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# Effect of ASEI Teaching Approach on Physics Students' Achievement and Retention in Nassarawa Eggon Metropolis

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## Abstract

This study was conducted to determine the effect of Activity, Student-centred, Experiment and Improvisation (ASEI) teaching Approach on the Students' Achievement and Retention in Physics in Nasarawa Eggon Metropolis. It compared the ASEI and conventional teaching approaches on students' achievement and retention in Physics in Nassarawa Eggon, Nasarawa State. Quasi-experimental research design of pre-test, post-test control group design was employed. The study answered two research questions and tested two research null hypotheses. The sample size of 96 SS II Physics students was drawn from the population of 1,938 SS II Physics students in Government Senior Secondary Schools in Nassarawa Eggon metropolis using purposive and random sampling techniques. The study made use of two groups gotten from two intact classes, out of which one was taught using

ASEI teaching approach and the other one was taught using conventional teaching approach. Two instruments, the Light Waves Achievement Test (LWAT) and Post-test in Light Waves (PTLW), were developed by the researchers and validated by experts with reliability coefficients of 0.86 and 0.80 respectively. Analysis of data was done using mean, standard deviation and ANCOVA. The result of the analysis showed that, students who were taught using ASEI teaching approach performed better than those taught using conventional teaching approach. The study concludes that ASEI teaching approach is better than the conventional approach of teaching Physics if properly employed by teachers. It is therefore, recommended that teachers should engage students in the learning process by making the teaching student-centred which would make the students active in the learning process. Policy makers should intensify effort in recommending ASEI teaching approach to Physics in the review of the Curriculum for Secondary Schools.

**Keywords:** Physics Education, ASEI Teaching Approach, Achievement, Retention, Conventional Teaching

## Introduction

Physics is a study of the science of the physical world in its relation to energy. The tools of Physics can be used to explain, describe and understand everything in the world. Majority of the world's inventions, appliances, tools, and building construction are made possible through the application of the principles of Physics. The keyboard instrument, communication gadgets, clinical thermometer, x-rays machine, firing gun, bicycle, motor car, camera, radio and televisions are a few of the many inventions and discoveries of man which require the knowledge of Physics for their understanding and how they operate.

It is common knowledge that many students whose ambition have been to specialize in professions such as Engineering, Medicine, Architecture, Surveying, Town planning, and other related fields of human endeavors often change their careers because they are not able to secure even the lowest credits in Physics. Therefore, students who are unable to obtain the lowest credit in Physics cannot be given admission to study any of the above-mentioned courses in higher institutions of learning.

The West Africa Senior School Certificate Examination (WASSCE) results revealed that many candidates perform below average in Physics (external examiner report of 2016, 2017 and 2018). Physics as a subject is therefore, confronted by many problems at senior secondary school level. Some of the identified constraints are inadequate supply of facilities, poor teaching methods, and lack of instructional materials specifically designed to aid the teaching of Physics (Solomon & Kedir, 2015).

Akhideno (2005) stated that though there has been a steady increase in the number of students offering science subjects over the years, their achievement has continued to be unsteady. Poor teaching strategies are some of the remote causes responsible for the poor performance of students in Physics (Uzoechi, 2006). Lecture and demonstration methods have been adopted as popular method of Physics instruction in the secondary schools. Uzoechi (2006) also identified weaknesses in these methods of teaching due to their ineffectiveness to yield desired results. Teaching is needed to establish experiences that will involve students and to support their thinking, explanation, view, evaluation,

communication and application of the scientific models needed to suit these experiences. The findings of the study on Strengthening Mathematics and Science Education (SMASE), a Nigeria baseline survey in 2006 revealed that majority of primary/secondary school teachers opted for demonstration, lecture and project methods of teaching in preference to group work activities; as many engage in chalk and talk method as they do not give room for students' active participation in the classroom activities.

Using hand-on activities like Activity, Student-centered, Experiment and Improvisation (ASEI) teaching approach, both high ability and low ability learners may be able to collaborate in terms of understanding, explaining and retaining the concept they have learnt in a Physics class. To this effect, the National Teachers' Institute (2007) stated that Physics as a science subject is activity-oriented and activities-based method was suggested as a good method for teaching it. This suggests that the mastery of Physics concepts cannot be fully achieved without appropriate teaching methods.

Hence, Activity, Student-centered, Experiment and Improvisation (ASEI) teaching approach places emphasis on fostering children's ability in solving problems. This approach of teaching is purely learner-centered and places the teacher in a less involving role. In Activity-Based teaching, students are grouped into small numbers so that each of them can participate effectively in the learning process. Each of these groups is allowed to select their leaders (chairman and secretary) that will oversee their various group contributions. After which the teacher issues out the necessary materials and instructions to each of the groups. Students in this way use their previous/pre-requisite knowledge also in tackling the given instruction while the teacher watches and observe their findings. Leaders of the groups present their points and afterward the teacher summarizes and corrects where necessary (SMASSE Newsletter, 2006). Students that are subjected to this approach of teaching may achieve better.

