

EFFECT OF INSTRUCTIONAL RESOURCES ON STUDENT'S ACHIEVEMENT IN PHYSICS AND CHEMISTRY IN SECONDARY SCHOOLS IN EBONYI STATE, NIGERIA

Dr. (Mrs) Chinyere A. Omebe

*Department of Science Education
Ebonyi State University, Abakaliki*

Asso. Prof. Omiko Akani

*Department of Science Education
Ebonyi State University, Abakaliki*

ABSTRACT: *This study effect of instructional resources on student's achievement in physics in secondary schools in Ebonyi State of Nigeria is a quasi-experimental design that deals with pre-test, post-test, non-equivalent, control group. Intact classes were used for the study. The participants for the study were drawn from four secondary schools in Ebonyi State. The schools were selected through simple random sampling. All the physics students of SS II in the selected sample schools were used for the study. Two schools out of the four schools were assigned to the treatment group while the remaining two were assigned to the control group. Two packages were developed by the researcher for control and treatment groups. Three research questions and three hypotheses guided the work. One instrument was used for the study, i.e. physics achievement test (PAT). Mean and standard deviations were used to answer the research questions while ANCOVA was used to test the null hypotheses. The following findings were made, physics students taught with instructional resources achieved higher and better than those taught without instructional resources. There is no gender bias in terms of students achievement in physics. Among other recommendations, both male and female students should be encouraged through counselling to see physics as one of the subjects needed for the country technological break through.*

KEYWORDS: Instructional resources, achievement, physics, PAT, Quasi-experimental, control group

INTRODUCTION

Science Teaching in Nigeria Secondary schools started when the grammar schools in Nigeria were established. Physics is one of the science subjects taught at the secondary school level of the Nigeria Educational-System. Physics as one of the science subjects remains one of the most difficult subjects in the school curriculum (Isola 2010). Several studies have revealed that the performance of Nigerian students in secondary school physics was generally and consistently poor over years (Omosewo, 1999, Akanbi, 1983; Omebe, 2009).

Poor achievement in physics could be attributed to many factors ranging from the attitude of students towards the subject, methods of teaching the subject, lack of motivation on the part of the teachers, lack of basic sciences background at the primary school and teacher's strategy which was considered as an important factor. This implies that the mastery of physics concepts might not be fully achieved without the use of instructional resources. The teaching of physics without instructional resources may certainly result in poor academic

achievement. Onasanya and Omosewa (2011) stressed that a professionally qualified science teacher no matter how well trained, would be unable to put his ideas into practice if the school lacks equipment and instructional resources for him to translate his competence into reality.

Sciences especially physics is resource intensive, and it may be very difficult to find some of the instructional resources for the teaching of physics in schools adequately. Instructional resources are natural and artificial resources which teachers use to aid or facilitate teaching and learning in a classroom setting. Maduabum (1989) defined resources as equipment which the teacher can use to help the achievement of lesson objectives. Some of these resources can be bought, the teacher can make some and in some cases, students can help to collect them.

Instructional resources are educational inputs which are of vital importance to the teaching of all science subjects in secondary schools. Well planned instructional resources in a lesson should do much to banish apathy, supplement inadequacy of books as well as arouse students' interest by giving them something practical to see and do, and at the same time helping to train them to think things out themselves (Jekayinfa, 1999). Onwa (2002) opined that different instructional resources of the teacher are necessitated by the fact that the learners have their differences and on the fact that learning is more effective if it takes place through the five senses of hearing, seeing, testing, touching and smelling.

The greater the number of senses involved in teaching and learning process, the higher the level of learners absorption and participation. With the use of instructional resources, the individual is capable of passing physics. For teachers to use instructional resources in assisting student with physics problem, they have to be knowledgeable in physics and those instructional resources he/she uses. The major problem now is what would be the nature of the performance of secondary school students in physics when taught using instructional resources.

Objectives of the Study

The purpose of the study was to determine the effect of instructional resources on students' achievement in physics.

