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Performance of Students of Varied Learning Styles Taught Physics Using Think-Pair-Share Learning Strategy

[1]**Emmanuel Edoja Achor,** [2]**Martha Mimi Chianson-Akaa and** [3]**Elom Isaac Ogbaji**
[1&2]Department of Science and Mathematics Education,
Benue State University, Makurdi-Nigeria;
[3]Department of Physics, College of Education, Oju, Benue State, Nigeria.

Abstract
This study investigated the effect of think-pair-share learning strategy on performance of students of varied learning styles in Physics in Benue State, Nigeria.Three research questions guided the study. Three hypotheses were tested. Quasi-experimental research of non-randomised pre-test, post-test control group design was adopted for the study. The population was made up of 964 senior secondary (SS) 2 students in the 2020/2021 academic session from 24 secondary schools in the area. The sample consisted of 321 SS2 students selected from six intact classes from six schools. Multistage sampling technique was employed for the study. Learning Styles Questionnaire (LSQ) and Physics Performance Test (PPT) with reliability coefficients of 0.85 and 0.99 respectively were used for data collection. The research questions were answered using mean and standard deviation, while Analysis of Variance (ANOVA) was used to test the hypotheses at 0.05 level of significance. The finding revealed thatthere is no significant difference in the mean performance scores of students with varied learning styles taught Physics using Think-Pair-Share learning strategy. It was found that significant differencesexisted in the mean performance scores of both male and female students with varied learning styles who are taught Physics using Think-Pair-Share learning strategy.Based on the findings, it was recommended among others that workshops, symposia and seminars should be organised regularly by Science Teachers' Association of Nigeria (STAN) and Ministry of Education to acquaint Physics teachers with the skill of taking cognizance of students' learning style preferences. Teachers of Physics should adopt Think-Pair-Share (TPS) learning strategy for teaching Physics concepts to both male and female students minding the differences due to learning style preferences so as to enhance their academic performance in the subject.
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Keywords: Academic Performance, Learning Styles, Physics, Think-Pair-Share Strategy.

INTRODUCTION
Physics is a branch of science that is concerned with the nature and properties of matter and energy. It involves the study of matter and its motion, through space and time, along with related concepts such as energy and force [1]. Physics is critical to students' lives in many facets of life. Physics is the branch of science that deals with objects, energy and their interactions. Bello [2] describes Physics as the bedrock of science and technology. Knowledge of Physics has led to inventions in various areas. The aims of Senior Secondary School Physics curriculum as stated by Federal Ministry of Education [3] are to: provide basic literacy in Physics for functional living in the society; acquire basic concepts and principles of Physics as a preparation for further studies; acquire essential scientific skills and attitude as a preparation for technological application of Physics; stimulate and enhance creativity.All these may be realised if the learning styles of students are taken into consideration.

Students' performance is crucial to national development. Good performance in Physics would build students' skills and competencies. This could enable them to become scientists who would contribute to sustainable development in Nigeria. However, it has been observed that students often perform poorly in the subject [4]. This situation could be reversed if their learning styles are given consideration.

A learning style refers to how they prefer to learn.It is a student's consistent way of responding to and using stimuli in the context of learning. Learning style is a habitual and distinct mode of acquiring knowledge [5]. It is a tendency to approach cognitive tasks with preferred mental set of activities and processes. Learning style can also be seen as consisting of distinctive behaviours which serve as indicators of how a person learns from and adapts to his/her environment[6].

A learning style the way each learner begins to concentrate, process and retain new and difficult information. It represents both inherited characteristics and environmental influences. A learning style model classifies students according to

where they fit on a number of scales pertaining to the ways they receive and process information[7]. It consists of the way a human senses interact with the environment to receive stimuli and process it into useful information. It refers to how a person's emotions and personality interpret environmental stimuli, given various preferences for perceiving and processing information.

