Effects of two Teaching Methods on Academic Performance of Physics Students in Secondary Schools in Ekiti State, Nigeria

Adebisi O. AWODUN (Ph D)
Department of Physics, College of Education, Ikere-Ekiti.
E-mail: bisawoideas@yahoo.com

Abstract
This study investigated Effects of two Teaching Methods on Academic Performance of Physics Students in Secondary Schools in Ikere Local Government Area of Ekiti State, Nigeria. The population for this study consists of all students in Senior Secondary School I (SSS I) offering Physics as a subject in all the public Secondary Schools in Ikere Local Government Area, Ekiti State. Stratified random sampling technique was used to select twenty (25) Physics students each from each of the six (6) selected SSS class I in Ikere LGA of Ekiti State, Nigeria. A total of one hundred (150) SSS I Physics students were used as samples for the study. Three null hypotheses were posited and tested at 0.05 level of significance using the T-test method. A well validated test item was administered to the sample students drawn from the population of secondary schools in the study area. The analysis of the test items revealed there was significant difference between the performance of students taught physics with cooperate learning and those taught with laboratory method. Study also reveals that female students taught with cooperate learning. It also reveals that there was no significant difference between the performance of students in male and female students taught with laboratory method. Based on the findings of the study, conclusion and appropriate recommendations were made.
Keywords: teaching, teaching methods, cooperative learning, laboratory method

Introduction

There has been a drastic reduction in the performance of secondary school students in Nigeria in the past decades especially in Physics. This could be traceable to psychological, physiological or environmental factors, teachers' poor condition of service; lack of qualified teachers; inadequate supply of facilities and equipment; lack of motivation, lack of instructional materials; and poor method of teaching (Emaikwu & Nworgu, 2005; Emaikwu, 2012). Physics education has been awfully reported and acknowledged by all as a subject that is predominantly taught in laboratory, without considering remote and underdeveloped settlement where it is necessary for government to establish at least a secondary school with or without laboratory through which devising other teaching technique in such scenario is inevitable. Owolabi & Oginni (2012) remarked that teachers achieve more if given the opportunity to improvise materials on what to be taught in the classroom.

Ogunniyi (2009) adduced poor performance in public examination to teaching techniques by teachers. The effect of poor performance in physics resulted into low achievement and low retention level in students' outcome both in internal and external examinations.

Mtsem (2011) reported that teaching method affects the responses of students and determines whether they are interested, motivated and involved in teaching learning process. What constitutes good teaching and learning of school subjects is the use of appropriate methods of teaching. Ogunniyi (2009) asserted that one of the most persistent and compelling problems besetting achievement is poor quality of teaching. Corroborating this assertion, Harrison (2010) reported that many school subjects especially Physics is not being learnt as it ought to be in Nigeria secondary school because of inappropriate teaching methods. Oginni & Owolabi (2012) reported several instructional strategies to be employed by various teachers in the teaching of Science and Mathematics, thereby encouraged the use of programmed instruction as a panacea to students' dwindling interest in Mathematic sand sciences.

The study of physics as a subject should be regarded as a necessary part of human endeavours. Unfortunately today, it is observed that many students have developed negative attitude towards the subject. It has become almost a general belief among students that physics is an abstract subject and hence too difficult to learn.The conceptual nature of physics, however, lends itself to several methods Project-based instructions places the emphasis of student learning on real-life practice, while lecture-based instruction relies on introducing new and complicated information to students in a familiar way. In both situations, the instructor must make extensive preparations to ensure the maximum level of student learning and that students will use different skills to interact with the information. Lecture-Based instruction is effective for teaching the history of physics and other fact-based information which help introducing students to "fill-in-the-blank time-line" of important concept in physics. The instructor need to prepare extensive notes on each concept that includes a graphic organizer and visual note sheet for the student. Providing the student with information both orally and visually is a vital part of instruction needed especially where there is no standard laboratory. Graphic organizers allow students to follow along with the lecture and build learners' understanding of each concept with the instructor. It also allows the instructor to informally assess student knowledge as the lesson progresses. Scholars refer to lecture method to be telling method which is different from teaching, even though, the method affords the class, opportunities to obtain useful and essential facts, information and knowledge at the maximum expense of time. Ogwuozor (2006) asserted that the most prominently used approach in the teaching of sciences in secondary schools is the often criticized lecture method as against the activity method.