Specifically this study seeks to determine the following:

- i. Effect of instructional resources on students' achievement in physics.
- ii. Effect of gender on the use of instructional resources on students achievement in physics.
- iii. Interaction effect of instructional resources and gender on students' achievement in physics.

Scope of the Study

The study was conducted with SS II Classes. The study covered the following topics in physics

- i. Equilibrium of forces
- ii. Simple machines

- iii. Thermal energy
- iv. Measurement of heart energy

Research Questions

The following research questions guided the study:

1. What is the effect of instructional resources on the student's mean achievement scores in physic?
2. What is the effect of gender of students in physics?
3. What is the interaction effect of use of instructional resources and gender on mean achievement scores of students in physics?

Hypotheses

The following null hypotheses were tested d 0.05% confidence level:

- Ho₁ There is no significant difference in the mean achievement scores of students taught with instructional resources and those taught without instructional resources.
- Ho₂ There is no significant mean effect of gender on the achievement of students, using instructional resources.
- Ho₃ There is no significant interaction effect between instructional resources and gender on students mean achievement scores in physics

Research Method

This study employed a quasi-experimental design that deals with pre-test, post-test, non-equivalent, control group. Intact classes were used for the study. There was no randomization of subject as randomization would have disorganized the school within the period of the study. The participants for the study were drawn from 4 (four) secondary schools in Ebonyi State of Nigeria. The Schools were selected through simple random sampling. All the physics students of SSII in the selected sampled schools were used for the study. Two schools out of the four schools were assigned to the treatment group while the remaining two were assigned to the control group. Assignment of schools to treatment or control group was achieved through simple balloting.

The instrument used for data collection is the physics achievement Test (PAT) The instrument was developed by the researcher and validated by two experts in Ebonyi State University lecturers in measurement and evaluation and 2 experts in physics in the same university. The researcher trained physic teachers in those selected schools that helped as research assistants. They were given instructions on what to do as they were their permanent teachers. The instrument consists of 50 multiple choice items with the four potions and was drawn from the topics taught: during the experiment. The instrument was subjected to face and content validation. A reliability co-efficient of 0.87 was obtained from the instrument using the Kuder-Richardson (K-R20) approach. It also has a stability index of 0.81 which was obtained from a test re-test carried out within an interval of two weeks.

At the on set of the experiment, the physics achievement Test (PAT) was administered to the research subjects in the both treatment and control group as pre-test. The treatment group was taught using instructional resource package, while the control group was taught the same topics without instructional resourced. The study lasted for two months. At the end of the two months the research assistants administered the post-test to both experimental and control groups. They marked, scored them and handed over their scores to the researcher. Mean and standard deviation were used to answer the research questions. While ANCOVA was used to test the null hypotheses at alpha level of 0.05

Control of Extraneous Variables

The following extraneous variables that were controlled to ensure that their effects do not interfere with the internal validity of the study.

Control of Mortality

The teachers carrying out the teaching intimated the students that the score of the test will constitute 20 marks of the class CA score for the term. This ensured that there was no unwarranted mortality due to absenteeism.

Initial Equivalence

Intact classes were used for the study for the treatment and control because the groups are not of equal cognitive strength at the onset of the experiment. Adjusted mean and the analysis of co-variance were also used for data analysis.

Subject interaction

In order to avoid subject interaction among students, the selected schools were far apart from each other. By this the students from one should did not know what the students from the other schools were doing.

Testing effect

To check the effect of the testing, the items in the instrument (PAT) were rearranged after the pre-test. The colour of the paper after the pre-test was changed too.

Teacher variables

Teachers of the two groups were trained on how to use` the packages and they were also monitored. This means that they have the required experience both in teaching and physics.

Hawthorne Effect

To ensure that the pupils are not aware that they are being used for experiment, the class teachers were used as the` research assistants. There was no reshuffling or re-grouping of subject, intact classes were used. The teachers were informed not to tell the students that they are being used for experiment.

RESULTS**Research Questions****Research Question 1**

What is the effect of instructional resources on the student mean achievement scores in physics?

