PRINT, AUDIO INSTRUCTIONAL RESOURCES AND STUDENTS' ACHIEVEMENT IN PHYSICS IN ABAK LOCAL GOVERNMENT AREA, AKWA IBOM STATE, NIGERIA

Paul, Ubong-Abasi S., Utibe, Uduak J., Patrick, Joseph Uko & John, Itoro Ime

Department of Science Education, Akwa Ibom State University
Ikot Akpaden, Mkpat Enin, Akwa Ibom State, Nigeria
Ubongabasipaul565@gmail.com

Abstract

Purpose: This study was designed to determine the effects of print and audio instructional resources on students' achievement in teaching the concept of optics in physics in Abak Local Government Area of Akwa Ibom State.

Design/Approach/Methods: Two research questions and two hypotheses were formulated to guide the study. A pretest-posttest non-equivalent quasi-experimental group design was adopted for the study. The population of the study consisted of all 854 students of the 2023/2024 academic session in the 11 co-educational public secondary schools in the area of study. The study sample comprised 105 physics students drawn from four SS2 intact classes of four selected secondary schools using a stratified random sampling technique. One instrument and two treatment packages (one for the print paper/text instructional resource group and the other for the audio tape instructional resource group) were used to gather data for the study. The instruments were subjected to face and content validity. The reliability of the instruments was established using Kuder Kuder-Richardson KR-20 reliability estimate. A reliability coefficient of 0.89 was obtained for the instrument. Data collected were analyzed using mean, standard deviation an analysis of covariance (ANCOVA) test statistics.

Findings: Results of the study revealed that students taught the concept of optics in physics using a print instructional resource performed significantly better than those taught using an audio instructional resource. Further findings revealed that instructional resources had no statistical differential/interaction effect on male and female students' performance when taught the concept of optics in physics.

Originality/Value: The researcher therefore concluded that using print instructional resource to teach the concept of optics would help to enhance students' academic performance. The researcher therefore recommends that Physics teachers should effectively utilized print instructional resources in teaching the concept of optics specifically and in the general teaching of physics concepts.

Keywords: Physics, print, audio instructional resources, students' achievement

Introduction

The study of physics to man is as old as creation. Physics has played a tremendous role in humanity because of its central role in the world's technological development. The importance of physics can be found in transportation, aviation, medicine, Industry, warfare, communication, peace and entertainment, among others (Utibe & Onwioduokit, 2019). Considering the importance of physics to humanity, it is equally important to lay a solid foundation for students using the right instructional materials capable of enhancing a high level of achievement. The instructional materials used in physics teaching can influence the level of understanding of physics concepts by students. There are three basic types of instructional materials in education, which include:

i. Print/visual
ii. Audio
iii. Audio-visuals

It should be noted that despite the efforts of government and concerned science educators to bring about improved students' achievement in physics; the level of students' achievement which is a function of their performance in their public examinations is still fluctuating as shown on the table of summary of physics WASSCE result in Akwa Ibom State from 2012 – 2021 attached.

Table 1: Summary of Physics WASSCE Results in Akwa Ibom State from 2015 – 2024

YEAR	No. of Candidates That Registered	No. of Candidates That Sat and Their Percentages (%)	Number Absent and Percentages (%)	Credit and Above Passes and Percentages (%) C6-AI	Number Failed and Percentages (%)	No. of Results Withheld (%)
2015	26,984	26,024	960	20,060	5,191	773
		96.44	***3.56***	***77.08***	***19.95***	***2.97***
2016	24,395	23,599	796	11,767	10,504	957
		96.74	***3.26***	***49.86***	***44.51***	***4.06***
2017	24,054	23,589	465	15,965	7,067	557
		98.07	*1.93*	*67.68*	***29.96***	***2.36***
2018	24,905	24,359	546	17,020	7,251	0
		97.81	***2.19***	***69.87***	***29.76***	***0.00***
2019	24,585	24,060	525	19,043	4,610	407
		97.86	***2.14***	***79.15***	***19.16***	***1.69***
2020	12,357	12, 145	212	7,802	3,481	0
		98.28	***1.72***	***64.24***	***28.66***	***0.00***
2021	11,697	11,453	244	7,484	3,300	0
		97.71	***2.09***	***65.35***	***28.82***	***0.00***
2022	19,887	19,704	190	14,883	3,490	0
		99.08	***0.96***	***75.53***	***17.71***	***0.00***
2023	22,851	22,427	424	10,771	10,940	716
		98.14	***1.86***	***48.03***	***48.78***	***3.19***
2024	19,125	18,633	492	8,791	8,978	864
		97.43	***2.57***	***47.18***	**48.18**	***4.64***