There is no single method which can be regarded as best for every teaching situation. Ada (2005) reported that there are numbers of criteria available that may guide the teacher in the choice of any given method of teaching which include: the content to be taught, objectives to be achieved, time available, number of students, teachers' preferences and individual differences, the type of lesson, facilities available, needs and interest of the class, among others. Adebola (2009) observed that students taught physics using heuristic method scored higher in achievement test followed by demonstration method while field and lecture methods scored the least. This indicated that there is a significant relationship in the instructional strategies employed by teachers for students' achievements. Problem solving method in the teaching of science students' influence their academic performance and students taught physics via problem solving method have a mean score higher than their counterparts who were taught the same concept with lecture approach. Good teaching is the result of exposing students to certain experience through adequate guidance and providing appropriate learning activities so that they acquire the best form of learning. In spite of efforts made by teacher and learners, we often discover that learning still falls short of desire expectations. This deplorable situation urgently requires physics educators and curriculum planners to pay attention so as to arrest the problem quickly before too much efforts and time are wasted (Owolabi, 2008). Gender in relation to achievement has been an issue of interest and concern to researchers in education. There are varying opinions on which gender (either males or females) achieves better than the other. On this, Offorma (2004) remarks that there are those that claim that males performed better than females, yet others claim that females achieved higher or better than their male counterparts. On the debate, Azikiwe, (2005), claims that the widely held view that females were superior in language use (acquisition and performance) was based mainly on studies in foreign countries especially English speaking ones and that this position is not tenable in Nigeria. She concluded that her survey on research studies on gender influence on achievement in language in Nigeria indicate that many studies did not establish enough evidence to support the claim that females are better than males in language. The issue of gender becomes crucial in this present day because the schools in the research are co-educational; hence, the need to see what effect gender has on students' achievement in the use of the two method technique in Physics learning. The problem of this study therefore is to ascertain how teaching methods enhances better performance of secondary schools students in physics.

Research Hypotheses

The following null hypotheses are formulated for the study:

1. There is no significant difference in the performance of students taught Physics with cooperate learning method and laboratory method.
2. There is no significant difference between the performance of male and female students taught physics with cooperative learning.
3. There is no significance difference between the performance of male and female students taught physics with laboratory method.

Cooperate Learning Method of Teaching and Physics Students Academic Performance

Cooperative learning is the umbrella term for a variety of educational approaches involving joint intellectual effort by students, or students and teachers together (Wendy, 2005). It requires a small number of students to work together on a common task, supporting and encouraging one another to improve their learning through interdependence and cooperation with one another (Larry & Hartman, 2002). The cooperative learning groups

usually comprises two to five students in a group that allows everyone to participate in a clearly designed task (Sarah, 2006; Wendy, 2005). Students within small groups' cooperative learning are encouraged to share ideas and materials and divide the work when appropriate to complete the task. Small group competitive learning provides students with opportunity to explore and discuss topics with peers in a Bonds-on, interactive environment (Larry and Hartman, 2002). Gillies (2004) affirmed that students benefit academically and socially from cooperative small group learning.

The learning together strategy of cooperative learning provides a conceptual framework for teacher to plan and tailor cooperative learning strategy according to their circumstances, students' needs, and school contexts (Ghazi, 2003). The challenges of teaching science are to teach it in a way that enables pupils to learn science concepts while acquiring process skills and positive scientific attitudes. One of the effective ways of accomplishing these objectives is through involving students in hands-on activities in the context of cooperative learning. Brad (2000) investigated the effectiveness of cooperative learning on students' academic performance in computer under cooperative and teacher-centered learning environments. He found that students in cooperative learning group exhibited higher level of academic performance. Chien (2002) also conducted an experiment on two vocational senior high classes to observe cooperative learning effect in the EFL classroom. Result indicated that students in cooperative EFL learning group performed better than their colleagues in the traditional EFL learning group. Chien's (2004) study was in agreement to her study in 2002. She created a measurement to gauge the effectiveness of cooperative learning. Her results showed that students in cooperative learning group improved in their posttest scores over time, which indicated that cooperative learning could improve English skills.