Learners rely on different learning styles. Fleming [8] classifies learning styles into Visual, Auditory and Kinesthetic (VAK) learning styles. Visual learners prefer to learning through the eyes for seeing. They utilise visual aids that represent ideas using methods other than words such as graphs, charts, diagrams and symbols [6]. Learners with visual learning style prefer to make use of their sights, pictures, diagrams and symbols. Auditory learners learn more effectively using sound and words [7]. They prefer to learn through listening to lectures, discussions and tapes. Kinesthetic learners prefer to learn using their various experiences such as moving, touching and doing, tasting, smelling, active exploration of the world, science projects and experiments.Fayombo [9] reported that some students' preferences for visual, auditory, kinesthetic and multiple modes of learning style and the majority of students benefitted from the learning strategies utilised in the classroom. The study also showed that the teaching strategies and learning style contributed 20% (R2= 0.20) to the variance in academic performance.

Learners with varied learning styles could learn more effectively if a learner-centred strategy like think-pair-share is adopted. Think-pair-share was originally developed by Lyman [10]. It allows students to contemplate on a posed question or problem silently.

The student may write down thoughts or simply just brainstorm in his or her head. When prompted, the student pairs up with a peer and discuss his or her idea(s) and then listen to the ideas of his or her partner. Following pair dialogue, teachers solicit responses from the whole group. When teachers use this strategy, they do not have to worry about students not volunteering. This is because each student will already have an idea in his/her heads [11].

The teacher can call on anyone and increase discussion productivity. Using Think-Pair-Share during classroom instruction could increase the rate of response and participation by students compared to the traditional (lecture) method. The wait time between think and pair could also enable students to critically reflect on a wide range of possible answer to a question by formulating their ideas and validating those ideas with their classmates.

The use of Think-Pair-Share strategy goes a long way in boosting student' confidence in classroom discussion and participation which could enhance their academic performance in Physics. Chianson [10] reported that that there was a significant difference in the mean scores of students who were exposed to think-pair-share strategy compared to those taught using the conventional approach. The result also revealed that after being exposed to think-pair-share strategy, no significant difference was obtained in the male and female students' achievement. Uzoma and Okoli [12] found **a significant difference in the mean academic achievement scores of students in Biology in favour of the experimental group. There was no significant difference in the mean academic achievement scores of male and female students taught Biology using think–pair-share instructional strategy.**

Gender is a psychological variable that may affect students' academic performance in Physics. Research revealed that male students perform better than their female counterparts in Physics, Chemistry and Biology [13]. On the contrary,Amogne [14] found that female students slightly outperformed male students in Physics. Yusuf and Afolabi [15] found no form of influence being exerted by gender on students' academic performance in the sciences. In a similar vein, Chianson [10] reported that after being exposed to think-pair-share strategy, no significant difference was obtained in the male and female students' achievement in Mathematics. Due to inconsistencies on gender differences in academic performance, this study examined if there would be difference in the academic performance of male and female students of varied learning styles taught Physics using Think-Pair-Share learning strategy.

Research Questions

1. What are the mean performance scores of students with varied learning styles taught Physics using Think-Pair-Share learning strategy?
2. What is the difference in the mean performance scores of male students with varied learning styles taught Physics using Think-Pair-Share learning strategy?
3. What is the difference in the mean performance scores of female students with varied learning styles taught Physics using Think-Pair-Share learning strategy?

Hypotheses

1. There is no significant difference in the mean performance scores of students with varied learning styles who are taught Physics using Think-Pair-Share learning strategy.
2. There is no significant difference in the mean performance scores of male students with varied

learning styles who are taught Physics using Think-Pair-Share learning strategy.
3. There is no significant difference in the mean performance scores of female students with varied learning styles who are taught Physics using Think-Pair-Share learning strategy.

Research Method

The design for this study was quasi-experimental research design. Thestudy was carried out in Oju Local Government Area of Benue State, Nigeria. The population of this study comprised 964Senior SecondaryTwo (SS2) students during the 2020/2021 academic session from 24 secondary schools in Oju Local Government Area of Benue state, Nigeria. A sample of 321SS2 students fromsix intact classes in six schools were selected using multistage sampling technique.