Table 1: Adjusted Mean and Standard Deviation and Achievement Scores of Students Taught Physics using Instructional Resources and those Taught without Instructional Resources

Groups	Mean (\bar{x})	Standard Deviation
Treatment group (with instructional resources)	44.10	2.70
Control group (without instructional resources)	12.13	3.22

Summary of the data analysis in Table 1

Based on the analysis, the result presented on the 1 above, the result show that the students taught using instructional resources had the mean of 44.10 and standard deviation of 2.70 and those taught without instructional resources had mean of 12.13 and standard deviation of 3.22.

From the mean scores of those taught with instructional resources reveal that teaching with instructional resources foster students achievement in physics than teaching students without instructional resources.

Research Question 2

What is the effect of gender on mean achievement scores of students in physics?

To answer the research question 2, the achievement scores of male and female students taught with instructional resources were compared. The summary of the result is presented in table 2.

Table 2: Mean Achievement Scores of Male and Female Taught Physics with Instructional Resources

Gender categories	Mean (\bar{x})	Standard Deviation
Male	44.91	3.7
Female	43.55	2.25

As shown in table 2 above, the mean achievement scores of male students taught physics with instructional materials is 44.91 with standard deviation of 3.7 while their female counterpart

had a mean achievement of 43.55 with a standard deviation of 2.25. It could be seen that the difference is very minute.

Research Question 3

What is the interaction effect of use of instructional resources and gender on the students mean achievement scores in physics?

To answer this research question, mean scores and standard deviation were computed as shown in table 3 below.

Table 3: Mean and Standard Deviation on Interaction Effect of Treatment and Gender of Students

Variables		Mean (\bar{x})	Standard Deviation
With instructional resource	Male	44.91	3.7
	Female	43.55	2.25
Without instructional resources	Male	14.85	1.87
	Female	10.65	2.81

Table 3 above is the interaction effect of instructional resources and gender on students' achievement. It shows that male students have mean achievement score of 44.91 and standard deviation of 3.7 using instructional resources while the female students had an achievement score of 43.55 with standard deviation of 2.25. Similarly for the control, the mean achievement score and standard deviation for the males is 14.85 and 1.87 while the mean achievement scores and standard deviation for the females is 10.65 and 2.81 respectively. The results have marginal effect in achievement in physics

H_{01} : There is no significant difference in the mean achievement scores of students taught physic using instructional resources and those taught without instructional resources

Table 4: ANCOVA result based on treatment

Sources of Variation	Sum of square	Df	Mean square	F-cal	Sig. F	Decision
Covariates	609.784	1	609.784	66.471	.000	
Pre-test	609.784	1	609.784	66.471	.000	
Main effect	16917.522	1	16917.522	1844.134	.000	
Treatment	16917.522	1	16917.522	1844.134	.000	Significant
Explained	17027.305	2	8763.653	955.302	.000	
Residual	614.638	67	9.174			
Total	18141.934	69	262.927			

* Significant at $p < 0.05$

The data were analyzed using ANCOVA with pre-test value as covariates. Result is significant, H_{01} rejected. Therefore, multiple classification analysis (MCA) was measured out.

Table 5: Means Classification Analysis based on Treatment Grand Mean = 35.83.

S/N	Variable Category	Unadjusted Deviation	Eta	Adjusted for Independents Covariates	Beta
1.	Instructional resources	18.27		18.29	
2.	No instructional resources	-13.70	.98	-13.72	.98
	Multiple RR square				.966
	Multiple R				.983

Table 5 shows the results of MCA on the contribution of each level of treatment.

From the table, the grand mean is 35.83 for achievement. Those with instructional resource group have the adjusted mean score of 44.12 while those without instructional resources group has an adjusted mean 14.55. Based on the results, it could be seen that instructional resources has the higher adjusted score which implies that it is more effective.