Achievement is the level of students' performance after completion of a given task or programme been tested on the said task they have undergone. Students' achievement in Physics has been dwindling over the years as shown by several WAEC Chief Examiner's Reports. Thus, several studies of achievement on Physics concepts among Nigerian final year Secondary Schools students revealed under-achievement which is attributed to teaching methods. To deal with the problem of students' poor achievement in Physics, there is need to shift from conventional methods to more efficacious teaching strategies (Okoye & Okeke, 2007).

The ASEI approach to teaching seeks the need for improvising locally available materials instead of depending on the ready-made ones which may not be available. Therefore, in ASEI teaching approach, teachers are encouraged to device knowledge and skills of improvising materials for teaching. Ajayi (2009) blamed lack of resources and teachers' poor knowledge and skills in improvisation as culminating in poor state of science and mathematics in schools.

When learners are exposed to manipulate materials available to them during teaching process, they may as well retain the knowledge learnt. The mind acquires the materials of knowledge through sensation and perception. These acquired materials in the mind need to

be preserved in form of images for knowledge to develop. Whenever a stimulating situation occurs, retained images are revived or reproduced to make memorization possible. Hence, concepts in Physics are supposed to be presented to the learners in a way or approach that touches their sub-consciousness which can trigger quick recalling of the concept being taught or learnt.

Specifically, the study aimed at finding out if the use of ASEI teaching approach to teach light waves could produce higher achievement and retention in students.

## Statement of the Problem

Physics is a core science subject offered in schools whose importance and applications are a major pre-requisite for the achievement of scientific and technological development in every nation. Students have however, consistently performed poorly in Physics over the years in both secondary schools and higher institution of learning. This achievement level has always been of concern to government, educators, teachers, parents and the stakeholders. It is common knowledge that many students whose ambition have been to specialize in professions such as Engineering, Space Science, Geophysics, Medicine, Architecture, Surveying, Town planning, and other related fields of human endeavors often change their careers because they are not able to secure even the lowest credits in Physics. Therefore, students who are unable to obtain the lowest credit in Physics cannot be given admission to study any of the above-mentioned courses in higher institutions of learning. Even those who may obtain the minimum credit in Physics might not do well in those mentioned courses if they have a faulty foundation in the knowledge of Physics and invariably it might affect the nation's scientific and technological advancement.

All efforts made by stakeholders in education have not changed the ugly trend for the better. Hence, the use of inappropriate teaching method had been identified as responsible for poor achievement among other factors. In Nigeria, the conventional teaching methods namely: lecture, demonstration, discussion method dominates the Physics classrooms. In these methods of teaching the teacher dominate the learning process and give little or no room for students to participate. Even if it is a demonstration method of teaching the highest a teacher can do is to demonstrate the process for students to see and cannot allow the students to handle the process themselves; hence a Chinese proverb "I hear and I forget, I see and I remember, I do and I understand". Therefore, this study is set to investigate the effect of the ASEI Activity-Based teaching strategy on secondary school students' achievement and retention in Light Waves.

## Objectives of the Study

This research aimed at determining the effect of ASEI teaching approach on students' achievement and retention of concept in light waves. Specifically, the study determined:

i. Whether there is difference in mean achievement scores between students taught physics using ASEI and those taught using Conventional method of teaching.
ii. Whether there is difference in mean retention scores between students taught physics using ASEI and those taught using conventional teaching.

## Research Questions

The following research questions were raised to guide the study;

i. What are the mean achievement scores of students taught Light Waves using ASEI teaching approach and those taught using Conventional method?
ii. What are the mean retention scores of students taught Light Waves using ASEI teaching approach and those taught using Conventional method?

## Statement of Hypotheses

The following null hypotheses guided the study and were tested at 0.05 level of significance.

i. There is no significant difference in the mean achievement scores of students taught light waves using ASEI teaching approach and those taught using conventional method.
ii. There is no significant difference in the mean retention scores of students taught light waves using ASEI teaching approach and those taught using conventional method.

## Methodology

A non-randomized control group, pre-test, post-test quasi-experimental research design was used for the study. Two intact classes were used in the study. One intact class was assigned to the ASEI teaching approach (experimental group) while the other intact class was used as a conventional approach (control group). At the end of the treatment (teaching) period, post-test was administered to both the experimental and the control groups and so also post-post-test was administered after two weeks of post-test to ascertain the extent of retention. The sample size of 96 SS II Physics students was drawn from the population of 1,938 SS II Physics students in Government Senior Secondary Schools in Nassarawa Eggon metropolis using purposive and random sampling techniques.

