Journal of CUDIMAC (J-CUDIMAC)
ISSN 0794-4764 (Print) ISSN 2651-6063 (Online)
Vol. 8, No.1, September, 2020

Comparative Effects of Think – Pair -Share and Group Investigation Cooperative Learning Strategies on the Academic Achievement of Students' in Sound Waves Physics Concepts in Kankia Township

[1]Omiola, M.A., [2]Muhammed, R.E. & [3]Ojeleye, A.A.

[1]Department of Science Education, Federal University Dutsin-Ma, Katsina State.
[2]Department of Science Education, Faculty of Education, University of Ilorin.
[3]Department of Science and Mathematics Education, Faculty of Education, University of Ibadan.
Corresponding: tayoprecious@gmail.com

Abstract

This study observed and compared the effect of think-pair share and group investigation cooperative learning strategies on the academic achievement of students' in sound waves physics concept in Kankia Township. The study targeted all SSI physics students in all public secondary schools in Kankia Township. Three intact classes of 45, 36 and 39 samples making a total of 120 students were used from randomly selected public secondary schools in Kankia Township. The instrument used in collecting data was a test instrument called 'Sound Waves Physics Achievement Test (SWPAT). It is 30 multiple choice questions on sound waves physics concept taken from WAEC and NECO examinations. The instrument was faced validated using the two experienced physics teachers from the two senior secondary schools in Kankia. The instrument SWPAT was used as pre-test for the three groups and it was used as post-test after teaching the experimental group I with (Think-pair-share), experimental group 2 with (Group Investigation) and the control group with lecture method for four periods. The data collected was analyzed using frequency counts, mean and t-test statistical analysis. The results of the finding showed that, there is significant difference in the mean achievement scores of students across the three groups who were taught sound waves physics concept and the difference is in favour of those taught using think-pair-share and group investigation cooperative strategies. Added to the above, the finding indicated that there is significant difference in the mean achievement scores between male and female students exposed to sound waves physics concept using think-pair-share cooperative learning strategy and this is in favour of the male students. The results of this study equally revealed that there is no significant difference in the mean achievement scores between male and female students exposed to group investigation cooperative learning strategy. Based on the findings, it is recommended that the government and the school authority should recruit qualified physics teachers and make provision and necessary facilities for the use of think-pair-share and group investigation cooperative learning strategies in the school.

Keywords: *Think-Pair-Share, Group Investigation, Sound Waves, Achievement, Concept, Cooperative Learning*

Introduction

One of the cooperative learning strategies is Think-Pair-Share developed by Lyman in 1981 as a new cooperative learning strategy (Dewi, 2011). This is a smart academic teaching technique model for promoting critical thinking and articulate communication in the classroom. In short, Think-Pair-Share provides an opportunity for all students to share their thinking with a least one or two members of the group, which in turn, increase their sense of involvement in the classroom teaching learning process. The benefits of this strategy include: First, presenting "think time" and improves the students' response quality. Second, students became actively participated in thinking about the academic concepts presented in lesson. Third, students get time to mentally "chew over" new ideas in direction to keep them in memory. Fourth, teacher gives students time to "think-pair -share" throughout the lesson, more of the critical information will be kept in place. Fifth, the students talk over new ideas, they are supported to make sense of those new ideas refer to their basic knowledge. During this time, discussion step resolves the problem on their misunderstanding of the topic discussed. Sixth, students are wished to participate since they do not feel the peer pressure appeared in front of the whole class. Seventh, Think-Pair-Share is easy to apply on the spur of the moment. The last benefit is that it is applicable easily for the big classes (Mataram, Afan, Marhaeni, Dantes, 2013).

Among the benefits of think pair share suggested by Reinhart (2000) are: 1. Helped to improve class discussions 2. Allowed students time to think individually 3. Increased individual accountability and personal responsibility for learning and participation in class 4. Students were more willing to share ideas with the whole class 5. Chance to develop deeper understanding of class material and 6. The teacher will be able to see better what students understood.