How cooperative learning affects student's achievement and problem solving skills was investigated by Effandi in 2003. This study of intact groups compared students' mathematics achievement and problem solving skills. The experimental group was instructed using cooperative learning methods, while the control section was instructed using the traditional lecture method. Results indicated that students in cooperative group instruction showed significantly better results in mathematics achievement and problem solving skills than their colleagues in the traditional group. The findings of Samuel and John (2004) also confirm the effectiveness of cooperative learning methods. They investigated the effects of cooperative learning strategy on students' achievement in chemistry. Using a non-equivalent control group design, the study found that cooperative learning strategy facilitated students' chemistry learning more than regular methods. Samuel and John (2004) examined how the cooperative class experiment (CCE) teaching methods affect students' achievement in Chemistry. The study founded that CCE method facilitated students' chemistry learning more than regular methods. The study of Martin and Roland (2007) confirmed the finding of Lawrence (2006). They compared the effects of cooperative learning method of jigsaw and traditional direct instruction method on the cognitive achievement in physics. Analysis of the result revealed no significant differences between the two groups of instruction in students' cognitive achievement in physics.

Laboratory Method of Teaching and Physics Students Academic Performance

Laboratory work is essential in the study of physics. The primary goals of introductory physics laboratories have been evolving over the past century. The current impetus for changes in laboratory instruction stems from new research on student learning and technology, as well as changes in the overall goals of physics instructors. The principle of Physics is stood on the test of all knowledge through experiment. Experiment is the sole judge of scientific "truth". But what is the source of knowledge? Where do the laws that are to be tested come from? Experiment, itself, helps to produce these laws, in the sense that it

gives us hints. But also needed is imagination to create from these hints the great generalizations—to guess at the wonderful, simple, but very strange pattern beneath them all, and then to experiment to check again whether we made the right guess. The laboratory should engage each student in significant experiences with experimental processes, including some experience, observation and investigation. For many students, an early experience with a stimulating scientific process in which they control the steps of an investigation can be a critical "turn-on" to physics and other sciences.

The laboratory should help the students develop a broad array of basic skills and tools of experimental physics and data analysis. While it is imperative that students have a broad experience with techniques using laboratory equipment, it is impossible to prescribe precisely which equipment should be used in all Physics laboratories. At the same time, it is advisable to allow students to make the use of many different types of laboratory apparatus to make observations. The most important feature of effective Physics teaching is to support theoretical explanations with actual practices in the laboratory. The laboratory practices generally aim to improve the students' abilities by providing observation for conducting the experiments (Morgil, Gungor Seyhan, & Secken, 2009). Laboratory activities have long had a distinctive and central role in Physics curriculum, and Physics educators have suggested that many benefits accrued from engaging students in Physics laboratory activities (Hosften & Lunetta, 2004; Burke, Thomas, & Brian, 2006). Also Leonard and Dufrense (1996) stressed that the use of inquiry approaches in college Physics laboratory courses provide evidence that such approaches involve students more and are more inductive than traditional approaches. He went further to say that the approaches provide less direction and therefore assign students more responsibility to determine procedural strategies and encourage students to make more use of Physics process skills. It was also reported that because students are using inquiry laboratory manual does not guarantee that students are doing inquiry or that the instructor is teaching using the inquiry process (Greenbowe & Hand, 2005; Burke, & Greenbowe, 2006). Herron & Nurrenbern (2005) cited in (Burke, Thomas, & Brian 2006) Stated that, "inquiry-oriented laboratory activities teach inquiry better than lecture/demonstration or verification laboratory exercises, but only if teachers are skilled in inquiry teaching methods and students are given the time and guidance required to become comfortable with the new methods and expectations". Experiencing and understanding scientific phenomena and the scientific process are goals of most science laboratory courses. To achieve these goals, laboratory courses should provide opportunity for students to "restructure information" rather than simply be involved in verifying what they have been told. Students need to actively construct physics knowledge by being purposefully involved in posing questions, determining claims, and providing evidence (Thomas & Brain, 2006). Physics learning goals that have been attributed to laboratory experience includes:

i. Enhancing mastery of subject matter; developing scientific reasoning, understanding the complexity and ambiguity of empirical work,
ii. Developing practical skills, understanding the nature of Physics, cultivating interest in Physics and interest in learning Physics; and developing teamwork ability in solving problems as stipulated in (National Research Council, 2006).

