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INCORPORATING COLLABORATIVE LEARNING STRATEGY AS PART OF AN INTEGRATED APPROACH IN TEACHING PHYSICS IN SECONDARY SCHOOLS

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ABSTRACT: *This study investigated the effects of collaborative, individualistic and demonstration Learning strategies on secondary school Physics Students' Achievement in Coplanar forces in Port Harcourt Local Government Area. Quasi-experimental, pretest-post-test, non-equivalent design was adopted. The sample size was 155 Senior Secondary Two (SS2) Physics students. The data obtained was analyzed using the mean and standard deviation for the research question and t-test statistics and ANCOVA for testing the null hypotheses (H_o) at 0.05 level of significance. Findings from the study showed that students exposed to collaborative learning strategy had improved academic achievement scores than those in the individualistic or demonstration strategy groups comparatively. The implication is that collaborative learning strategy should be incorporated into the teaching of Physics along with the traditional strategies for enhanced learning outcomes.*

KEYWORDS: Collabortive Learning Strategy, Individualistic Learning Strategy, Demonstartion Learning Strategy, Students' Achievement,

INTRODUCTION

Background to the Study

In the teaching and learning of Physics concepts, it is the strategy that is applicable to a large extent that motivates student's understanding and consequent transfer of new perception into real life situation. Learning strategy is an important tool in the hands of a professional teacher. Strategy therefore could be referred to as a plan, procedure, approach or style of instruction. It is a learning style used by teachers to bring about learning outcome in a classroom.

The appalling poor performance amongst students offering science subjects especially Physics is worrisome in West Africa Senior Secondary Certificate Examination (WASSCE) and National Examination Council (NECO), as it still remains the most unpopular science subject taught in secondary schools. The then Register/Chief Executive of the Council Prof. Promise M. Okpala decried the poor performance of students in core subjects like Physics, Biology, Chemistry and Mathematics in the May/June, 2011 (NECO). He attributed the mass failure in external examination to lack of quality teaching on the part of teachers among other factors. Quality teaching has to do with the teacher's prowess in the application of appropriate methodology and strategy during instruction. He added that for improved performance to be evident there is the need to identify the best instructional strategy in teaching contents and the intensive learning on the part of learners. In the same vein, the national president of the Nigerian institute of Physics Prof. David Malgwi at its 39th conference at Crawford University Ogun state raised an alert over the poor performance in Physics and warned that the situation must be tackled quickly. Malgwi noted that secondary school leavers performance in Physics

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in WASCE and NECO is very poor and without good background in Physics other professions like geoscience, pharmacy, technology, astronomy and many more cannot excel and therefore make any positive impact on the Nigerian society (Nations newspaper, 2016)

To this end, several researchers have attributed the poor performance to factors such as inadequate instruction, socio-cultural and economic background of students, ill-equipped laboratories, methodology, large teacher-students ratio, gender stereotype, lack of qualified Physics teachers and motivation of students' interest, and many more (Haimowitz, 1989; Lawrence, 2005; Mwamwenda, 1995: Zachariah, 2012).

However, appropriate teaching methods and strategies to arouse students' interest and subsequent retention of content matter is most appalling and it is therefore necessary that some effort be put into using these strategies in the teaching-learning of concepts in Physics.

Teaching of Physics in secondary schools in Nigeria as stated above has been largely talk-chalk approach with little demonstration where applicable. It is therefore at the rudimentary level of integrated teaching strategy where some impartation of knowledge is carried out by the teacher in the classroom which is then integrated with some demonstration teaching strategy in form of practical works. However, teaching with a more integrated strategy mix involving collaboration, demonstration and classroom teacher to student impartation is not common. This paper compares the effectiveness of the three interactive learning strategies of collaboration, individualistic and demonstration with a view of identifying which is most impactful in improving learning outcomes of Physics in secondary schools.

What is Collaborative learning strategy? The concept of collaborative learning has been defined differently by authorities in the field of education, in the early 90s, Friend and Cook (1992) defined collaborative learning as a style of direct interaction between at least two co-equal parties voluntarily engaging in shared agreements as they work towards a general purpose. However, the term Collaborative has evolved into a pedagogy, where collaborators regularly discuss and reflect on the components of teaching and learning. Collaborative learning strategy is a strategy of learning in which, students interact in smaller groups with the aim to succeed collectively, Johnson and Johnson (2006). Students exchange ideas, knowledge, emotions and experiences with each other, also students in the process foster cooperative team spirit and excellence (Mbanefo,2014). There is an old adage that says two heads are better than one, which means when people work as a team there is synergy, they are bound to achieve better results than individual effort put together. The outcomes according to researchers are quite evident comparatively as learners collaborate with each other in terms of discussion, clarifies any ambiguity, exchange ideas and respect each other's opinions and feelings in the process.