The instruments used in this study for data collection were Learning Styles Questionnaire (LSQ) adapted from O'Brien [16]which was used for identifying learners' learning style preferences and Physics Performance Test (PPT) constructed by the researchers using SS2 Physics curriculum. LSQ was divided into ClustersA, B and C. Each of the clusters consists of 10 items. Clusters A, B and C were on visual,auditory and kinesthetic learning styles respectively. The scoring format is: 1 for never applies to me; 2 for sometimes applies to me; and 3 for always applies to me.The 40-item PPT, which was multiple choice in nature, covered aspects of the subject such as equilibrium of forces, linear momentum, mechanical energy and machines, temperature and its measurement. A table of specification was developed for effective teaching and selection of items in the PPT.

The instrumentswere given out for face and content validation by four experts in the Department of Science and Mathematics Education, Benue State University, Makurdi.The experts' comments and suggestions were used to revise the instruments.A trial test wasconducted withSenior Secondary 2 students from Government Secondary School, Obusa,Oju Local Government Area, who were part of the population, but not part of the main research. The reliability coefficients of LSQ and PPT were calculated using Cronbach alpha and Kuder-Richardson 20 formula (KR-20)respectively. The reliability coefficients obtained were 0.81 and 0.99 respectively.Six research assistants were used for collection of data. The research questions were answered using percentages, mean and standard deviation. Analysis of Variance (ANOVA) was used to test the hypotheses at 0.05 alpha level.

Data Analysis and Interpretation

The results of data analysis and interpretation were presented according to the research question as follows:

Research Question 1: What are the mean performance scores of students with varied learning styles taught Physics using Think-Pair-Share learning strategy?

Table 1: Mean and Standard Deviation on Performance Scores of Students with Varied Learning Styles Taught Physics Using Think-Pair-Share Learning Strategy

Learning styles		Pre-PPT	Post-PPT	Mean gain
	Mean	36.47	43.76	7.29
Visual Learning Style	N	34	34	
	Std. Deviation	14.25	10.17	
	Mean	34.65	45.41	10.76
Auditory Learning Style	N	141	141	
	Std. Deviation	13.44	9.74	
	Mean	38.72	44.69	5.97
Kinesthetic Learning Style	N	39	39	
	Std. Deviation	14.82	9.28	

Table 1 shows that the mean performance score of students with visual learning style is 36.47 with a standard deviation of 14.25 in pre-test and 43.76 with a standard deviation of 10.17 in post-test. The mean performance score of students with auditory learning style is 34.65 with a standard deviation of 13.44 in pre-test and 45.41 with a standard deviation of 9.4 in post-test. The mean performance score of students with kinesthetic learning style is 38.72 with a standard deviation of 14.82 in pre-test and 44.69 with a standard deviation of 9.28 in post-test. Table 5 further shows that the mean gain performance score for students with visual learning style is 7.29, while that of students with auditory learning style is 10.76 and 5.97 for students with kinesthetic learning style.

Research Question 2: What is the difference in the mean performance scores of male students with varied learning styles taught Physics using Think-Pair-Share learning strategy?

Table 2: Mean and Standard Deviation on Performance Scores of Male Students with Varied Learning Styles Taught Physics Using Think-Pair-Share Learning Strategy

Learning styles		Pre-PPT	Post-PPT	Mean gain
Visual Learning Style	Mean	33.10	50.05	16.95
	N	21	21	
	Std. Deviation	13.68	9.93	
Auditory Learning Style	Mean	28.10	41.80	13.70
	N	73	73	
	Std. Deviation	10.97	11.70	
Kinesthetic Learning Style	Mean	25.54	45.23	19.69
	N	13	13	
	Std. Deviation	11.38	9.39	

Table 2 shows that the mean performance scores of male students with visual learning style is 33.10 with a standard deviation of 13.68 in pre-test and 50.05 with a standard deviation of 9.93 in post-test. The mean performance scores of male students with auditory learning style is 28.10 with a standard deviation of 10.97 in pre-test and 41.80 with a standard deviation of 11.70 in post-test. The mean performance scores of male students with kinesthetic learning style is 25.54 with a standard deviation of 11.38 in pre-test and 45.23 with a standard deviation of 9.39 in post-test. The table further shows that the mean gain in performance scores for male students with visual learning style is 16.95, while that of male students with auditory learning style is 13.70 and 19.69 for male students with kinesthetic learning style.

