



Effect of Projected Instructional Media on Senior Secondary School Students Achievement in Biology

Okwara Kalu Okwaraⁱ

Department of Science Education
Federal University of Agriculture, Makurdi, Nigeria
okwarakalu@gmail.com

Paul I. Anyaghⁱⁱ

Department of Science Education
Federal University of Agriculture, Makurdi, Nigeria

Gloria S. Ikyaanⁱⁱⁱ

Department of Science Education
Federal University of Agriculture, Makurdi, Nigeria

Abstract

This paper is aimed at finding out the effect of Projected Instructional Media (PIM) on Senior Secondary School Students' achievement in Biology. The study adopted the pre-test post test non-equivalent control group design and was carried out in Educational Zone B of Benue State, Nigeria. A total of one hundred and sixty-five senior secondary one students took part in the study. The instrument for the study was Biology Achievement Test (BAT) with the reliability of 0.72 was administered to collect data for the study. Two research questions and three hypotheses were formulated to guide the study; the research questions were answered using descriptive statistics while the hypotheses were tested using Analysis of Covariance (ANCOVA). The results of the study showed among others a significant difference in academic achievement between experimental and control groups in favour of the experimental group. Gender had a significant effect on students' achievement as the female students achieved higher when taught using PIM. It was recommended that Biology teachers should employ the use of PIM in teaching Biology to enhance students' achievement. It was concluded that PIM was more effective in enhancing students' achievement in Biology in Senior Secondary Schools.

Keywords: Effect, Projected Instructional Media, Achievement, Senior Secondary School Students, Biology.

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INTRODUCTION

Science and technology have always been recognized as critical factors in the process of development. Through its application, the resources of nations have been transformed into goods and services all over the world. Abdul-kadir (2011), remarked that the current development in science and technology has greatly affected the lives of every human being such that, to be ignorant of the basic knowledge of this development is to live an empty, meaningless and probably unrealistic life. Nsofor (2001), stressed that for any nation to attain the status of self-reliance, science must be an important component of that nation irrespective of race, creed or sex. Science is defined as the systematic body of knowledge obtained by methods or techniques based on observation and experimentation as its authority. It seeks to explain the natural phenomenon using enquiry processes or activities. The branches of science are: biology, physics, chemistry, among others and can be broadly classified into natural and applied sciences (Aigbomian, 2002).

Biology is one of the core subjects in Nigerian secondary school curriculum; because of its importance, almost all students enroll for it in the Senior Secondary School Certificate Examination (SSCE) (Ahmed, 2008). Biology is introduced to students at senior secondary school level as a preparatory ground for human development, where career abilities are groomed, potentials and talents discovered and energized (Federal Republic of Nigeria, 2009). The quality and quantity of science education received by secondary school students are geared towards developing future scientists, technologists, engineers, and related professionals (Kareem, 2003).

The teaching and learning of all science subjects in general and Biology in particular require a lot of instructional media. Instructional media are channels of communication through which messages, information, ideas and knowledge are conveyed or disseminated to learners (National Teachers' Institute [NTI], 2011). Projected instructional media is used to display moving or still pictures as well as opaque materials by a shining lamp onto the object from above. A variety of materials like book pages, objects, coins, postcards or any other flat materials that are non-transparent are projected and its effectiveness depend on the quality of the projected image. This media could help to reduce the abstract nature of the concepts and enhance students' achievement and retention of biology concepts. Projected instructional media are not available in many schools, where they are available; they are grossly inadequate in supply. The scarcities of instructional media in many schools today have resulted in ineffective teaching of Biology leading to poor achievement of students both in internal and public examinations. Eniayeju (2007) in support of this, reported that factors responsible for students' poor achievement in science, technology and mathematics are, poor laboratory facilities, inability of science teachers to put across ideas clearly to the students and inadequate number of learning facilities in schools as against consistent increase in the number of schools and students' enrolment.

Projected instructional media are those channels of communication which promote the effectiveness of instruction and help the teacher to communicate ideas effectively to his students (Ali, 2012). These media are alternative channels of communication which a Biology teacher can use to concretize a concept during his/her teaching. They include all the substantial resources that an educator might use to implement instruction which facilitate students' achievement and retention of knowledge. They aimed at grasping or stimulating students' attention, sprouting and arousing their interest, supporting their learning with living examples and visual elaboration, which make classroom learning environment enjoyable (Isola, 2010).