It was also stated that no single laboratory experience is likely to achieve all these learning goals, different types of laboratory experiences may be designed to achieve one or more goals. Buntine, Read & Barrie, et al. (2007) stated that laboratory work is integral to bridging the gap between the molecular and macroscopic levels in Physics. Good laboratory programs provide a learning environment where physics students can forge links between theoretical concepts and experimental observations (Hegarty-Hazel, 1990). In a well designed laboratory, students interact closely with teachers and peers, so that learning can be enhanced, monitored and assessed effectively (Psillos & Niedderer, 2002 in Buntine et al., 2007). It has

been recognized that a well-designed laboratory program for science, such as Physics, serves as a stimulant motivating students to learn.

Furthermore, laboratory experiments can help students to understand abstract concepts in Physics. Practical work is fun and interesting for the students. As a result of this, they are motivated to explore the material which related to the topics in the classroom. Practical work in the laboratory encourages students to approach problems and solve it, find the facts and new principles, develop ability to cooperate and develop critical attitude towards the subject. However, teachers' roles to help the students achieve these positive aims of practical work are very important. One of the teacher's roles is to create the positive learning environments in the laboratory to achieve the best education for the low performing Physics students.

Gender and Academic Performance of Students

Gender is a cultural construct that distinguishes the roles, behaviour, mental and emotional characteristics between females and males developed by a society. Umoh (2003) defines gender as a psychological term used is describing behaviours and attributes expected of individuals on the basis of being born as either male or female. According to Okeke (2003), the study of gender is not just mere identification of male and female sexes. Scholars have gone further to identify responsibilities assigned to opposite sexes and to analyze the conditions under which those responsibilities are assigned. Furthermore, Okeke (2003) specifically notes that the study of gender means the analysis of the relationship of men and women including the division of labour, access to resources and other factors which are determined by society as opposed to being determined by sex. It further involves the study of the socio-cultural environment under which responsibilities are assigned and the relationships emanating from it.

Gender is a major factor that influences career choice and subject interest of students. Further explanation in this context shows that Home Economics, Nursing, Secretary-ship and other feminine related careers have been traditionally regarded as aspects of the school curriculum reserved for females (Umoh, 2003). Based on this, males chose male stereotyped occupations and females chose female stereotyped occupations. According to Umoh (2003) more difficult tasks are usually reserved for males while less difficult ones are considered feminine in a natural setting. Example of this is breaking of firewood, which is often seen as manly task while washing of plates could be seen as a female task at home. Thus at school males are more likely to take to difficult subject areas and challenging problem-solving situations while female on the other hand prefer simple subjects and often shy away from difficult tasks and problem-solving situation.

Ekeh (2003) discovered that male secondary school students performed better than females in science and mathematics. These differences in performance can be attributed to gender stereotyping which encourages male and female students to show interest in subjects relevant and related to the roles expected of them in the society. The National Assessment of educational Progress in 1992 showed that males had higher average scores than girls between the ages of 9, 13 and 17.

Research Method

The research design used was descriptive in nature and this work is design to explain the effect of two teaching methods academic achievement of secondary school student in Physics in Ikere Local Government Area of Ekiti State.

Stratified sampling technique was used to select 20 students two public schools in Ikere Local Government, this make it 40 students.

The instrumentation used in collecting data for this study was student achievement test in physics. The model is the likert scale model which has two sections A and B. Section

A contains the personal data of the respondents, while section B of the questionnaire contains items that related to the research topic.

The drafted question was given to experts in the field of science education for verification before it was finally submitted to the supervisor for approval.

The data was collected for the study. It was analysed using percentage mean, standard deviation and t-test analysis techniques. The result of the data would be presented in tabular form in chapter four.

Results and Discussion

Hypothesis 1: There is no significant difference in the performance of students taught Physics with cooperate learning method and laboratory method.

Table 1: T-test analysis of performance of students taught Physics with cooperate learning method and laboratory method.