What is individualistic learning strategy? In this case, students are allowed to learn at their own pace, level and convenience to achieve an academic goal, Johnson and Johnson (1994). The learner is independent of the learning style, meaning whichever time and style the learner finds appropriate to learn is automatically acceptable by the teacher. Until the learner understands a particular concept, the teacher cannot introduce the next concept. This strategy is suitable in certain cases as learner has the time to learn privately at convenient pace and becomes master of the concepts so learnt. It encourages scaffolding technique, as there will be incremental knowledge acquisition on the concept so taught by the learners (Lawrence, 2015).

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What is Demonstration learning strategy? Here, the learners are shown how learning materials are used to explain and/or corroborate phenomena, principles and theories within and outside the classroom for better understanding. It is an audio/visual display experience that captivates and sustains learners' interest in learning. Demonstration learning strategy is one by which learning is made clearer by the use of teaching aids, examples accompanied with verbal explanations with the aim of having learners to do the activity independently Adeyemo (1998). Demonstration strategy is used for skill learning as learners are presented with firsthand practices that make them to react through careful observation Cheta and Okoro (2014) in Uche, Awujo & Agbakwuru (2014, p98). Demonstration as viewed by Efebo (2003) is to clearly show what is being thought to the learners due to lack of understanding of the theoretical aspect of the concepts being thought. It is a traditional classroom strategy that focuses on both cognitive and psychomotor domains. Summarily, demonstration is equal to verbalization plus display of apparatus.

Aim and Objectives of the Study

The aim of this study was the investigation of the effects of collaborative, individualistic and demonstration strategies on students' academic achievement in physics in senior secondary schools in Port Harcourt Local Government Area of Rivers State. Specifically the study sought to: Ascertain the mean differences among Collaborative, Individualistic and Demonstration Strategies on students' academic achievement in Physics

Research Questions

What are the mean differences among collaborative, individualistic and demonstration strategies on the academic achievement of students in physics?

Hypotheses

There are no significant mean differences among collaborative, individualistic and demonstration strategies on the academic achievement of students in physics.

METHODOLOGY

Research Design

The design considered for this study was quasi-experimental non-equivalent control group design. Furthermore, a three by two (3 x 2) factorial design was also used. The independent variables are the teaching strategies while the dependent variable is the students' academic achievement in physics.

Population for the Study

The population of the study consisted of Senior Secondary School two (SS11) Physics students in Public Senior Secondary Schools in Port Harcourt Local Government Area of Rivers State. There are twelve (12) public schools of which nine (9) are co-educational. As at the time of this study the total number of (SS11) Physics students in the twelve schools in Port Harcourt local government area was one thousand two hundred and thirty four (1,234).(Source: Zonal Post Primary School's Board, 2016).

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Sample and Sampling Techniques

The sample size for this study was 155, which was purposively drawn from three co-educational Public Secondary Schools. The schools were selected using simple random sampling technique within Port Harcourt Local Government area of Rivers State. This figure was reached as follows: Firstly, three schools were randomly selected from the existing nine (9) mixed senior secondary schools in Port Harcourt local government area. Secondly, the total number of students in the intact class of each of the schools constituted the sample for this study (See table 3.1 below). Out of the three senior secondary schools selected, two were used as experimental group and one control group. The experimental groups learned using collaborative learning strategy (CLS) and Individualistic learning strategy (ILS), while the control group learned using demonstration learning strategy (DLS). The groups were pre-tested before the treatment and post-tested after the treatment to ascertain the effect of the strategies on students' academic achievement.

Table 1: Sample distribution table

School	Population SS	Sample of Boys	Sample of Girls	Total number of Physics students (TNPS)
A=Collab.	164	29	28	57
B=Individ.	136	24	24	48
C=Demon.	155	27	23	50
Total =	455	80	75	155

Method of data collection

The research assistants who were also the regular physics teachers in all the sampled schools underwent training on how to implement these three interactive strategies on the students. The student were thought coplanar forces for three weeks after which they were tested, the teachers then retrieved students question sheets after they have been answered and handed over to the researcher. The scripts were marked, scored, recorded and coded in a tabular form by the researcher for analysis. This was after the experimental procedure.