Research Question 3: What is the difference in the mean performance scores of female students with varied learning styles taught Physics using Think-Pair-Share learning strategy?

Table 3: Mean and Standard Deviation on Performance Scores of Female Students with Varied Learning Styles Taught Physics Using Think-Pair-Share Learning Strategy

Learning styles		Pre-PPT	Post-PPT	Mean gain
Visual Learning Style	Mean	41.95	51.14	9.19
	N	21	21	
	Std. Deviation	8.80	8.08	
Auditory Learning Style	Mean	43.99	45.70	1.71
	N	73	73	
	Std. Deviation	9.92	9.02	
Kinesthetic Learning Style	Mean	43.00	44.08	1.08
	N	13	13	
	Std. Deviation	11.47	11.26	

Table 3 reveals that the mean performance score of female students with visual learning style is 41.95 with a standard deviation of 8.80 in pre-test and 51.14 with a standard deviation of 8.08 in post test. The mean performance score of female students with auditory learning style is 43.99 with a standard deviation of 9.92 in pre-test and 45.70 with a standard deviation of 9.02 in post-test. The mean performance scores of female students with kinesthetic learning style is 43.00 with a standard deviation of 11.47 in pre-test and 44.08 with a standard deviation of 11.26 in post-test. The table further shows that the mean gain in performance scores for female students with visual learning style is 9.19, while that of female students with auditory learning style is 1.71 and 1.08 for female students with kinesthetic learning style.

Hypothesis 1: There is no significant difference in the mean performance scores of students with varied learning styles who were taught Physics using Think-Pair-Share learning strategy.

Table 4: Two-Way ANOVA on Performance Scores of Students with Varied Learning Styles taught Physics Using Think-Pair-Share Learning Strategy

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	414.646[a]	3	138.215	1.478	.222	.021
Intercept	42462.400	1	42462.400	454.044	.000	.684
Pre PPT	335.288	1	335.288	3.585	.060	.017
Learning styles	**106.563**	**2**	**53.281**	**.570**	**.567**	**.005**
Error	19639.280	210	93.520			
Total	453764.000	214				
Corrected Total	20053.925	213				

a. R Squared = .021 (Adjusted R Squared = .007)

Table 4 reveals that F (1,210) = 0.570; p = 0.567 >0.05. Since p-value is greater than 0.05 level of significance, the null hypothesis is not rejected. This implies that there is no significant difference in the mean performance scores of students with varied learning style taught Physics using Think-Pair-Share learning strategy. The partial Eta square of 0.005 was obtained for learning styles meaning that only 0.5 % of mean performance scores can be account for by the learning styles preference of students in Physics class.

Hypothesis 2: There is no significant difference in the mean performance scores of male students with varied learning styles who are taught Physics using Think-Pair-Share learning strategy.

Table 5: Two-Way ANOVA of Performance Scores of Male Students with Varied Learning Styles Taught Physics Using Think-Pair-Share Learning Strategy

Dependent Variable: PostPPT Male

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	2221.736[a]	3	740.579	6.386	.001	.149
Intercept	19931.770	1	19931.770	171.870	.000	.612
Pre PPTM	1059.260	1	1059.260	9.134	.003	.077
Learning styles	**859.977**	**2**	**429.989**	**3.708**	**.028**	**.064**
Error	12640.759	109	115.970			
Total	230911.000	113				
Corrected Total	14862.496	112				

a. R Squared = .149 (Adjusted R Squared = .126)

Table 5 reveals that F (1,109) = 3.708; p = 0.028 <0.05. Since p-value is less than 0.05 level of significance, the null hypothesis is rejected. This implies that there is significant difference in the mean performance scores of male students with varied learning style who are taught Physics using Think-Pair-Share learning strategy. The partial Eta square of 0.064 was obtained for learning styles meaning that only 6.4 % of mean performance scores can be account for by the learning styles preference of male students in Physics class.