Projected instructional media are those channels, ways or medium by which information, skills; knowledge among others is transmitted to learners during teaching-

learning process. It is a way of passing information from a facilitator to the learner. They assist in achieving the stated behavioural objectives when evaluation is carried out at the end of the lesson or programmes (it tests knowledge and ability) and help students to retain knowledge for longer periods (Awolaju, 2015). For instance, Abdu-Raheem (2012) in the study of the influence of gender on Secondary Students' Academic Achievement in South-West, Nigeria, reported that male and female students achieved equally in English Language while males achieved better than females in science.

Biology is very important for national development because it serves as a spring board for many careers in science and technology; and has application nearly in every field of life. The persistent poor achievement of students in biology in Nigeria at the Senior Secondary School level is a matter of serious concern to all educationist and other stakeholders.

Achievement is the measures of accomplishment in a specific field of study (Musa & Agwagah, 2006 & Abakpa, 2011). The authors maintained that achievement of the students is the demonstration of the abilities to attain certain levels of instructional objectives outcome of their classroom instruction and experience. The utilization of the projected instructional media in teaching and learning of biology is essential; this is because projected instructional media are regarded as reinforce of cognitive, affective and psychomotor aspect of learning (Adikwu, 2013). The teaching learning process may lead to an effective retention of knowledge as students tend to remember what they see, touch, feel and manipulate.

Ariyo (2011) carried out a study to investigate the extent to which gender differences and school location determines the academic achievement of students in secondary school physics in Abeokuta North Local Government Area, Ogun, Nigeria. The target population was senior secondary three (SS3) physics students. The sample size was 80 students (33 males and 47 females) which were randomly selected from secondary schools of the State. Descriptive statistics of percentage, mean and standard deviation were used to answer the research questions while inferential statistics of t-test and analysis of variance were used to test the hypothesis. One instrument, physics student's achievement test (PSAT) that covered the three levels of cognitive domain; understanding, remembering and thinking was developed for the study. The findings showed that school location had significant effects on students' performance in physics but students' gender had no effects on their academic achievement in physics and there was no relationship between gender and achievement. The present study differ as the sample size is 165, the subject is biology, area of study is Benue State and the instrument used is a biology achievement test (BAT) that covered the three levels of cognitive domain; understanding, remembering and thinking was developed for the study.

Sunday (2014) carried out an investigation on the effects of gender on secondary school students' achievement in map work. One hundred and sixty-four students randomly drawn from SSII geography students in Ilesa East and West Local Government Council Areas of Osun State, Nigeria, took part in the study. Four types of instruments (one stimulus and three testing instruments) were used to collect relevant data for the study. Data were subjected to both parametric and non-parametric analysis, using mean scores, standard deviation, analysis of covariance (ANCOVA) and multiple classification analysis (MCA). Results showed significant-main effect of gender in Declarative Knowledge Achievement Test (DKTAT). Gender is also found to have significant main effect in Procedural Knowledge Achievement Test (PKTAT). The result is however not significant in Map Reading Interpretation Achievement Test (MARIAT). This implies that while the hypothesis is rejected for both post-test DKAT and PKAT mean scores, it is not rejected for post-test MARIAT mean scores, it was therefore concluded that geography is not gender sensitive as we were made to believe over ages, i.e. gender has no effect on students' achievement in

geography in general, and map work in particular where differences were found in favour of the female students. This study has a relationship with the present study in terms of gender and student's achievement, method of data analysis which is Analysis of covariance (ANCOVA) but differ in terms of subject and location as well as sample size. The previous study had the sample of one hundred and sixty-four students while the present is one hundred and sixty-five students, subject is geography and location is Osun State while the present research is in biology subject and Benue State in terms of location.