Group Investigation is one of cooperative learning methods which focused on student's participation and activity. According to Sharan and Sharan (1992), Group Investigation is a cooperative learning method to integrate interaction and communication in the classroom with the process of academic inquiry. The students are taught to work together with their friends. They work together to achieve the goal or the success which has always been desired by them.

Implementation of GI proceeds in six steps as reported by Tan, Sharan & Lee, (2006). First, the teacher presents a multifaceted problem to the class, and students choose an interest group. The problem posed here is particularly important, as a variety of reactions from students is necessary for appropriate group formation. Second, groups plan their investigation – the procedures, task and goals consistent with the chosen subtopic. Third, groups' carryout the investigation as planned in the above step. Fourth, groups plan their presentation. They evaluate what they have learned, and synthesize into forms that can be understood by the class. Fifth, groups conduct the presentation. Finally, the teacher and students evaluate the investigation and result presentation. Throughout the process, group representatives often make reports to the class, helping group members appreciate that they are part of a larger social unit.

Benefits of Group Investigation cooperative learning strategy (GI) include: Each member has a role. There is a direct interaction between students. Each group member is responsible for learning as well as friends of his group. The teacher helps develop group interpersonal skills and the teacher only interacts with the group when needed (Carin, 1993).

Physics explains the fundamental laws of the universe and introduces important concepts that are essential for advanced study of chemistry, biology and all other branches of science. Physics is essential for understanding chemistry. Without physics students cannot understand major chemical principles. Physics extends well into our everyday life, describing the motion, forces and energy of ordinary experience. In actions such as walking, driving a car or using a phone, physics is at work. For everyday living, all the technologies you might take for granted exploit the rules of physics (Egoyan, A., Mirtskhulava, M., & Chitashvili, D., 2005).

Physics is one of the most fundamental natural sciences. It involves the study of universal laws, and the behaviours and relationships among a wide range of physical phenomena. Through the learning of physics, students will acquire conceptual and procedural knowledge relevant to their daily life. In addition to the relevance and intrinsic beauty of physics, a study of physics also helps students to develop an understanding of the practical applications of physics to a wide variety of other fields. With a solid foundation in physics, students should be able to appreciate the intrinsic beauty and quantitative nature of physical phenomena, and the role of physics in many important developments in engineering, medicine, economics and other scientific and technological fields. Furthermore, learning about the contributions, issues and problems related to innovations in physics will help students to develop a holistic view of the relation of science, technology and society. Physics, like other science electives, will provide a platform for developing scientific literacy and for building up essential scientific knowledge and skills for life-long learning in science and technology. However, as important as physics is an essential part of science and assist in the meaningful development of the nation, the students perform low in the subject (Chief WAEC, 2019).