Hypothesis 3: There is no significant difference in the mean performance scores of female students with varied learning styles who are taught Physics using Think-Pair-Share learning strategy.

Table 6: Two-Way ANOVA on Performance Scores of Female Students with Varied Learning Styles Taught Physics Using Think-Pair-Share Learning Strategy

Dependent Variable: PostPPT Female

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	602.377[a]	3	200.792	2.389	.073	.065
Intercept	12321.930	1	12321.930	146.591	.000	.587
PrePPTF	27.017	1	27.017	.321	.572	.003
Learning styles	**556.258**	**2**	**278.129**	**3.309**	**.040**	**.060**
Error	8657.847	103	84.057			
Total	241319.000	107				
Corrected Total	9260.224	106				

a. R Squared = .065 (Adjusted R Squared = .038)

Table 6 reveals that F (1,103) = 3.309; p = 0.040<0.05. Since p-value is less than 0.05 level of significance, the null hypothesis is rejected. This implies that there is significant difference in the mean performance scores of female students with varied learning style who are taught Physics using Think-Pair-Share learning strategy. The partial Eta square of 0.060 was obtained for learning styles meaning that only 6.0 % of mean performance scores can be account for by the learning styles preference of female students in Physics class.

DISCUSSION OF FINDINGS

Findings revealed that there was no significant difference in the mean performance scores of students with varied learning styles taught Physics using Think-Pair-Share learning strategy. This means that the use of Think-Pair-Share learning strategy enhanced the academic performance in Physics of students with varied learning styles almost on equal level. Fayombo [9] reported that though some students had preferences for visual, auditory, kinesthetic and multiple modes of learning style, the

majority of students benefitted from the learning strategies utilised in the classroom. The earlier study by Fayombo further showed that the teaching strategies and learning style contributed 20% to the variance in academic performance. This finding contradicts that of Achor, Aligba and Iloakasia [17] who found that there was significant difference between academic performance of students of varied cognitive styles taught using taught using collaborative strategy in Basic Science.

The adoption of Think-Pair-Share learning strategy in the present study is based on the conviction that when Physics teachers use this strategy, they do not have to worry about students with varied learning styles not volunteering. This is because the students with varied learning styles already have ideas of what was to be taught in their head. The teacher can call on anyone and increase discussion productivity to adequately cater for the diverse learning preferences of the students in Physics class. The use of Think-Pair-Share learning strategy in the present study enabled physics teachers to assess their students' learning in a way that boost student' confidence in classroom discussion, participation and hence performance in Physics.

The finding of this study also revealed that there is significant difference in the mean performance scores of male students with varied learning styles who are taught Physics using Think-Pair-Share learning strategy. Think-Pair-Share learning strategy has been effectively used in the present study to facilitate instructional delivering through small groups and empowering all female students with varied learning styles to work together to build their understanding of topics and concepts. This implies that the use of Think-Pair-Share learning strategy is gender sensitive in enhancing the performance in Physics of male students with varied learning styles. The finding seems to be in tandem with Uzoma and Okoli [12] who found **that there was no significant difference in the mean academic achievement scores of male and female students taught Biology using Think-Pair-Share instructional strategy. Thus due to different learning styles, even among the male students only, differences exist in their academic performance.**

Similarly, the result of this research indicated that there is significant difference in the mean performance scores of female students with varied learning styles who are taught Physics using Think-Pair-Share learning strategy. The finding is disagreement with Chianson [11] who reported that after being exposed to think-pair-share strategy, no significant difference was obtained in the male and female students' achievement in Mathematics. Think-Pair-Share learning strategy allowed female students with varied learning styles to actively participate in the learning process by talking with each other and listening to others' opinions. This could be responsible for the significant improvement in themean performance scores of all female students with varied learning styles taught Physics using Think-Pair-Share learning strategy.