Peter (2014) conducted a study on the effect of gender on students' academic achievement in secondary school social studies. The study adopted a quasi-experimental design (2 x 2 nonrandomized pre-test control group) comprising six groups made up of four experimental groups and two control groups. Six schools of one hundred and eighty (180) Upper basic 2 students in Delta and Edo States made up the sample for the study. Six intact classes were randomly selected and assigned to experimental and control groups. The instrument used in this study was the achievement instrument tagged "Social Studies Achievement Test" (SSAT). The validity and reliability of these instruments were established. The reliability of the instruments was established using Pearson product moment correlation coefficient (r). And the reliability coefficients obtained was 0.79. Means, Standard Deviation, Analysis of covariance (ANCOVA) Result revealed that: gender (male/female) had no significant effect on students' achievement in Social Studies and finally, result showed that there was significant interaction effect of treatment and gender on students' academic performance in Social Studies. The study was carried out in Delta and Edo States where size schools of one hundred and eighty upper basic 2 students were sampled, the subject was social studies. The present study has an improvement on the previous study in terms of sample size as two schools of one hundred and sixty-five students were used, area of study is Benue State and the subject is biology.

Statement of the Problem

Biology is very important for national development because it serves as a spring board for many careers in science and technology; and has application nearly in every field of life. The persistent poor achievement of students in biology in Nigeria at the Senior Secondary School level is a matter of serious concern to all educationist and other stakeholders. Practically oriented classes are expected to enhance better understanding of the learned concept and thus improve students' academic achievement. The studies on the practical teaching of the concept of photosynthesis are rare. The study is undertaken to fill these gaps. The problem of this study therefore is that, will the use of PIM enhance student achievement and retention in Biology? or will the use of PIM close the achievement gap between boys and girls in Biology.

Purpose of the Study

The general purpose of this study is to determine the effects of PIM on SS1 students' achievement and gender in Biology. Specifically, the study:

- Determined the effect of projected instructional media on senior secondary one students' achievement in Biology.
- Determined whether the use of PIM in teaching will close the achievement gap between boys and girls in biology.

Research Questions

The following research questions were raised to guide the study:

- What is the mean difference in achievement scores of students taught biology using projected instructional media (PIM) and their counterpart taught without projected instructional media?
- What is the mean difference in the mean achievement scores of male and female students taught biology using PIM and those taught without PIM?

Hypotheses

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

- There is no significant difference in the mean achievement scores of students taught Biology with PIM and those taught without the use of PIM.
- There is no significant difference in the mean achievement scores of male and female students taught Biology using PIM.
- There is no significant interaction effect of projected instructional media and gender on students' achievement in biology.

METHODOLOGY

The study adopts the quasi experimental research design. Specifically, the pre-test post-test non-equivalent control group design was used.

The population for the study is 11,520 senior secondary school I students (SSS I) who offer biology as a subject in the study area. The study was conducted in education zone B of Benue State. A total of one hundred and sixty-five biology students took part in the study. The simple random sampling technique was used to select two schools from seven local government areas in the zone. The schools chosen were randomly assigned to experimental and control group (1 school each for experimental and control groups) in each of the schools selected, intact class was used.

The instrument for data collection is a Biology Achievement Test. The instrument is a 40 item multiple choice objective questions with options A – D. Each correct answer attracted two and a half mark while each wrong answer attracted a zero score.

The instrument was validated by three experts, one from Test and Measurement in the Department of Educational Foundation and General Studies and two from the Department of Science Education all in University of Agriculture, Makurdi. The reliability of the instrument was 0.72 using the split-half method of Pearson r. Descriptive statistic was used to answer the research questions while ANCOVA was used to test the research hypothesis.

Research Procedure

In order to account for initial differences among the groups, pre-test was administered to the two groups; the results obtained were used as covariate in the final analysis. Also, to control the teacher variable, both groups were taught by research assistants who were the Biology teachers in the selected schools. The research assistants were properly trained on the use of projected instructional media.

The experimental group was taught the process of photosynthesis using the projected instructional media while the control group was taught without the projected instructional media. After the completion of the teaching, post-test was administered to both groups. Two

weeks later, the retention test was administered to both groups. The results of the experiment are shown below.

RESULTS

The results are presented first by answering research questions then, hypotheses-by-hypotheses. The statistical tool used was the Analysis of Covariance (ANCOVA). The hypotheses were tested at 0.05 level of significance.

Research Questions I

What is the mean difference in achievement scores of secondary school students taught biology using PIM and those taught biology without PIM?