Research Conceptual Framework

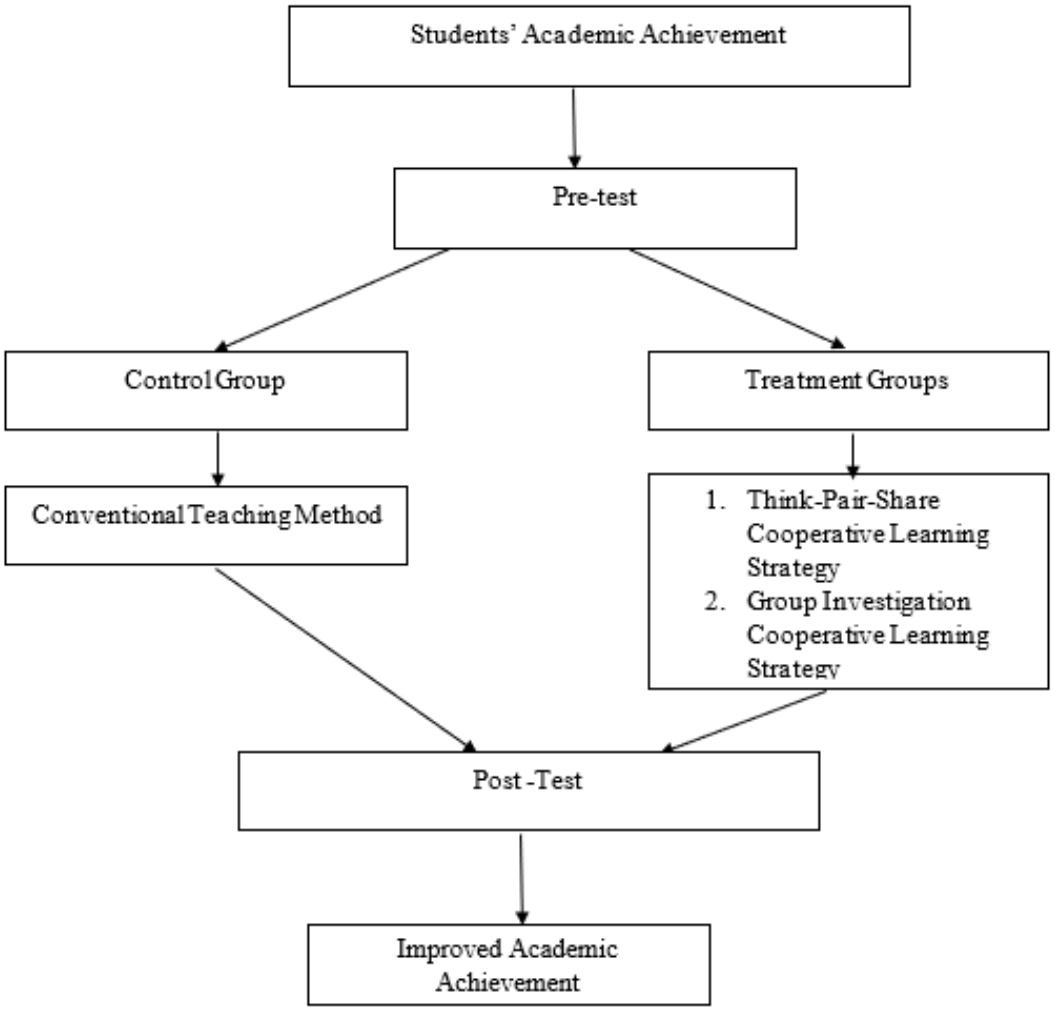

Fig.1: The Conceptual Framework on the Effectiveness of Think-Pair-Share, Group Investigation and Conventional Methods

Purpose of the Study

The main purpose of this study was to compare the effects of Think – Pair -Share and Group Investigation Cooperative Learning Strategies on the academic achievement of secondary school students in sound waves physics concepts in Kankia Township. Specifically, the study:

1. Determine the effects of think-pair-share strategy, group investigation strategy and conventional strategy in sound waves physics concept;
2. Examine the difference in male and female students' academic achievement in sound waves physics concept after being taught using think-pair-share strategy;
3. Survey the difference in male and female students' academic achievement in sound waves physics concept after being taught using group investigation strategy

Research Questions

The following research questions were formulated to guide the conduct of this study:

1. What are the effects of think-pair-share, group investigation and conventional strategies on students' academic achievement in sound waves physics concept?
2. Will there be any significant difference in the academic achievement of male and female students taught sound waves physics concept with think-pair-share?
3. Is there any significant difference in the academic achievement of male and female students taught sound waves physics concept with group investigation strategy?

Research Hypotheses

H01: There is no significant difference in the achievement of students when taught sound waves physics concept using think-pair-share, group investigation and conventional strategies;
H02: There is no significant difference in the academic achievement of male and female students taught sound waves physics concept using think-pair-share;
H03: There is no significant difference in the academic achievement of male and female students taught sound waves physics concept using group investigation.