Source: *WAEC Result portal Lagos, Nigeria, 2025; number in italics is percentages*

There have been widespread complaints in the nation that the level of students' achievement in physics is low. In a Study by Onah *et al* (2020), it was reported that there is a poor trend in students' achievement in physics. The poor trend does not favour the national growth in science and technology education. The nation educational system is characterized by insufficient manpower, lack of equipment, poor attitude of teachers and students toward the teaching and learning of physics, as well as poor conceptual understanding by the students. Physics education faces a lot of challenges (Akpan et al, 2023). The attempt to solve these problems led to the use of innovative teaching systems. The innovative teaching systems involve the use of organized combination and utilization of people, materials, facilities, equipment and procedures to achieve the desired instructional objectives.

Media resources are instructional package that carries information from the teacher to the students (Grant, 2015). The different names are merely contextual (Grant, 2015). They all involve media (materials) derived from the communication revolution, which can be used to promote the teaching process. Media resources are used to provide a conceptual framework that students can use to clarify the task ahead. This is used to explain that learning as a product has been maintained for a long period. For any teaching to be effective, there must be learning, and the learning must be meaningful. A meaningful lesson is measured in terms of the level of achievement. Utibe and Onwiodukit (2019) described learning as a situation where the content of the lesson is provided for the students instead of the students struggling to discover it. The study also explains meaningful achievement through proper learning, which involves the process of subsumption. This occurs when the learned information enters a student's cognitive structure and interacts with and is subsumed under more conclusive concepts already possessed by the student. Ifeanyi-obi *et al* (2014) in a study stated that media resource involves the use of media resources that are maximally clear and stable. The media resources are materials which a teacher employs to help the students make connections to their learning experiences. The aim is to present students with materials and concepts that help them to relate, interact and achieve knowledge gained.

In a study by Umarova (2020), it was observed that the effect of media resources should be most visible for tests that involve creative problem solving of knowledge gain for use in a later situation. Since the media resources used allow the learner to structure the concept into a meaningful learning experience. New information about a concept is filled into an existing framework of categories called ''Schemas'' that contains specific information about a concept. Therefore, when prior knowledge is retrieved and achieved, this schema provides a framework on which to attach the new knowledge. If no previous knowledge is available, the media resources are used to give knowledge to the learners for this framework to be utilized and new information acquired for the future (Grant, 2015). Media resources may be in the form of print, visuals, audiovisuals/static/display and electronic (Jegede & Adebayo, 2013).

The primary aim of physics teaching is to promote the understanding of concepts being taught with a view to applying knowledge of such understanding to real-life situations. The fluctuation observed in physics performance by students attests to the fact that physics teaching has not been properly done, hence, the concepts being taught may not be properly understood by the learners, as evidenced in their performances. This problem has led to a vigorous search for appropriate media that would best help in the realization of the primary aim of physics teaching, thus improving the achievement of concepts taught in physics. For teaching to be effective, the teacher is expected to be skilful in the selection and application of appropriate media resources. There is no one "best" medium for instructional presentation. Some concepts are better suited for prints, others are best suited for visuals and yet others for the combination of two or more media.