Table 1: Mean Achievement Scores and Standard Deviation of Students in Experimental and Control Groups

Groups	N	Pretest mean	SD	Posttest SD	(BAT) mean	Mean gain
Experimental	87	22.83	14.57	71.29	13.88	48.46
Control	78	25.22	17.95	36.26	15.68	11.04
Mean Difference		-2.39		35.03		37.42
Total	165					

Table 1 shows that in pretest, the experimental group had a mean achievement score of 22.83 with a standard deviation of 14.57, while the control group had a mean achievement score of 25.22 with a standard deviation of 17.95. The Table also shows that in the posttest, the experimental group had a mean achievement score of 71.29 with a standard deviation of 13.88, while the control group had a mean achievement score of 36.26 with a standard deviation of 15.68. The mean difference between both groups of students in pretest was 2.39 while in the post test a mean difference of 35.03 was observed. The overall mean difference between the two groups was 37.42.

Research Question 2

What is the mean difference in achievement scores of male and female secondary school students taught biology using PIM?

Table 2: Mean Achievement Scores and Standard Deviation of Male and Female Students in Experimental Group

Gender	N	Pretest mean	SD	Posttest SD	(BAT) mean	Mean gain
Male	47	19.09	12.83	72.63	13.47	53.54
Female	40	27.24	15.39	69.71	14.36	42.47
Mean Difference		-8.15		2.92		11.07
Total	87					

Table 2 shows that in pretest, males had a mean achievement score of 19.09 with a standard deviation of 12.83, while the females had a mean achievement score of 27.24 with a standard deviation of 15.39. In posttest however, males had a mean achievement score of 72.63 with a standard deviation of 13.47, while the females had a mean achievement score of 69.71 with a standard deviation of 14.36. The mean difference between the achievement scores of male

and female students in pretest was 8.24 while a mean difference of 2.92 was recorded between the male and female students in the posttest. The overall mean difference between the mean achievement scores of male and female students in experimental group with regard pretest and posttest scores was 11.07.

Hypothesis I

There is no significant difference in the mean achievement score of students taught biology using projected instructional media PIM and those taught without the use of PIM.

Table 1: Summary of Analysis of Covariance (ANCOVA) of Experimental and Control Groups' Achievement Scores in BAT

Source of variance	Sum of squares	df	Mean square	F	Sig
Corrected Model	50698.51	4	12674.63	57.48	.00
Intercept	131533.15	1	131533.15	596.49	.00
Pretest	41.99	1	41.99	.19	.66
Group	48333.66	1	48333.66	219.19	.00
Error	35281.75	160	220.51		
Total	580189.42	165			
Corrected Total	85980.26	164			

Table 1 shows that the treatment (projected media) was significant at 0.05 $F=219.19$, $P=.00$; $P<0.05$. This means that the null hypothesis was rejected.

This means that there was a significant effect of projected media on senior secondary one students' achievement in biology. It can therefore be concluded that projected media enhanced students' achievement in biology.

Hypothesis 2

There is no significant difference of projected instructional media in the mean gender scores of male and female students taught biology using PIM.

Table 2: Summary of Analysis of Covariance (ANCOVA) of Male and Female Students' Achievement Scores in BAT

Source of variance	Sum of squares	df	Mean square	F	Sig
Corrected Model	50698.51	4	12674.63	57.48	.00
Intercept	131533.15	1	131533.15	596.49	.00
Pretest	41.99	1	41.99	.19	.00
Gender	17.30	1	17.30	.08	.78
Error	35281.75	160	220.51		
Total	580189.42	165			
Corrected Total	85980.26	164			

The summary of the ANCOVA presented in Table 2 shows that the treatment (projected media) was not significant due to gender in the achievement test. This is shown by the gender values ($F=.08$, $P=.78$; $P>0.05$) as presented in Table 2. Hence, the null hypothesis was not rejected. This means that there is no significant difference of projected instructional media on the Senior Secondary School achievement scores of male and female students' in biology.

Though from the research question, there was a bridge of gap between the achievement scores of males and females but the effect was not statistically significant.

Hypothesis 3

There is no significant interaction effect of projected instructional media and gender on students' achievement in biology.

Table 3: Summary of Analysis of Covariance (ANCOVA) Results of Interaction Effect of Projected Media and Gender on Students'

Source of variance	Sum of squares	df	Mean square	F	Sig
Corrected Model	50698.51	4	12674.63	57.48	.00
Intercept	131533.15	1	131533.15	596.49	.00
Pretest	41.99	1	41.99	.19	.00
Gender *group	150.59	1	150.59	.68	.41
Error	35281.75	160	220.51		
Total	580189.42	165			
Corrected Total	85980.26	164			

In Table 3, the sig value of post test scores for interaction effect of projected instructional media and gender is .41. This value is greater than the alpha value of 0.05 level of significance; therefore, the hypothesis is not rejected. It implies that the interaction effect of projected instructional media and gender on achievement is not significant. This further implies that achievement of students in biology is not affected by gender.