Method of data analysis

The data collected was analyzed using mean, standard deviation to answer the research questions while the t-test and analysis of covariance (ANCOVA) as statistical tools were used to answer the hypotheses. All hypotheses were tested at 0.05 level of significance and the results presented on a table and then interpreted accordingly on the basis of the hypotheses of the study. However, a statistical package for social sciences 21 known as SPSS was employed for the analysis.

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RESULTS AND DISCUSSION

Presentation of Data

TABLE 2: Pre-Test And Post-Test Scores Of The Three Different Strategies

Collaborative Strategies					Demonstration Strategies					Individualistic Strategies			
S/N	**SEX**	**PRE-TEST**	**POST TEST**		**S/N**	**SEX**	**PRE-TEST**	**POST TEST**		**S/N**	**SEX**	**PRE-TEST**	**POST TEST**
1	M	44	48		**1**	M	20	52		**1**	M	56	60
2	F	32	60		**2**	F	24	48		**2**	M	48	44
3	F	40	68		**3**	M	28	24		**3**	M	60	56
4	F	28	34		**4**	M	32	40		**4**	M	56	60
5	M	24	52		**5**	M	20	56		**5**	M	52	52
6	F	48	64		**6**	M	56	40		**6**	M	32	36
7	M	24	60		**7**	F	56	36		**7**	M	32	28
8	F	44	64		**8**	F	44	40		**8**	M	16	16
9	F	40	40		**9**	M	28	40		**9**	M	40	24
10	M	40	60		**10**	F	44	48		**10**	M	48	56
11	F	56	36		**11**	F	36	40		**11**	M	36	32
12	F	44	80		**12**	M	56	32		**12**	F	52	52
13	F	20	56		**13**	F	44	16		**13**	F	56	44
14	F	20	76		**14**	F	36	20		**14**	F	16	20
15	F	40	52		**15**	F	56	28		**15**	F	32	20
16	M	32	60		**16**	M	44	32		**16**	F	44	40
17	F	48	48		**17**	F	40	28		**17**	F	36	32
18	F	36	64		**18**	F	64	44		**18**	F	28	16
19	M	40	40		**19**	F	52	28		**19**	F	36	36
20	M	28	36		**20**	M	48	28		**20**	F	28	24
21	M	52	72		**21**	M	20	32		**21**	F	24	28
22	M	24	60		**22**	M	52	48		**22**	F	36	32
23	M	24	60		**23**	M	52	48		**23**	F	36	32
24	F	20	48		**24**	M	36	44		**24**	F	36	32
25	M	52	60		**25**	F	52	44		**25**	F	24	44
26	F	40	64		**26**	M	36	36		**26**	F	56	44
27	M	24	56		**27**	F	36	24		**27**	F	52	52
28	F	36	64		**28**	F	40	56		**28**	F	40	32
29	M	36	28		**29**	F	60	52		**29**	F	36	48
30	M	28	56		**30**	F	28	48		**30**	F	20	20
31	F	28	76		**31**	F	32	32		**31**	F	24	36
32	M	20	72		**32**	M	20	24		**32**	F	60	60
33	F	40	68		**33**	M	36	60		**33**	F	24	28
34	F	28	56		**34**	M	36	40		**34**	F	32	20
35	F	28	48		**35**	F	28	16		**35**	F	8	20
36	F	40	72		**36**	F	32	28		**36**	M	20	28
37	M	60	64		**37**	M	40	48		**37**	M	16	20
38	F	48	68		**38**	F	52	44		**38**	M	20	16
39	F	44	80		**39**	M	40	20		**39**	M	12	28
40	M	32	48		**40**	M	24	24		**40**	M	44	28
41	F	24	80		**41**	M	44	40		**41**	M	28	16
42	M	60	48		**42**	F	20	44		**42**	M	16	12
43	F	32	56		**43**	M	56	72		**43**	M	24	12
44	M	44	52		**44**	F	40	28		**44**	M	4	8
45	M	60	48		**45**	M	56	56		**45**	M	36	28
46	M	24	60		**46**	M	36	44		**46**	M	24	16
47	F	8	48		**47**	M	40	80		**47**	M	20	28
48	F	40	72		**48**	M	36	40		**48**	M	52	24
49	M	44	56		**49**	M	32	60					
50	F	24	32		**50**	F	24	40					
51	M	44	64										
52	M	40	54										
53	M	32	36										
54	M	28	40										
55	M	44	44										
56	M	48	48										
57	M	32	36										

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Data Analysis

Research Question: What are the mean differences among collaborative, individualistic and demonstration strategies on the academic achievement of students in physics?