H_{02} : There is no significant mean effect of gender on the achievement of students using instructional resources

Table 6: ANCOVA Results on Gender

Sources of Variation	Sum of square	Df	Mean Square	F-cal	F-Critical Value
Covariates	609.784	1	609.784	2.349	.130
Pre-test	609.784	1	609.784	2.349	.130
Main effect	136.037	1	136.037	.524	.472
Gender	136.037	1	136.037	.524	.472
Explained	745.821	2	372.910	1.436	.245
Residual	1739.6	67	239.644		
Total	1814.94	69	262.927		

* Significant at $p < 0.05$

In the Table 6 above, the result obtained was not significant; hence H_{02} was rejected. This means that at 0.05 level of significance, there was no significant difference in the achievement between male and female when taught with instructional resources. It implies that the instructional resources are best to be used to teach both male and female students.

H_{03} : There is no significant interaction effect between instructional resources and gender on students mean achievement scores in physics

Table 7: ANCOVA Result on Interaction between Treatment and Gender

Sources of Variation	Sum of square	Df	Mean Square	F-cal	F-Critical Value
Covariates	609.784	1	609.784	95.421	.000
Pre-test	609.784	1	609.784	95.421	.000
Main effect	17078.709	1	8539.354	1336.270	.000
Treatment	16917.1522	1	16917.1522	2647.317	.000
Gender	161.187	1	161.187	25.223	.000
2-way interaction	38.072	1	38.072	5.958	.017
Treatment and gender	38.072	1	38.072	5.958	.017
Explained	17726.564	4	4431.641	693.480	.00
Residual	415.379	65	6.390		
Total	1814.943	69	262.927		

* Significant at $p < 0.05$

Summary of table 7 above was found that interaction between treatment and gender has no significant at 0.05 level of significance, which states that there is no significant interaction effect of treatment and gender on students' achievement in physics when students were taught with instructional resources. H_{03} was not rejected meaning that there was no significant effect of interaction between treatment and gender on students' achievement in physics.

Discussion of Results

Findings from this study revealed that there was significant effect of treatment on students achievement in physics. The researcher found out that the students taught with instructional resources achieved statistically significantly higher in the physics achievement test than those taught without instructional resources. It is therefore observed that using instructional resources assists the teacher and allows students' interaction with and make students to achieve better and higher in lesson. It also helps students' intellectual ability to be higher during teaching and learning processes. Instructional resources encourage creativity and makes learning more concrete.

This finding corroborates previous findings of Oladejo, Olosunde, Ojebisi and Isola (2011). They worked on instructional materials and students achievement in physics. They observed that instructional materials perform such functions as the extension of the range of experience available to learners, supplement and complement the teachers verbal explanations thereby making learning experience richer and providing the teacher with interest into a wide variety of learning activities.

This result also agreed to the view of Moronfolo (2002) who stressed that science subjects should be taught in primary as a practical subject. Omosowo (2008) ascertained that in modern science curriculum, students need to be encouraged to learn not only through their eyes or ears but should be able to use their hands and head to manipulate apparatus.

Okoboli in (Isola, 2010) studied gender difference in academic achievement of primary school pupils in English language and mathematics in relation to the result obtained above, observed significant difference among male and female students in the two subjects and the difference was in favour of using instructional materials. Finally, there was no significant interaction effect of treatment and gender on the students achievement in physics.

CONCLUSIONS AND RECOMMENDATIONS

Following the results obtained on the basis of the analysis of data for the study, the following conclusions were arrived at:

Instructional resources are effective vehicles for carrying information for learning to occur. Instructional resources should be used for teaching and learning as these can help to improve on student's achievement in physics. Physics students taught with instructional resources achieved higher and better than those taught without instructional resources. There is no gender bias in terms of students' achievement in physics by senior secondary school students.

From the findings of the study, the following recommendations were made:

Conference, seminars and workshops should be organized regularly for physics teachers to broaden their knowledge on instructional resources and the best way to be making use of instructional resources by the teachers. Physics teachers should adopt the use of instructional resources to teach various concepts involved in physics. Both male and female students should be encouraged through counselling to see physics as one of the subjects needed for the country technological break through. There is also need for the development of positive attitudes by teachers towards the use of instructional resources for their students. This will encourage the development of their proficiency. Regular supply of instructional resources should be embarked on by the governments at all levels.

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