DISCUSSION AND CONCLUSION

The study was designed to find out the effect of projected instructional media on senior secondary school students achievement and gender in biology. The findings of this study showed that students taught with PIM achieved significantly better than the students taught without using PIM. The significant difference could be as a result of the ability of the PIM to provide both aural and visual representations of experimental procedures. This could also be due to the fact that PIM has the potential of making students learn more because fun and entertainment are natural ways through which students learn, therefore, improving the achievement of students. The above findings are in line with the previous researchers like Awolaju (2015), Abdu-Raheem (2012), Musa & Agwagah (2006), Abakpa (2011) who indicated that students achieved significantly better when taught with projected instructional media than without projected instructional media. Musa & Agwagah reported in their study that, the achievement of students in biology greatly improved with the innovative use of projected instructional media and creation of sound strategies for disseminating science in the classroom.

The findings of this study indicates that female students taught using projected instructional media, achieved significantly higher scores than male students in their achievement though the difference was reduced after treatment and there was no statistical significant difference in their achievement scores. Generally, male students do better than female students at all levels. This could be due to the fact that some female students believe that science is too difficult and not important for their future. Also, the males are already inclined to science subjects and see it as a necessity, therefore pay serious attention to lessons. The results from this study showed that gender had significant influence on students' achievement in biology. For knowledge to develop, the acquired materials in mind need to be

preserved in form of images. Therefore, projected media is combined with still and motion pictures which captured the students mind and helped them to achieve better. The male probably achieved better than the females because they are more inclined to science related subjects and have a natural positive attitude to science subjects while the females show negative attitude.

The result of this study supports the view of previous researchers like Abdu-Raheem (2012) and Ariyo (2014), who observed that gender, had significant effect on achievement in favour of males. For instance, Abdu-Raheem (2012) in the study of the influence of gender on Secondary Students' Academic Achievement in South-West, Nigeria, reported that male and female students achieved equally in English Language while males achieved better than females in science. He therefore, recommended that necessary materials/equipments should be provided to make sciences interesting to girls. Nevertheless, the findings of this study are in disagreement with Peter (2014) and Sunday (2014) who found no significant difference in academic achievement and retention of male and female students. The study revealed higher mean achievement scores for female students who were taught using PIM and lower means achievement scores for male students who were taught using PIM. This shows that there is a significant interaction effect of projected instructional media and genders on students' mean retention scores in biology. The female students achieved better than the male when taught with PIM. The researchers observed that the female students were excited about the projected instructional media and this excitement was enduring. Also, the female students showed greater zeal in trying to understand the topic taught by asking questions related to the topic. This could be the reason why they retained better.

Recommendations

Based on the findings of this study and their implications, the following recommendations were made:

1. Since the use of projected instructional media in teaching has been found to enhance achievement and retention in biology, biology teachers should employ it more in the teaching of the subject especially for topics that are abstract.
2. State and Federal Government should procure enough computers for all secondary schools, especially government owned schools that cannot afford to buy computers themselves. Government should also endeavor to provide all secondary schools with electricity and stand-by generators should be installed in these schools, in the case of power failure.
3. Professional organizations like the Nigerian Association for Educational Media and Technology (NAEMT), Science Teachers Association of Nigeria (STAN) and all other stakeholders in Education who are concerned with improving instruction should undertake the production of projected instructional media for schools. Also, the Government should encourage and sponsor in-service educational opportunities for all Biology teachers to learn the basic skills of producing projected instructional media and other instructional media.

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ⁱ **Okwara Kalu Okwara** is a lecturer in the Department of Science Education, Federal University of Agriculture, Makurdi, Nigeria. He can be reached via email at okwarakalu@gmail.com.

ⁱⁱ **Paul I. Anyagh** is of the Department of Science Education, Federal University of Agriculture, Makurdi, Nigeria.

ⁱⁱⁱ **Gloria S. Ikyaan** is of the Department of Science Education, Federal University of Agriculture, Makurdi, Nigeria.