The instruments used in this study were the Light Waves Achievement Test (LWAT) and Post-test in Light Waves (PTLW) which were developed by the researcher. The LWAT and PTLW were validated by three experts. The reliability of LWAT and PTLW were calculated using the Split-Half reliability and the Spearman Brown Formula and it was found to be 0.86 and 0.80 respectively.

Prior to the commencement of the treatment, pre-test on LWAT was administered to experimental and the control groups. After the pre-test the scripts were collected and marked by the researchers and the result was kept for analysis. After four weeks of treatment, the post-test (PTLW) was administered to the experimental and the control groups. The scripts were also collected, marked and the result was recorded for analysis. Lastly, after two weeks of Post-test, the post-post-test was administered to the experimental and the control groups. The scripts were collected, marked and recorded for analysis.

The research questions were answered using descriptive statistics of mean and standard deviation, while Analysis of Covariance (ANCOVA) was employed to test the significant differences between the mean scores of the Experimental and Control groups at 0.05 levels of significance.

## Results

**Research Question One**

What are the mean achievement scores of students taught Light Waves using ASEI teaching approach and those taught using Conventional method?

**Table 1: Means and Standard Deviations of Students taught using ASEI and Conventional Teaching Strategies**

| Teaching Approach | Type of Test | No of Students | Mean Score | Standard Deviation | Mean Gain |
|---|---|---|---|---|---|
| ASEI | Pre-test | 50 | 9.39 | 3.200 | 17.63 |
| | Post-test | 50 | 27.02 | 4.833 | |
| Conventional | Pre-test | 46 | 7.92 | 2.64 | 9.73 |
| | Post-test | 46 | 17.65 | 4.551 | |

Result in Table 1 showed that the post-test achievement mean scores of the experimental group (students taught with ASEI teaching approach) is 27.02 with standard deviation of 4.83 and that of the control group (students taught with conventional teaching approach) is 17.63 with standard deviation of 4.55. This gives a positive mean difference of 9.39 and standard deviation of 0.28 in favour of the experimental group.

**Research Hypothesis One**

There is no significant difference in the mean achievement scores of students taught Light Waves using ASEI and those taught using conventional methods.

**Table 2: Result of One-way ANCOVA on Students' Achievement when taught Light Waves using ASEI and Conventional Teaching Strategies**

| Source | Type III Sum of Squares | Df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Corrected | 4805.985[a] | 2 | 2402.993 | 83.151 | .000 |
| Model | 4006.290 | 1 | 4006.290 | 138.631 | .000 |
| Intercept | 1034.399 | 1 | 1034.399 | 35.794 | .000 |
| Pre-test | 2674.981 | 1 | 2674.981 | 92.563 | .000 |
| Group | 2716.544 | 94 | 28.899 | | |
| Error | 94193.000 | 96 | | | |
| Total | 7522.529 | 95 | | | |
| Corrected Total | | | | | |

Table 2 showed the post-test scores analysis for significant differences between ASEI and conventional teaching strategies. The $F_{(1,169)} = 166.414$ and $p = 0.000 < \alpha = 0.05$ was significant, implying that there was significant difference in the mean scores of student's achievement when ASEI and conventional teaching strategies were used, this is because the p-value 0.00 is less than alpha level 0.05, therefore the hypothesis is rejected.

**Research Question Two**

What are the mean retention scores of students taught light waves using ASEI and those who were taught using Conventional method of teaching?

**Table 3: Means and Standard Deviations of Students Taught Light Waves Using Activity-based and Conventional Teaching Strategies**

| Teaching Approach | Type of Test | No of Students | Mean Score | Standard Deviation | Mean Gain |
|---|---|---|---|---|---|
| ASEI | Post-test | 50 | 27.02 | 4.833 | -1.53 |
| | Post-post-test | 50 | 25.49 | 5.067 | |
| conventional | Post-test | 46 | 17.65 | 4.551 | -4.69 |
| | Post-post-test | 46 | 12.96 | 4.508 | |

Table 3 showed that the post-post-test mean retention scores of the experimental group (students taught with ASEI teaching approach) is 25.49 with standard deviation of 5.067 while, the control group (students taught with conventional approach) is 12.96 with standard deviation of 4.508. This gives positives mean score difference of 12.53 and standard deviation of 0.559 in favour of the experimental group.

**Research Hypothesis Two**

There is no significant difference in the mean retention scores of students taught light waves using ASEI teaching approach and those taught using conventional method.