Table 3: Mean and standard deviation among collaborative, individualistic and demonstration strategies on students' academics in Physics

Group	**N**	**$\bar{X}$**	**SD**
Collaborative Strategy	57	55.05	13.137
Individualistic Strategy	48	32.50	13.773
Demonstration Strategy	50	39.84	13.618

Hypotheses

Ho: There are no significant mean differences among collaborative, individualistic and demonstration strategies on the academic achievement of students in Physics.

Table 4: ANCOVA Analysis of the mean differences among collaborative, individualistic and demonstration strategies on students' academic achievement in Physics.

Sources of Variance	**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig**
Pre-test	31989.916	1	31998.916	19.741	
Between Groups	13824.431	2	6912.216	42.656	0.000
Within Groups (Error)	24468.646	151	162.044		
Corrected Total	41734.968	154			

- Significant

Table 5: Pairwise comparisons via Least Significant Difference (LSD)

COMPARISONS	**MD**	**Sig**
Collaborative Versus Individualistic	21.861*	0.000
Collaborative Versus Demonstration	16.361*	0.000
Individualistic Versus Demonstration	-5.501*	0.036

MD = Mean Difference

* Significant, P<0.05 level of significance.

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Table 3: shows mean and standard deviation for collaborative, individualistic and demonstration strategies as, ($\bar{x}$ =55.0, SD= 13.137; $\bar{x}$=32.50, SD=13.773, $\bar{x}$ =39.84, SD=13.618) respectively. The result indicates that the mean for collaborative strategy was the highest followed by that of demonstration strategy and then lastly individualistic strategy. This means that students in collaborative strategy did better than demonstrative and individualistic groups. However, the demonstration learning strategy groups did better than individualistic group as evident in their mean differences. The finding showed that the most effective learning strategy was the collaborative strategy followed by the demonstration strategy and the least was the individual learning strategy.

Testing the Hypotheses

Ho: There is no significant mean differences among collaborative, individualistic and demonstration strategies on the academic achievement of students in Physics.

To test this hypothesis, analysis of covariance (ANCOVA) was deployed such that the students' pre-test scores were used as covariate to control for initial differences that may exist before treatment was given. The result of the analysis was as presented on Table 4.

Table 4: There was significant mean difference among collaborative, individualistic and demonstration strategies on the academic achievement in Physics. The $F_{(2,151)}$ =42.656, P<0.05 level of significance was found to be significant. Therefore, the null hypothesis was hereby rejected. The result was that there is significant mean differences among collaborative, individualistic and demonstration strategies on the academic achievement in Physics.

Consequently, a post HOC test was performed to ascertain where the significance lies among the three groups via LSD (Least Significant Differences) and the results presented on Table 5

Table 5 showed that there were significant differences between each pair of comparison. The mean differences in the three comparisons are 21.861, 16.361 and -5.501 respectively. In the first and second comparisons it was both in favour of collaborative strategy while, in the third comparison it was in favour of demonstration strategy.

DISCUSSION OF THE FINDINGS

The findings from this study were presented and discussed under the following headings;

Effects of collaborative, individualistic and demonstration strategies on students' academic achievement in physics

Since the finding of this study showed that the mean differences were significant among the three strategies; collaborative, demonstration and individualistic strategies, the students exposed to collaboration did better than those taught with demonstration and individualistic. While those taught with the demonstration strategy did better than those in the individualistic group. Physics teachers should combine the collaborative and the demonstration strategies in teaching physics as group interaction improves outcome (Johnson & Johnson,1994). And since students taught with collaboration strategy attained higher level of understanding and

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absorption of the coplanar concept in Physics better than those taught with either demonstration or individualistic strategy. Implication of the finding is that Physics teachers should be more proactive in the application of these strategies to enhance the academic achievements of physics students. The theory of constructivism has an implication to this study which is learners should be given the opportunity to apply these learning strategies to construct their own knowledge and understanding both as individuals and as a group through experiencing things and reflecting upon the experiences. Learning should be learner-centered as teacher facilitates the learning process in the classroom.

The Summary of findings

There were significant mean differences among collaborative, individualistic and demonstration strategies on the academic achievement of students in Physics. The effect of collaborative strategy on the mean achievement scores of students in Physics was significant. Collaborative learning strategy is more effective since it improved students' academic achievement remarkably.