Methodology

Research design adopted in this study was quasi-experimental design which used pre-test, post-test, non-equivalent, non-randomized and control group. The target population for the study was all the senior secondary school students offering Physics in Kankia Township, Katsina State, Nigeria. Three groups were involved in this study which are think-pair-share (experimental group I), group investigation (experimental group II) and control group. Simple random sampling technique was used to choose three secondary schools among four government secondary schools present in Kankia Township. One intact class was also chosen from each school so as not to interrupt school programmes. Experimental group one (Think-pair-share) consisted of 45 students, 25 males and 20 females, experimental group 2 (Group Investigation) consisted 36 students, 20 males and 16 females and the control group consisted of 39 students, 21 males and 18 females.

The instrument used in collecting data was a test instrument called 'Sound Waves Physics Achievement Test (SWPAT)'. It is 30 multiple choice questions on sound waves physics concept taken from WAEC and NECO examinations. The instrument was faced validated using the two experienced physics teachers from the two senior secondary schools in Kankia. The instrument SWPAT was used as pre-test for the three groups and it was used as post-test after teaching the experimental group I with Think-pair-share, experimental group 2 with Group Investigation and the control group with lecture method for four weeks. After the revision, the post-test was administered to the three groups with the assistance of their class teachers. The data collected was analyzed using frequency counts, mean, t-test and ANCOVA statistical analysis.

Results

Research Question One: Do think-pair-share, group investigation and conventional strategies have effects on students' academic achievement in sound waves physics concept?

Table 1
Mean Achievement Scores and Standard deviations of Students in each group

Group	No	Type of Tests	Mean	SD	Gain Scores
Think-pair-share	45	Pre-Test	13.93	3.86	
		Post Test	21.31	4.35	7.38
Group Investigation	36	Pre-Test	10.78	2.92	
		Post Test	23.83	3.32	13.05
Lecture	39	Pre-Test	10.80	2.35	
		Post Test	17.18	2.78	6.38

Table 1 shows that mean gains for the experimental groups I (Think –pair-share) & II (Group Investigation) are 7.38 and 13.05 respectively. In the control group the mean gain is 6.38. Students of the experimental group II that were taught using Group investigation cooperative learning had the highest mean gain score in sound waves physics concept follow by think-pair-share.

H01. There is no significant difference in the achievement of students when taught sound waves physics concept using think-pair-share, group investigation and conventional strategies;

Table 2
Analysis of Covariance (ANCOVA) of Students' Achievement Scores by Teaching Strategies

Source of Variation	Type III Sum of Squares	df	Mean Square	F	Sig
Corrected Model	884.853a	3	294.951	23.101	.000
Intercept	2758.445	1	2758.445	216.046	.000
Pre-test	31.316	1	31.316	2.453	.120
Group	833.650	2	833.650	32.646	.000
Error	1481.072	116	12.768		
Total	53909.000	120			
Corrected Total	2365.925	119			

Result from table 2 clearly shows that the main effect for group was statistically significant ($F(2,119)= 32.646$, $p=0.000$). This shows that F ratio is significant at 0.05 level of significance implying that the mean score of the students taught through think-pair-share cooperative learning strategy and Group Investigation strategy were significantly different from those taught through the lecture method.

Hence, the null hypothesis was rejected. The rejection was upheld because the observed difference could not be due to chance, error or advantage of prior knowledge of either group of students since obtained mean achievement had been adjusted in the pretest. The post hoc test below also confirms that there is significant difference in the mean achievement acquired by the three groups.

Table 3
Scheffe Post hoc Test mean Achievement Scores

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.
EXP G1	EXP G 2	-2.52222*	.80394	.009
	CONT G	4.13162*	.78657	.000
EXP G 2	EXP G1	2.52222*	80394	.009
	CONT G	6.65385*	.83097	.000
CONT G	EXP G1	4.13162*	.78657	.000
	EXP G 2	-6.65385*	.83097	.000

*Key: *Mean difference is significant at the 0.05 level*

Research Question Two: Will there be any significant difference in the academic achievement of male and female students taught sound waves physics concept with think-pair-share?

