



Effect of Activity-Based Learning Strategies on Students Academic Performance in Physics, in Yenagoa Metropolis of Bayelsa State.

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ABSTRACT

This study investigated the effect of activity-based learning strategies on secondary school Physics students' performance in Yenagoa metropolis, Bayelsa State. Quasi-experimental pretest-posttest research design was adopted for the work. The study sample consists of 150 senior secondary school Physics (SS2) students drawn from a population of 926 Physics students using purposive sampling technique. Two schools were assigned to the experimental group, while one class was used as the control group. A 20-item multiple choice achievement test on Heat Energy titled PATHE was used to gather data for the study. The reliability of the instrument PATHE was obtained using Kuder-Richardson formula 21 (KR21) and a value of 0.82 was obtained. Two research questions and two null hypotheses guided this work. Research questions were analyzed using mean and standard deviation, while the hypotheses were tested using ANCOVA at 0.05 level of significance. Major findings of this study showed that students taught using the activity-based learning strategies (cooperative, and practical work) performed significantly better than their counterparts taught using the demonstration method. Practical work method was more effective than cooperative method while cooperative method proves to be more effective than the demonstration method. Based on the findings, it was recommended among others that The use of activity based learning strategies in the teaching and learning of Physics should be made compulsory for all Physics teachers, especially at the secondary school level and that Government at all levels should show commitment and support in promoting innovative teaching in Physics and other science subjects at the secondary school level by providing an enabling environment and the required facilities in secondary schools so as to make students' centered learning activities a reality

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Introduction

Physics is known as the fundamental science which creates a foundation for other natural sciences. It is usually defined as the study of matter and energy and the interactions between them. [4]. But unfortunately, despite the important roles Physics play in our daily lives, most students usually regard it as a very difficult subject not knowing that we are all surrounded by Physics all the time, whether we realize it or not. From the electric bulbs in our homes, to the tap in our buildings, are all either designed, manufactured or built by basic principles in Physics. A report by the chief Registrar/Chief Executive of the council, Prof. Promise M. Okpala decried the poor performance of students in core science subjects like Physics, Biology, chemistry and Mathematics in May/June, [10]. He attributed the mass failure in external examination to lack of good and quality teaching on the part of the teachers, nonchalance in terms of learning on the part of the students, among other factors. Good and quality teaching has to do with the teacher's prowess in the application of appropriate teaching methods and strategies 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 the students. In the same vein, the national president of the Nigerian institute of Physics Prof. David Malgwi in 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 with immediate effect. He stated that secondary school leavers performance in Physics in WASSCE and NECO is very poor and without good background in Physics, other professions like Engineering, Geoscience, Pharmacy, Medicine, Astronomy and many more cannot excel and therefore make any meaningful impact on the Nigerian society [16]. And of course, Nigeria cannot realize her dream in the development of science and technology if its citizens do not have outstanding performance in Physics and other science oriented subjects.

Important to note also, is the fact that no nation can survive economically and compete favorably, if the future generation is performing poorly in scientific fields like Physics. And that is why it is a matter of concern that despite

the utility value of Physics and its involvement in science related courses that give prominence to a nation, students performance in the subject at the senior secondary school level still remains at a very low level. This has for long been posing a lot of concern to science educators. Surprisingly, this is not just a national issue but is an international problem as stated by [9]. It is an international problem that there is declining interest to study science as well as lack of enthusiasm to take Physics course in schools and colleges. Decline in enrollment and graduation rates in Physics at all levels has been evident even in advance countries like USA, UK, Germany and Netherlands [13].