Instructional media, according to Ekukinam (2019), are vehicles used to convey the objective of the lesson in such a way that the learners can best acquire the required knowledge and skills at the end of the lesson. Any good media resource should be able to hold the students' interest and attention until the lesson is over. Knowledge of instructional media, in addition to their effective application, results in effective teaching and learning. When a teacher relies upon a single medium as an instructional medium, students' boredom can easily degenerate into learning or discipline problems. Modern physics teachers therefore need to be methodologically flexible if the needs, interest and aspirations of the students must be sustained.

i. According to the levels of technology of the materials
    a. Low level technology
    b. High level technology
ii. According to the sense they stimulate
    a. Audio medium – stimulate the ears
    b. Visual medium – stimulate the eyes
    c. Audiovisual medium – stimulate both eyes and ears
iii. As projected and non-projected media
    a. Projected – Slides, filmstrips, video, opaque projector etc.
    b. Non-projected – still pictures, graphics models, realia etc.
iv. As print and non-print media (Ekukinam, 2019).

This study is an attempt to investigate the effect of print, audio instructional resources and students' achievement in Physics in Abak Local Government, Akwa Ibom State, Nigeria.

Statement of the Problem

For over a decade (2015-2024), students' performance in physics has been inconsistent, as revealed from the literature that the teaching strategies used for teaching the lessons are not appropriate. The school system has not been able to employ a system of physics teaching that would enhance students' achievement in the subject to a steady level of increasing performance. The Table on a summary of physics WASSCE results in Akwa Ibom State, from 2015 – 2024 as attached, supports the claim above. The trend further implies that the teaching of physics does

not lead to the students' increasing and sustained understanding of concepts taught. Of all the factors that could be responsible for this poor achievement, the teacher and the media resources often come under attack.

Even when the students are blamed, an explanation is given only in terms of the students' output in physics. Little attention is paid to the fact that the way learners are taught could influence their achievement in the subject. The researcher is particularly interested in print text and audio tape media because, according to the background of the study, these media is suspected to facilitate students' achievement in physics. It is absolutely important at this point in our National development to place a high premium on science and technology. This can only be actualized through the use of appropriate result-oriented teaching strategies. The gap this study will fill is statistical data on this study in Akwa Ibom State. The study was steered by the following questions:

1. What is the difference in the mean achievement scores of physics students taught the concept of optics using print and audio instructional resources?
2. What difference exists in the mean achievement scores of male and female physics students taught the concept of optics?

Hypotheses

HO_1: There is no significant difference between the mean achievement scores of physics students taught the concept of optics using print and audio instructional resources.

HO_2: There is no significant difference between the mean achievement scores of male and female physics students taught the concept of optics.

Materials and Methods

The research design adopted for this study is a pretest-posttest non-equivalent quasi-experimental design. According to McLeod (2023) quasi-experimental design does not allow the randomization of the students in the class used for the study. The study was carried out in Abak Local Government Area of Akwa Ibom State, Nigeria. Abak is situated between coordinates: latitude $4^{o}.59^{t}$N and $7^{o}.47^{t}$E and longitude 4.983^{o}N and 7.783^{o}E. Abak lies on the South-West of Akwa Ibom State and bounded in the North by Ikono Local Government Area, North West by Essien Udim Local Government Area. West by Etim Ekpo and Ukanafun Local Government Area. South by Oruk Anam and in the East by Uyo Local Government Area. Abak is located about 18 kilometers from Uyo, the State capital; it has a landmass of 304 square kilometers. There are 11 public secondary schools in the area of study (Local Education Authority, LEC, 2025). The area of the study was chosen because students manifest weak and inconsistent achievement in physics.

The population for the study comprised 3,854 senior secondary two (SS2) Physics students for the year 2023/2024 session in the 11 public secondary schools in Abak Local Government Area, Akwa Ibom State (Local Education Authority 2024).

A total of 105 SS2 physics students constituted the sample for the study. A simple random sampling technique was used to draw two schools that were used in the study. From the two schools selected, 1 was assigned to experimental group I (taught using print text instructional resource) and the other was assigned to experimental group II (taught using audio tape instructional resource). In each of these schools, one SS2 intact class was used for data collection. Coeducational public schools were used, since gender was a variable in the study, and the researchers ensured that each school had a fair representation of male and female students.