Table 4
Mean and Standard deviation of mean achievement score across gender in think-pair-share strategy

Group	GENDER	No	Pretest Mean STD	Mean Posttest Mean STD	Gain Scores
Think-pair-share	Male	25	13.40	22.68	9.28
	Female	20	3.95	3.66	8.13
			14.60	19.60	
			3.75	4.63	

The data on students' achievement scores in Table 4 revealed that male students taught sound waves physics concept using think-pair-share strategy had mean gain score of 9.28 while that of the female students was 8.13. This implies that the male students who were taught using think-pair-share strategy performed better than their female counterparts.

H02: There is no significant difference in the academic achievement of male and female students taught sound waves physics concept using think-pair-share.

Table 5
T-test analysis of male and female students' mean score of students in think-pair-share

Group	No	Mean	STD	df	t-cal	t-cri	P	Decision
Male	25	22.68	3.66					
				43	1.03	1.99	0.03	Significant
Female	20	19.60	4.63					

Table 5 shows that there was a significant difference between mean score of males and females when they were exposed to sound waves physics concept using think-pair-share strategy. This is because the P-value of .03 obtained is less than 0.05 significant level set for the hypothesis. Hence, the null hypothesis is rejected. Therefore, there is a significant difference in the students' achievement scores between male and female when taught sound waves physics concept using think-pair-share cooperative learning strategy.

Researcher Question Three: Is there any significant difference in the academic achievement of male and female students taught sound waves physics concept with group investigation strategy?

Table 6
Mean and Standard deviation of mean achievement score across gender in think-pair-share strategy

Group	GENDER	No	Pretest Mean STD	Mean Posttest Mean STD	Gain Scores
Group	Male	20	11.86	24.05	12.19
Investigation	Female	16	2.82	3.11	14.26
			9.27	23.53	
			2.40	3.68	

Table 6 indicated that the male students taught sound waves physics concept using group investigation strategy had a mean gain score of 12.19 while that of the female students was 14.26. This implies that the female students who were taught using sound waves physics concept using group investigation strategy performed better slightly higher than their male counterparts.

H03: There is no significant difference in the academic achievement of male and female students taught sound waves physics concept using group investigation.

Table 7

T-test analysis of male and female students' mean score of students in group investigation

Group	No	Mean	STD	df	t-cal	t-cri	P	Decision
Male	20	24.05	3.11					
				34	3.63	1.72	.062	Not Significant
Female	16	23.53	3.68					

The result from Table 7 showed that there is no significant difference in mean achievement scores between male and female students that were taught sound waves physics concept using group investigation strategy. The p-value was found to be .062 at P≤0.05. Hence, the null hypothesis is accepted. Therefore, there is no significant difference in the students' mean achievement scores when taught sound waves physics concept using group investigation cooperative learning strategy.

Discussion

This study observed and reported the effects of think – pair -share and group investigation cooperative learning strategies on the academic achievement of students in sound waves Physics concepts in Kankia Township. Three research questions were answered and three hypotheses were tested at 0.05 significant level. The results of the findings revealed that, there is significant difference in the mean achievement scores of students across the three groups who were taught sound waves physics concept and the difference is in favour of those taught using think-pair-share and group investigation cooperative strategies. This finding is in line with the finding of Ibrahim (2016) on effects of multimedia instructional strategies on chemistry students' science process skills acquisition and achievement in Kano State which reported that there was significant difference in the mean achievement scores across the three groups participated in the experiment but the mean gains were in the favour of the two experimental groups. The finding is equally supported by the findings of Aremu and Abidun (2010), Lin(2011), Tayo(2012), Aksoy(2012) who found out that students exposed to multimedia instructional strategy(experimental group) performed significantly better than those exposed to the conventional method.