Physics like any other science oriented subject can be taught and learnt by various teaching methods, some by listening and some other methods are by doing. The selection of the most suitable teaching strategy is a basic condition for a successful teaching/learning process. Teaching of science requires more understanding and conceptual linkage of various scientific representation. [1]. The teaching/learning techniques must have necessary provision for students' active engagement with explanatory ideas, theories and evidence so as to enable the connection of scientific concepts to real purposes and practices in the world they live. Important to note also, is that, the most recommended strategies for teaching science are problem solving, enquiry-based teaching, laboratory-based activities and project-based teaching/learning approaches. But unfortunately, teachers teach classes the same way they were taught, typically using lecturing [7]. This unfortunately leaves the learners to the fate of depending on rote learning without having an in-depth understanding of scientific phenomenon, concepts and theories. But the fact still remains that the type of instructional method carried out by a teacher determines to a large extent how interested the students find the subject. According to [2], the demonstration method is not effective by researchers and educationalist worldwide. Whereas, activity-based learning strategies seems to be the best strategies for Physics instruction as they tend to encourage the constructive and discovery learning approach. [5]. opined that activity based learning strategies involves working with and transforming physical objects in order to learn through experience. Important to note also, is that students need visual aids which they can use to reduce the abstract nature of Physics. This implies that, for effective learning in Physics to take place, teachers may need to apply activity-based learning approach in the teaching and learning process as they are likely to encourage mastery and retention of concepts, enhance practice of learning by observation and processing from concrete to abstract. They equally tend to foster peer tutoring and encourage students to study on their own. They also encourage collaborative learning, critical thinking, creativity and effective communication. They are students centred by nature. Usually during activity based instruction, students have the opportunity to read, discuss, write, practice, analyze, synthesize and evaluate. The major theoretical perspectives related to these instructional methods are the constructivist, cognitivist and motivational learning theories.

In a nutshell, students must be actively involved (hands on) in their learning process through the activity based learning strategies which include cooperative learning, discovery learning, active learning approach, scaffolding, games and play, computer assisted instruction, effective practical work, demonstration learning strategies etc. For this work, the researcher wish to ascertain the effect of

cooperative learning strategy and practical learning strategy on the academic achievement of Physics students in Yenagoa metropolis of Bayelsa State.

Cooperative learning strategy is an approach that facilitates the exploration of problem solving. [8]. clearly asserted that students showed improvement in their academic interactions and learning styles as a result of cooperative learning strategy. It creates an environment for students to be engaged in the teaching and learning process. [12]. defined cooperative instructional strategy as a teaching method in which students work in groups of 4 - 6 members and are rewarded in same way for performance as a group. In cooperative learning strategy, each individual has responsibilities and is held accountable for aiding in the completion of the assignment; therefore, success is dependent on the work of everyone in the group [11]. Cooperative learning is a technique that allows students to learn from each other and gain important interpersonal skills. It enables learners to collaborate as they work in groups, express themselves comfortably and equally share ideas that would enable them complete a given task or achieve a certain learning goal. Students who are intelligent can explain problems to the less able ones thereby facilitating understanding. Previous literature suggests that group work could arouse students' learning interest, cultivate their exploring ability and creative thinking and improve their team spirit and social communication skills [6]).

On the other hand, effective practical work method, is a teaching method in which the students are meant to learn through handling and manipulation of materials and equipment, observing directly and demonstrations [12]. Appropriate practical work is a means through which the idea of constructivism is achieved. It is students' centered since students are engaged in instructional activities that challenge and extend students' insight. The benefit of appropriate practical work is the focus on practice, after the presentation and modelling, the teacher directs structured practice, the teacher ask specific important questions and allow students to respond. Immediate feedback will be given to students, telling them what is correct and what is incorrect. After that, the teacher assigns assistance to the students, monitors the practice and continues to provide feedback. The concept of practical work involves observation, experimentation, or application by individual or small groups dealing with actual materials. This teaching strategy is not limited to a classroom called laboratory. Any environment outside the classroom that provides practical work to give first hand experiences to the learner could be regarded as a laboratory where practical work can take place. [12] added that practical work could be in form of field work or exploration of the students' immediate environment. Students can be encouraged to apply some scientific concepts to solve problems within their immediate environment, either at home or at the school. Practical work strategy also known as "hands on, minds on" learning strategy entails "that which I here, I forget but that which I do I remember", and it is very true of science. Students hear when they are taught, and the information imparted here could be forgotten easily. They see when the teacher demonstrates but the information imparted here could also be forgotten easily. They see when the teacher demonstrates but there may be misrepresentations or oversights in the demonstration and so the concept may not be well understood by the students. But the students will understand better when they practice or do the activities

necessary to nail in the concept and this is the crux of science teaching. Students construct their knowledge actively by thinking, doing and interacting with the environment using practical work strategy [15]. As a result, practical work strategy is of great importance to Physics teaching and learning. During practical work, the students are free to carry out investigations in accordance with their conception and there is no bondage of authority.