The following instrument and treatment packages were used to gather data for the study.

(i) Physics Achievement Test (PAT)
(ii) Print Text Lesson Package (PTLP)
(iii) Audio Disc Lesson Package (ADLP)

The Physics Achievement Test (PAT) instrument consisted of 50 multiple-choice test items constructed on the concept of optics by the researcher. The instrument had two sections, A and B. Section A of the instrument contained demographic information about the respondents. Section B of the instrument was a 50-item multiple-choice test with five options lettered A-E, with only one correct option and four distractors. The test was used as a pretest and posttest to determine the achievement profile of the students in the concept of optics in physics before and after teaching using the two different media instructional resources.

The Print Text Lesson Package (PTLP) was also developed by the researcher and contains various text, drawings and calculations related to the concept of optics. It served as an instructional resources/materials aimed at enhancing the teaching of the concept of optics in physics and was used in teaching students under experimental group I.

The Audio Disc Lesson Package (ADLP) was an audio package developed by the researcher and contains various audio clips on concepts of optics. It also served as instructional materials/resources aimed at enhancing the teaching of the concept of optics in physics, and was used in teaching students under experimental group II.

The instruments were face validated by a Lecturer in the Department of Physics, a Lecturer in Measurement and Evaluation, all at Akwa Ibom State University and a Physics teacher from one of the selected schools used for the study. The content validation of the Physics Achievement Test (PAT) was done using a Table of specification.

To further strengthen the validity of the instrument, the 50 multiple-choice test items were administered to a trial testing group of 30 students who would not be part of the main subject for the study but who were found to be equivalent in all respects to the subjects in the study. The researcher made use of two of the schools that met the criteria for sampling, but they were not used for the main study. The result obtained in the administration of the instrument was subjected to Kuder-Richardson KR-20 reliability estimate. The result showed a reliability

coefficient of 0.89. On the basis of the high reliability index, the instrument was deemed suitable to be good enough for use in conducting the research.

The 50 items multiple choice physics achievement test question lettered A-E with four wrong option and one correct option was scored one (1) mark for each correct option in a question and zero (0) mark for wrong options. The maximum mark was fifty (50) for answering all correct options, and the minimum mark was zero (0) for all wrong answers.

The researcher obtained an introduction letter from the Department of Science Education, Akwa Ibom State University. A formal permission was sought from the principals of the selected two schools through the introduction letter from the researchers' Department. Before the instructional process commenced, the researcher first administered the pre-test to the students in the two schools and obtained their scores to ascertain their pre-entry ability before treatment. After the pretesting exercise, the researcher commenced the treatment procedure in the schools selected by teaching students the concept of optics using the print instructional resource for the experimental group school I and audio instructional resource for the experimental group school II. The instruction was carried out during the normal school periods following the school time-table for two weeks.

At the end of the instructional process, the researcher in each school administered the post-test to the students. The scores obtained from the pre-test and post-test were analyzed using mean and standard deviation to answer the research questions while Analysis of Covariance (ANCOVA) was used to test the hypotheses at 0.05 level of significance.

RESULTS

Table 1: Summary of Mean and standard deviation analysis of students' pre-test and post-test scores classified by treatment groups

Treatment Groups	N	Pre-test		Post-test		Mean diff
		$\bar{X}$	SD	$\bar{X}$	SD	
Print instructional resource	56	5.91	2.00	17.61	1.02	3.83
Audio instructional resource	49	6.06	2.11	13.78	2.63	

Results in Table 1 shows that the mean difference between students taught the concept of optics using print and audio instructional resources was 3.8 with the achievement of students in print instructional resources having a mean score of 17.61 while those taught using audio instructional resources had a mean score of 13.78. This result indicates that students taught using print instructional resources had the highest mean gain score compared with those that were taught using audio instructional resources. Hence there is a mean difference in favor of those that were taught using print instructional resources.