The result of this study also indicated that there is significant difference in the mean achievement scores between male and female students exposed to sound waves physics concept using think-pair-share cooperative learning strategy and this is in favour of the male students. This correlates with the findings of Valentine, (1998); Shin and McGee, (2002) which confirmed that females do not gain experience or confidence in the manipulation of science equipment as male. The result of this study equally contradicts the views of previous researcher such as Ugwu and Nzewi (2015) who indicated that male students taught using videotaped instructional strategy achieved higher scores than female students at all levels.

The results of this study similarly indicated that there is no significant difference in the mean achievement scores between male and female students exposed to group investigation cooperative learning strategy. This is in line with the findings of Babajide (2010) as well as Achor and Shikaan (2015) who established that gender has no significant effect on students' science process skills achievement.

Conclusions

The following conclusions are drawn based on the findings from this study:

1. Think-pair-share strategy and group investigation cooperative learning strategies enhance academic achievement of senior secondary students in sound waves physics concept.
2. Think-pair-share cooperative learning strategy favours male students while group investigation cooperative learning strategy favours female students.

Recommendations

The following recommendations were made based on the findings and conclusions reached in this study:

1. The government and the school authority should recruit qualified physics teachers and make provision and necessary facilities for the use of think-pair-share and group investigation cooperative learning strategies in the school.
2. Teachers should be given opportunities to enroll in training and re-training in the effective implementation of think-pair-share and group investigation cooperative learning strategies.

References

Achor, E.E & Shikaan, V.M. (2015). Does the Method of Instruction Matter in Middle Basic Pupils‟ Science Process Skill Acquisition? An Examination of Field-Based Inquiry and Conventional Strategies. *Journal of Scientific research &Reports, 7(6), 426-437.*

Chief Examiner Report (2019). *Chief examiner report on physics issues*. Lagos: Author.

Dewi, M. J. (2011). *The effect of cooperative reading strategies on students reading comprehension: An experimental study on the parallel eight grade students of SMP Negeri 3 Negara*. UNDIKSHA. Unpublished Thesis.

Egoyan, A., Mirtskhulava, M., Chitashvili D. (2005). *The Role of Physics in Science Integration.* UNESCO: Paris. Albert Einstein Century International Conference.

Ibrahim, S. (2016). *Effects of multimedia instructional strategies on chemistry students' science process skills acquisition and achievement in Kano State*. Master thesis submitted to the Department of Science Education, National Open University of Nigeria, Lagos.

Mataram M., Afan, A., Marhaeni, N., Dantes, N. (2013). The effect of think pair share technique on the English reading achievement of the students differing in achievement motivation at grade eight of smpn 13. *e-Journal Program Pascasarjana Universitas Pendidikan Ganesha Program Studi Pendidikan Bahasa Inggris 3, 47–53.*

Reinhart, S. C. (2000). Never say anything a kid can say! *Mathematics Teaching in the Middle School, 5, 478–483.*

Sharan, Y., & Sharan, S. (1992). *Expanding cooperative learning through group investigation*. Colchester, VT: Teachers College Press.

Slavin, R. E. (2008). *Cooperative Learning*. Bandung: Nusa Media.

Slavin, R.E. (1995). *Cooperative learning: Theory, research, and practice 2nd ed*. Boston: Allyn & Bacon

Tan, I. G. C., Sharan, S. & Lee, C. K. E. (2006). *Group investigation and student learning*: An experiment in Singapore schools. Marshall Cavendish Academy.

Ugwu, C.A. & Nzewi, U.M. (2015). Effects of Two Instructional Delivery Approaches on Senior secondary schools' students‟ achievement in Biology.*56th Annual Conference proceedings of Science Teachers Association of Nigeria.*

Valentine, E. F. (1998). Gender differences in learning and achievement in mathematics, science, and technology and strategies for equity: *A literature review. Retrieved, from the World Wide Web:*