For demonstration method of teaching according to [12], it is the method of teaching which involves showing, doing and telling the students the points of emphasis. Also, demonstration method is used for skill learning as learners are being presented with first hand practices that makes them to react through careful observation.

Statement of the Problem

To many senior secondary school students, Physics is a very difficult subject. This conclusion can be attributed majorly to previous poor performance they usually obtain at the end of their exams in Physics both at internal and external examination. Subsequently, students tend to develop poor interest in the subject and this can be seen in the obvious decrease in the number of secondary school students going in for Sciences. The number of students that enrolled and sit for WAEC in May/June have always recorded a mass failure particularly in Physics as reported regularly by examination bodies such as WAEC and NECO as seen on the pages of the daily newspapers and as observed by the president of Nigerian Institute of Physics (NIP) Prof David Malgwi at its 39th conference at Crawford University, Ogun state. He raised an alarm over the poor performance in Physics and equally warned that the situation must be tackled as a matter of urgency. He emphasized on the poor performance of secondary school leavers in Physics in WAEC and NECO which if not checked would have a negative ripple effect on other science related professions like medicine, engineering, architecture, etc [16].

These prompted the researchers into asking, why the decline in performance and enrolment rate in Physics. Thus the need for this research, to determine if there are better teaching methods that can be used to make the teaching and learning of Physics simpler and more interesting, thereby improving their academic performance in Physics. This is the trust of the research work; to investigate the cooperative learning strategy and practical work learning strategy on secondary school Physics students' academic performance in Yenagoa metropolis, Bayelsa State.

Aim and Objectives of the Study

The aim of the study is to determine the effect of cooperative learning and practical work learning strategies on senior secondary students' academic performance in Physics in Yenagoa metropolis, Bayelsa State. Specifically, the objectives of the study are to:

1. Investigate the effect of cooperative learning strategy on students' academic performance in Physics.
2. Find out the effect of practical work on students' academic performance in Physics.

Research Questions

1. What is the effect of cooperative learning strategy on Physics students' mean performance score in Physics?
2. What is the effect of practical work on students' mean performance score in Physics?

Hypotheses

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

1. There is no significant difference between the mean performance score of Physics students taught with cooperative learning strategy and those taught with the demonstration teaching method.

2. There is no significant difference between the mean performance score of Physics students exposed to practical work and those taught with the normal demonstration method of instruction.

Methodology

Quasi experimental research design of pre-test, post-test control group design was used. Purposive sampling technique was used to select a study sample of 150 Physics senior secondary two (SS2) from a population of 926 SS2 Physics students in Yenagoa metropolis of Bayelsa state. Two intact classes were used as the experimental group, taught using cooperative learning strategy and practical based methods, while the control group was taught using the demonstration method of teaching. In all, there were 100 students for the experimental group, and 50 students for the control group. The instrument used was a researcher-made Achievement test titled, "Physics Achievement Test on Heat Energy (PATHE)", which consist of 20 multiple choice questions with options A to D, with only one correct answer. Each question attracted five (5) marks for a correct response, and zero (0) for a wrong response. The instrument was validated by two experts in the field of Curriculum studies and Educational Technology, Faculty of Education, University of Port Harcourt, and one experienced Physics teacher from one of the senior secondary schools in Yenagoa, Bayelsa state. The reliability coefficient 0.82 was obtained using test retest method. The research questions were analyzed using mean and standard deviation. While the hypotheses were tested using analysis of Covariance (ANCOVA).

Data analysis and Presentation

Research Question 1: What is the effect of using cooperative learning strategy on students' mean performance score in Physics?

Table 1. Mean and standard deviation, for the experimental and control group.

Groups	N	Pre-test	SD	Post-test	SD	\bar{x}
		\bar{x}		\bar{x}		
experimental	50	36.30	7.41	78.30	12.96	42.00
control	50	35.20	8.86	54.40	7.60	19.20

Table 1 showed the mean difference of 42.00 for the cooperative method and mean difference of 19.20 for the demonstration method. This result indicates that cooperative method is more effective and improves students' academic performance in Physics much more than the demonstration method, particularly in the teaching and learning of Heat Energy.