CONCLUSION AND RECOMMENDATIONS

It was discovered that Think-Pair-Share is capable of enhancing academic performance in Physics of students with varied learning styles. Besides, it was revealed that performance in Physics of male and female students with varied leaning styles could be boosted if Think-Share-Pair instructional strategy is applied. This implies that the perennial poor academic performance in Physics would most likely be overcome if teachers adopt Think-Pair-Share learning strategy for teaching Physics to male and female students with varied learning styles with caution. Based on the findings, it was therefore, recommended that:

1. Physics teachers could over look students' learning style preferences while teaching Physics concepts using think-pair-share strategy.
2. Teachers of Physics should adopt Think-Pair-Share (TPS) learning strategy for teaching Physics concepts to both male and female students with varied learning styles with caution to enhance their academic performance in the subject.

REFERENCES

[1]. Mahmud, R., Muhammad, N., Sani, M., Bala, B., Mua'zu, R.L. *Problems of students in conducting effective Physics Practical in senior secondary schools in Sokoto Metropolis.* Retrieved 7th April, 2020 from http.www.edu.org (2015).

[2]. Bello, T. O. Effect of availability and utilization of Physics laboratory equipment on students' academic achievement in senior secondary school Physics. *World Journal of Education, 2* (5), 1-7 (2012).

[3]. Federal Ministry of Education. *National Physics Curriculum.* Lagos: NERDC Press (2014).

[4]. Mbamara, U. S., Eya, P. E. Causes of low enrolment of Physics as a subject of study by secondary school students in Nigeria: A descriptive survey. *International Journal of Scientific Research in Education*, *8* (4), 127-149 (2015).

[5]. Tulbure, C. Learning styles, teaching strategies and academic achievement in higher education: A cross-sectional investigation. *Procedia-Social and Behaviour Sciences,33* (2012), 398-402 (2011).

[6]. Oguamanam, H. The ELTANITE. *Journal of English Language Research, 2* (1), 23-38 (2011).

[7]. Oruwari, J.W., Obiefuna, C.A. Students' learning styles and their performance in English Language in Senior Secondary Schools in Imo State, Nigeria. *African Educational Research Journal,3*(4), 230-237(2015).

[8]. Fleming, N. *Visual, auditory and kinesthetic (VAK) learning styles*. Retrieved 12 February, 2015 from http//www.learning/styles/preferences (1987).

[9]. Fayombo, G. *Learning styles, teaching strategies and academic performance among some psychology undergraduates in Barbados School of Education, the University of West Indies Care Hill Campus*. Retrieved August 13, 2006 from https://www.carehill.uwi.edu/the/ hun/publications/EducationCERJ.htm (2015).

[10]. Lyman, F.T. *Think-Pair-Share (TPS) learning strategy*. Retrieved 26th August, 2011 from http/www.cooperative learning.org (1981).

[11]. Chianson, M.M. Effect of think-pair-share strategy on secondary school Mathematics students' achievement, self-esteem and retention in fractions. Unpublished PhD thesis, Benue State University, Makurdi-Nigeria (2014).

[12]. Uzoma, J. I., Okoli, J. N. Effect of think-pair-share instructional strategy on secondary school students' academic achievement in Biology in Anambra East Local Government Area, Anambra State. *UNIZIK Journal of STM Education*, *3*(1), 64-75 (2019).

[13]. Popoola, A. A. Influences of literacy on gender parity in Mathematics lesson: Literacy and Reading in Nigeria. *Journal of Literacy and Reading in Nigeria*, *13*(1), 9-19 (2009).

[14]. Amogne, A. E. Analysis of gender disparity in regional examination: Case of Dessie Town, Ethopia. *Basic Research Journal of Education Research and Review*, *4*(2), 29-36 (2015).

[15]. Yusuf, M.O., Afolabi, A.O. Effect of Computer Assisted Instruction (CAI) on secondary school students' performance in Biology. *Turkish Online Journal of Educational Technology*, *9* (1), 62-69 (2010).

[16]. O'Brien, L. Learning styles: Make the student aware. *National Association of Secondary School Principal Bulletin*, *73*, 85-89 (1985).

[17]. Achor, E. E., Aligba, S. O. Iloakasia, A. O. Collaborative teaching strategy and academic performance of students of different cognitive styles in Basic Science. *Journal of the International Centre for Science, Humanities and Education Research*, 5(1), 85-89 (2021).