educational Development (JORED)*.Vol.5. Nos 1&2,205 -218.

Abdurrahman, O. Y., & Malik, S. Z. (2017). Influence of Think – Pair – Share strategy on motivation and achievement in chemical thermodynamics among secondary students in Nassarawa, kano State. *Journal of the National Association for science, humanities and Education Research*,12(4), 105 – 114.

Adegoke, F. A.(2015).*Teaching for Nigerian secondary schools modern strategies in the teaching of Chemistry.* Ibadan: Powerhouse Press Publisher.

Akinsola,N.(2015).EducationandScience,Technology.*Journal of Research in Science Teaching,* 10(2),12-16.

Al-Mustapha, A. (2014). Effect of team teaching on the chemistry achievement of secondary students'in Chemistry.*Journal of Social Science Education,* Kebbi State University of Science and Technology, Aliero. 4(1), 22 - 37

Ameh, S. (2016).Gender related differences in acquisition of formal reasonings chemata: Pedagogic implication ofTeaching science using Think – Pair – Share Strategy.*InternationalJournalof Education,* 23(1), 435-440.

Bashir, A. E., & Mahmud, Y. E. (20017). Impact of Think – pair – share strategy on gender and achievement in Chemical Thermodynamics among secondary students in Kano Municipal. *International Journal of Scientific Research,* 5(8),116-123.

Dantani, A. A. (2017). Effect of Think – Pair – Share collaborative instructional strategy on students' achievement and retention in Chemical Thermodynamics.*Journal of Art and Science Education,* 6(2), 415 – 423.

Eze, S. (2017). Effect of practical knowledge of Chemistry as predictors of students' performance in theoretical aspect of Chemistry. *Journal of Art and Science Education,*Universityof Nigeria, Nsukka, 6(2), 276 – 289.

Habib, R. S., & Abdulhakim, Z. N. (2016). Influence of gender on achievement in Chemical Thermodynamics using Think – Pair – Share strategy among secondary students in Funtua, katsina State. *Journal of Nigerian Academy of Education,* 2,(12),132-140.

Jimoh, F. (2015). Gender, Science choice and achievement : A maltese perspective.*International Journal of Science Education,* 14(4),445-461.

Lukman, A. Z., & Yusuf, B. M. (2017). Correlation between Think – Pair – Share and STAD strategies on achievement in Chemical Thermodynamics among secondary School students in Oro, Kwara state. *Journal of Emerging Trends in Educational Research and Policy studies,* 5(3), 38 – 46.

Nigerian Educational Research and Development Council (NERDC, 2018).Workshop on difficult concepts; *Chemistry Group Report*. Lagos NERDC Press, Yaba, Lagos, Nigeria.

Njoku, F. (2017). Role of chemistry for sustainable development. Retrieved on 13th July, 2016 from http://www.antoine.frostburg.edu/chem.pdf

Ocho, L. O. (2016). National development and the curriculumin Oriaifo, S. O. Edozie, G. C.; & Ezeh, D. N. (eds.),*Curriculum issues in contemporary Education.* BeninCity: Da Sylra.

Olorundare, A. S. (2017). Correlates of poor academic performance of secondary school students in the Chemistry in Nigeria. *Paper presented at the International Institute for Capacity Building in Higher Education,Virginia State University,Virginia, USA.* 20th–31s tJune, 2014.

Olorunyomi, A. A. (2017). Effect of experiential teaching method on students' achievement in Chemistry. *Journal of Science Education,* Ekiti State University,Ado Ekiti, 4(1), 115 - 127.

Opara, N. C. (2016). Effect of collaborative instructional strategy on students' achievement and interest in Chemistry.*International Journal of Science Education,* 16(6), 45-65.

Shehu, M. U, (2018). Effect of STAD instructional strategy on achievement in the concept Chemical Thermodynamics among secondary school students in Zaria educational zone of Kaduna state. *International Journal of Education,* 4(11), 244 -247.

Timothy, M. T. (2013). Effect of activity-based on psychomotor skills acquisition and interest of senior secondary 2 in Chemistry. *Journal of Education,* 2(1), 222 - 236.

Usman, A. Y., & Mustapha, O. F. (2018). Effect of Think – Pair – Share and lecture methods on retention and achievement in Chemical Thermodynamics among secondary students in Kashere, Gombe State. *International Journal of Academic Research,* 4(2)61 – 66.

WAEC (2014 - 2018). *Chief Examiner's reports* for May/June WASSCE. Lagos:WAEC.