Research Question 2: What is the effect of practical work on Physics students' performance in Physics?

Table 2. Mean and standard deviation, for the experimental and control group

Test: achievement	N	Pre-test	SD	Post-test	SD	Mean difference
Method		\bar{x}		\bar{x}		\bar{x}
Practical work method	50	38.30	7.70	80.60	11.19	42.00
Demonstration method	50	35.20	8.86	54.40	7.60	19.20

Table 2 showed the mean difference of 42.10 for the practical method and mean difference of 19.20 for the

demonstration method. This result indicates that practical method is more effective and improves students' academic performance in Physics than the demonstration method.

Hypotheses

Hypothesis 1: There is no significant difference between the mean performance score of Physics students taught with cooperative learning strategy and those exposed to demonstration method.

Table 3. Summary of ANCOVA of students performance in Physics based on methods of teaching.

Source	Type III sum of squares	Df	Mean square	F	Sig.
Corrected model	577.846 ²	2	288.923	64.299	0.000
Intercept	716.238	1	716.238	159.396	0.000
Pre-test	6.636	1	6.636	1.477	0.227
Method	560.273	1	560.273	124.687	0.000
Error	435.864	97	4.493		
Total	18623.000	100			
Corrected total	1013.710	99			

Table 3, shows a significant difference between cooperative and demonstration method on students' performance in Physics. Thus the null hypothesis was rejected ($p = 0.001$ and $f_{1,97} = 124.687$).

Hypothesis 2: There is no significant difference between the mean performance score of Physics students taught with practical work method and those taught with demonstration method.

Table 4. Summary of ANCOVA of students performance in Physics based on methods

Source	Type III sum of squares	Df	Mean square	F	Sig.
Corrected model	55011.473 ²	2	27505.736	410.626	0.000
Intercept	3318.472	1	3318.472	49.541	0.000
Pre-test	3482.473	1	3482.473	51.989	0.000
Method	50040.216	1	50040.216	747.038	0.000
Error	6497.527	97	66.985		
Total	396750.000	100			
Corrected total	61509.000	99			

Table 4, shows a significant difference in practical work and demonstration method on students' performance in Physics. Thus the null hypothesis was rejected ($p = 0.001$ and $f_{1,97} = 747.038$).

Discussions of Findings

The study revealed that teaching of Physics with cooperative method enhanced performance of the students. The difference in mean scores was significant. This shows that the students taught with cooperative method performed better. This implies that cooperative method is a good teaching method, and that it can be used to enhance students' performance in Physics. This agrees with [6] who reported that group work arouse students' learning interest, cultivate their exploring ability and creative thinking and improve their team spirit and social and communication skills in learning. This further agrees with [13] who opined that group work can help students become more active in their learning.

It was also revealed that practical work method is more effective and improves students' academic performance in physics more than the demonstration method, as shown in table 4. The table revealed that, there was significant difference in the mean scores of students in the practical work

and demonstration method groups. This implies that students who are exposed to practical work method achieved better scores than the students who were exposed to demonstration method. This is in line with [3]. who reported that When adequate materials are provided for students' practice, it will promote meaningful learning, stimulate interest, encourage critical thinking, exploration, deep learning and develop curiosity of mind.

Conclusion

From the findings, the three teaching strategies used in this research work were significantly different in their effects on students' performance in Physics. Practical work method was more effective than cooperative method while cooperative method was more effective than the demonstration method.

Recommendations

The following recommendations were made from the findings:

1. The use of activity based learning strategies (cooperative learning strategy, and practical work method) in the teaching and learning of Physics should be made compulsory for all Physics teachers and instructors especially at the secondary school level as its importance cannot be over emphasised.
2. Physics teachers at the secondary school level should as a matter of urgency be given orientation through seminars, workshops and conferences on the importance of applying the activity based learning approach in the teaching and learning of Physics.
3. Government at all levels should show commitment and support in promoting innovative teaching of Physics and other science subjects at the secondary school level by providing an enabling environment and the required facilities in secondary schools so as to make students' centred learning activities a reality.

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