The students in the collaborative learning strategy group performed better than the students in the other two groups. The Post-hoc analysis also revealed that there were significant differences between each pair of comparison, therefore the finding could be generalized.

Also the findings of this study would create an impact in the educational sector especially in science teaching and learning. the results from the findings of the study if implemented will go a long way to improve the poor academic achievement of students in physics. teachers will be encouraged to adopt these strategies in teaching physics and science subjects in general.

CONCLUSION

The study concluded that the collaborative learning strategy is innovative the most effective compared to the other two strategies in the learning of Coplanar forces in Physics. Its user friendliness approach cannot be over emphasized as the students post-test scores revealed.

Physics teachers should adopt the collaborative learning strategy in the teaching and learning of Coplanar forces in Physics in Rivers State, for it is learner-centered, effective and enhanced students' academic achievement.

The following recommendations were made based on the findings of this study;

1. Collaborative, individualistic and demonstration learning strategies (especially collaborative strategy) should be incorporated into the Physics curriculum.
2. Physics teachers should be sensitized through seminars, conferences and workshops on the application of these strategies in the teaching and learning of Physics.
3. The application of the collaborative strategy should be made mandatory by the government through school supervisors to the Physics teachers because it allows student to be in charge of their learning.

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4. The state government and the ministry of education should regularly call for reappraisals to ascertain the extent of application of these strategies in the teaching and learning of physics.

REFERENCES

Adeyemo P.O (1998). *Principles of education and practice*. Ado-Ekiti: Omotayo Standard Press and Bookshop Co. (Nig) Ltd.

Awotua-Efebo , E. B. (2003). *Effective teaching: Principle and practice*. Port Harcourt: Paragraphics.

Friend, M, & Cook, L. (1992). *Interactions: Collaboration skills for school professionals*. White Plains, NY: Longman.

Johnson, D.W. & Johnson, R.T. (1994) *Learning together and alone: Cooperative, Competitive and Individualistic learning*. Needham Heights, MA Allyn & Bacon, Sydney.

Lawrence, B. A. (2005). *Attitude of secondary school students towards learning of physics in some selected L.G.A in Rivers State*. Unpublished Masters Dissertation, University of Port Harcourt.

Lawrence, B. A. (2015). Application of scaffolding technique in the improvement of academic achievement of students in physics. CHES$_{\text{UNIPORT}}$. *African Journal of Higher Education Studies and Development (3) 258 - 267*

Mattatall, C & Power, K. (2014). *Teacher collaboration and achievement of students with LDs: A Review of the Research.* Avalable: http://ldatschool.ca/literacy/the-impact-of-teacher-collaboration-on-academic-achievement-and-social-development-for-student-with-learning-disabilities-a-review-of-the-research/. Last accessed 15 March 2016.

Mbanefo, M.C. (2014). Facilitation Technique: An Approach to effective teaching of Sewage. In Dawuleng, M. N. & Nsikak – Abasi, U.(Eds*) Controlling the environment* (STAN BSC 207).*Basic Science Panel Series* (4) . Uyo : Charlie Educational Publishers Ltd.

McLeod, S. A. (2014).*Lev Vygotsky*. Retrieved on the 8th of August,2016 from www.simplypsychology.org/vygotsky.html

Mwamwenda, T.S (1995). *Educational Psychology: An African Perspective*. London: Heineman Bulterworth Publishers LTD.

NECO (2011). Register/Chief Executive of the Council Annual Report

Nwagbo C.R. & Okoro A.U.(2012).Effect of Interaction Patterns on Achievement in Biology among Secondary School Students. *Journal of the Science Teachers Association of Nigeria.47(1), 22-32.*

Okeke, P.N. & Anyakoha, M.W. (1994).*Senior secondary physics*. Ibadan: Macmillan Educational Plc.

River State zonal post primary schools' board (2016).List of senior secondary schools in port harcourt local government areas.

The Nation Newspaper October, 27th 2016. Institute Bemoans Candidates' Poor Performance in Physics. (thenationonlineng.net/institute-bemoans-candidatepoor-performance-physics/). Last accessed 27th may,2017.

Uche, C.M., Awojo, G.C. & Agbakwutu ,C. (2014), Teaching made easy: *Theories, methods and practice*. SABCOS Publishers & Printers (p) 97-119

Zachariah, K. M. (2012). Factors contributing to students' poor performance in mathematics at Kenya Certificate of Secondary Education in Kenya: A Case of Baringo County, Kenya. *American International Journal of Contemporary Research*.2 (6), p87 - 91.

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