**Table 4: Result of One-way ANCOVA on Students' Retention when Taught Light Waves Using ASEI and Conventional Teaching Strategies**

| Source | Type III Sum of Squares | Df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Corrected | 8130.830[a] | 2 | 4065.415 | 271.426 | .000 |
| Model | 228.283 | 1 | 228.283 | 15.241 | .000 |
| Intercept | 1389.525 | 1 | 1389.525 | 92.771 | .000 |
| Post-test | 997.493 | 1 | 997.493 | 66.597 | .000 |
| Group | 2531.356 | 94 | 14.978 | | |
| Error | 75210.000 | 96 | | | |
| Total | 10662.186 | 95 | | | |
| Corrected Total | | | | | |

Table 4 results revealed that the post-post-test scores analysis for significant differences between ASEI and conventional teaching approaches, $F_{(1,96)} = 66.597$ and $p = 0.000 < \alpha = 0.05$ was significant, meaning that there was a significant difference in the mean scores of students' retention when taught ASEI and conventional teaching strategies. This is because the p-value 0.00 is less than alpha level 0.05 hence, the null hypothesis is rejected.

## Discussion

The findings of this study revealed that ASEI teaching strategy has significant effects on students' achievement in Physics. This was confirmed by hypothesis 1 testing, which shows

the rejection of the null hypothesis because there was significant difference in students' achievement in favour of ASEI teaching strategy ($F_{(1,96)}$ = 92.563 and p = 0.000<α =0.05). The result of this study is consistent with the finding of Ajala (2011), whose study examined the effects of using group instructional strategy on learning of Physics in senior secondary schools in Nigeria and also determined whether group instructional strategy will improve the performance of below average ability students, and she found out that students that were exposed to group instructional strategy performed better than those exposed to individual learning treatment. This study is also in agreement with the work of Nilufer (2012) who investigated the effect of group investigation and cooperative learning techniques on the academic achievements of first year university students attending classes in which the units of force and motion were taught within the general physics course. The study revealed that there is no significance difference between Group Investigation Group (GIG) and Learning Together Group (LTG), but a significance difference was observed between Learning Together Group (LTG) and Control Group (CG). Again, the work of Jackson and Joseph (2014) agreed with this present study. They investigated the influence of Activity, Student-centred, Experiment and Improvisation – Plan, Do, See and Improve (ASEI-PDSI) approach in the teaching and learning of Mathematics in selected Secondary Schools in Vihiga, Kenya. The finding of their work showed that the ASEI-PDSI had a significant effect on students' achievement.

Furthermore, the outcome of the work of Aku (2016) is also similar to this study. He examined the comparative effect of Guided Discovery and Discussion Teaching Methods on Basic science students Achievement and Retention in Keffi Educational Zone of Nasarawa State, Nigeria. The result revealed that students who were exposed to Guided Discovery performed better than those who were exposed to Discussion teaching Method. But these findings contradict the conclusion made by Ugiagbe, (2010) who reported that students taught by using lecture method attained higher achievement gain than those taught by using activities based (guided-inquiry method).

It also shows that students taught with Activity-based teaching strategy retain better knowledge than students taught with conventional approach. The null hypothesis 2 was rejected because there was significant difference in students' retention scores ($F_{(1,96)}$ = 66.597 and p = 0.000<α =0.05). This agreed with Adamu (2009), who revealed that students in the activity-based approach retain better knowledge than those exposed to conventional approach; this also is consistent with the present study because it is also an activity-based approach of teaching as it retains knowledge for longer time and consequently leads to students' retention of knowledge learnt. The result is also the same as the work done by Suleiman (2011), who found out that students who were taught Chemistry using Inquiry method of teaching retain knowledge better than those who were taught using the traditional Lecture Method.

## Conclusion

Based on the findings of this study, it is evident that effective adoption and implementation of aspects of the ASEI teaching strategy to teaching Physics leads to better learning outcomes. The experimental group that was sensitized inclusion of ASEI teaching strategy

produced higher learning outcomes both in post-test and post-post-test as compared to the control group. i.e students achieved and retained better knowledge while taught with ASEI teaching strategy than the conventional method.

## Recommendations

Based on the findings of this study, the researcher recommends the following:

i. ASEI teaching strategy should be emphasized more by Physics teachers than the conventional approach. Physics teachers should teach students the skills for investigation and activities based rather than telling them all the facts in science.

ii. Professional bodies like Science Teachers Association (STAN) should encourage the teachers of Physics to improvise the available local materials in teaching (Activity-based teaching strategy) rather than relied on the readymade one that are not always available.

iii. At the pre service level, the use and implementation of ASEI teaching strategy in the classrooms should be emphasized in the methodology courses being offered by the student-teachers.

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