Variable	N	Mean	SD	df	T-cal	T-tab	Remark
Cooperate learning	20	15.78	4.22				
Laboratory method	20	19.23	4.93	38	2.38	2.01	*

P < 0.05 level of significance, * = Significant

The result in table 1 shows the difference between the performance of students taught physics with cooperate learning and laboratory method, the table revealed that the mean score for student taught with cooperative learning (15.78) was less than the mean score for students taught with laboratory method (19.23) with mean difference of (3.45). The T-test analysis showed that t-calculated (2.38) was fairly greater than the critical t-value (2.01) at the 0.05 level of significance. This implies that there is significant difference between the performances of students taught physics with cooperate learning and those taught with laboratory method. Hence, the null hypothesis was no upheld.

Hypothesis 2: There is no significant difference in the performance of male and female students taught physics with cooperative learning.

Table 2: T-test analysis of performance of male and female students taught physics with cooperative learning.

Variable	N	Mean	SD	df	T-cal	T-tab	Remark
Male	10	13.24	4.65	18	0.30	2.01	**
Female	10	13.78	3.20				

P > 0.05 level of significance, ** = Not Significant.

Table 2 above shows the difference between the performance of students in male and female students. The table showed that the mean score for male students (13.24) was less than the mean score for female (13.78) with mean difference of (0.54). The T-test analysis revealed that T-calculated (0.30) was less than the critical T-value (2.01) at the 0.05 level of significance. Hence, the null hypothesis was upheld. This means that there is no significant difference between the performance of students in male and female students taught with cooperate learning.

Hypothesis 3: There is no significant difference between the performance of male and female students taught physics with laboratory method.

Table 3: T-test analysis of performance of male and female students taught physics with laboratory method

Variable	N	Mean	SD	df	T-cal	T-tab	Remark
Male	10	13.10	3.54				
Female	10	14.31	4.78	18	0.64	2.01	**

P > 0.05 level of significance , ** = Not Significant.

The result of analysis in table 3 shows the difference between the performance of male and female students. The table showed that the mean score for male students (13.10) was less than the mean score for female students (14.31) with mean difference of (1.21). The T-test analysis revealed that T-calculated (0.64) was less than the critical T-tabulate (2.01) at the 0.05 level of significance. Hence, the null hypothesis was upheld. This implies that there is no significant difference between the performance of male and female students taught with laboratory method.

Discussion of Findings

Hypothesis 1 showed that there was a significant difference between the performance of students taught with cooperate and laboratory method. This suggests that teaching methods have significant influence on students' performance in physics. Thus, the finding of this result agreed with that of Lawrence (2006) where he posited that various teaching methods play significant impact on students' performance.

The result hypothesis 2 indicated that there was no significant difference between the performance of students in male and female students. This implies that gender has no effect on academic performance of students.

Conclusion

This study shows that there was significant difference between the performances of students taught Physics with cooperate learning method and laboratory method. In a well designed laboratory, students interact closely with teachers and peers, so that learning can be enhanced, monitored and assessed effectively.

There is no significance difference between the performance of male and female students taught physics with cooperative learning. Difficult tasks are usually reserved for males while less difficult ones are considered feminine in a natural setting.

In conclusion, is no significance difference between the performance of male and female students taught physics with laboratory method. Gender has no significant influence on students' performance in science.

The results of the study showed that the use of cooperate is more effective than the competitive interaction strategy in physics classes. There is need to find techniques of improving physics-learning which is regarded as being the most feared of the sciences. This assertion also supported by Neil (1990) when he claimed that small groups working cooperatively to ask for and give help to one another would encourage their interaction as well as build confidence. These implied that the co-operate learning seems to be one of the teaching learning techniques which can enhance students' performance promotes academic goals, improved skills and attitudes in physics.

Recommendations

In view of the results of these findings and conclusions reached in this study, the following recommendations are hereby offered.

1. Physics teachers should be encouraged to adopt laboratory based instructional intervention method as an effective learning strategy to enhance the performance of low performing students in and influence their attitude towards Physics.
2. Laboratory-based instructional intervention should be used in teaching various concepts in Physics starting from senior secondary school and continuing in tertiary institutions.
3. Physics students at senior secondary schools level should be given the opportunity to handle and manipulate materials, tools and equipment in the laboratories.
4. More females students should be encouraged to enroll in Physics classes and teachers should target them for guidance as females have qualities which can enhance their acquisition of Physics concepts.

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