Table 2: Summary of Mean and Standard Deviation Analysis of Physics Students' Pre-Test and Post-Test Scores Classified by Gender

Gender	N	Pre-test		Post-test		Mean Gain
		$\bar{X}$	SD	$\bar{X}$	SD	
Male	61	5.77	2.18	15.89	2.74	0.2
Female	44	6.27	1.82	15.73	2.74	

Results as shown in Table 2 revealed that the mean difference between male and female students taught the concept of optics was 0.2 with the achievement of male students having a mean score of 15.89 while female students had a mean score of 15.73. This result indicates that male physics students had a slightly higher mean gain score when compared to their female counterparts.

Table 3: Summary of Analysis of Covariance (ANCOVA) of Students' Post-Test Scores Classified by Treatment Groups

Source		Type III Sum of Squares	df	Mean Square	F	P
Covariate	Pretest	6.656	1	6.656	1.772	.186
Main Effect	Instructional resources	386.890	1	386.890	102.974	.000*
Error		383.231	102	3.757		
Total		27049.000	105			
Corrected Total		773.562	104			

** = Significant at P< 0.05 level of significance*

In Table 3, the calculated Probability value (P-value) .000 of the main effects (instructional resources) is less than the significance level (0.05). Therefore, the null hypothesis is rejected. This implies that at $P < 0.05$, there is a significant difference in the mean achievement scores of physics students when taught the concept of optics using print and audio instructional resources in favor of those that were taught using print instructional resources.

Table 4: Summary of Independent t-test Analysis of Physics Students' Post-Test Scores Classified by Gender

Gender	N	Mean	SD	df	t-cal.	P
Male	61	5.89	2.74	103	0.29	.771*
Female	44	5.73	2.74			

** = Not Significant at P> 0.05 level of significance*

As shown in Table 4, the analysis of male and female students' posttest performance scores in physics when taught the concept of optics is not significant since the calculated p-value (.771) of gender is greater than the alpha level (0.05). Therefore, the null hypothesis is retained.

This implies that there is no significant difference in the mean achievement scores of male and female physics students in optics.

Discussion

Findings from the testing of hypothesis one, as shown in Table 3, disclosed that there is a significant difference in the mean achievement scores of physics students taught the concept of optics using prints and audio instructional resources. The academic achievement of students taught using print and audio instructional resources in physics was compared. The outcome of the comparison indicated that the use of prints instructional resources in teaching the concept of optics significantly improved the academic achievement of students more than those who were taught using audio instructional resources. Students who were taught using print as instructional resource benefited more thereby achieved better than those who were exposed to the use of audio as instructional resource. This result could be attributed to the fact that students that were exposed to print resources in teaching and learning the concept of optics had the opportunity to see the visuals of the concept through the print materials which conveyed more meaning on the concept taught and provide a more meaningful instruction than those who only listen to the audio instruction without visuals backup to the learning. The result of this finding is in line with Olaniyi and Hassan (2019), Obilor and Ikpa (2021), whose studies reported that various types of print media [textbooks, journals, periodicals and others] enhance the academic performance of students. Also, students who were exposed to self-instructional print media (whether independently or conjointly with the conventional teaching method) significantly outperformed their counterparts who were taught through the conventional teaching method alone.

The findings in testing of hypothesis two, as shown in Table 4, revealed that there is no significant difference in the mean achievement scores of male and female physics students in the concept of optics. The overall achievement of male and female students in physics was compared. The outcome of the comparison indicated that there is no difference in the achievement of male and female students in physics. Hence, both male and female students learn at the same pace, thereby achieving equally in physics. These findings lend support to Olayinka (2016), who also reported that gender is not a significant predictor of physics students' attainment in SSCE. Also in support of this finding, Oladajo, Olosunde, Ojebisi and Isola (2011) reported that gender was an insignificant factor in students' performance in physics.

Conclusion and Recommendations

Based on the findings of the study, the researcher hereby concluded that students' exposure to print instructional resources in teaching and learning the concept of optics in physics was found to be most effective in facilitating students' academic achievement without bias to gender. Based on the findings and the conclusions reached, it was recommended that Physics teachers should effectively utilized print instructional resources in teaching the concept of optics specifically and in the general teaching of physics concepts.

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