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Enhancing Students' Academic Achievement in Biology using Projected Instructional Media

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Abstract. This study investigated how projected instructional media could enhanced students' academic achievement in biology. It also determined whether the performance of the students would vary with gender when exposed to projected instructional media. It employed pre-test, post-test, control group quasi-experimental design. The sample consisted of sixty five students offering biology. Two schools were purposively selected in Ijebu East Local Government Area based on certain criteria. Two schools were randomly selected to form experimental and control groups. Two null hypotheses were formulated and tested at 0.05 level of significance. Two instruments were used for the study. Analysis of Covariance and t-test were used for data analysis. Findings indicated that students taught biology using projected instructional media performed better than those taught using conventional method of teaching. In addition, there was no significant difference between the mean scores of male and female students taught biology using projected instructional media. Based on the findings, it was recommended among other that secondary school biology teachers should effectively make use of projected instructional media in teaching the students the abstract and difficult concepts in biology irrespective of gender.

Keywords: Projected Instructional Media, Biology, Students' Academic Achievement, Gender,

1. Introduction

Science education occupies the central position in producing resources needed for socio-economic, scientific and technological development and growth of any nation. Recognizing the importance of science education, the Federal Government of Nigeria (FRN, 2014) included science programmes in her secondary school curriculum. The broad aim of secondary education in Nigeria is the preparation for useful living within the society and also for higher education. To achieve this aim, the FGN made biology as one of the science subjects taught at senior secondary schools. Science is the systematic body of knowledge obtained by methods or techniques based on observation and experimentation. It seeks to explain the natural phenomenon using enquiry processes or activities. Alebiosu (2017) noted that for any nation to attain the status of self-reliance, science must be an important component of that nation irrespective of sex or race. One of the branches of science is biology.

Biology is the science of life that studies living matter, structure, function and behaviours of organism. It is concerned with evolution, distribution and taxonomy of life (Bilesanmi-Awoderu, Afuwape & Jolaosho, 2017). The importance of biology in the industrialization and other sector of the economy cannot be overemphasized. As a matter of fact, it is a prerequisite for pursuing a number of careers in sciences which include medicine, pharmacy, biochemistry, botany, nursing, zoology among others.

Considering the paramount importance of biology to human life, it has been noted that the performance of students in internal and external examinations have not been impressive and the failure rate is much higher and alarming. This can be attested to from the results of students in biology between 2009 – 2018.

Table 1: Students' Achievement in the May/June Biology between 2009 and 2018 in Ogun State.

Year	Total Entry	No of Passes	% of Passes	No of Failure	% of Failure
2009	10,337	3,654	35.50	6,683	64.50
2010	10,059	2,268	22.50	7,791	77.50
2011	8,534	2,652	31.00	5,882	69.00
2016	8,934	1,518	17.00	4.416	83.00
2013	6,874	1,986	29.00	4,888	71.00
2014	9,026	3,581	39.65	5,445	60.35
2015	6,128	2,686	40.45	3,442	59.55
2016	6,894	2,270	32.90	4.624	67.10
2017	6,934	1,518	15.00	5,416	85.00
2018	6,274	1,986	31.00	3,885	69.00

Grades lower than $A_1 - C_6$ (i.e. distinction and credit) are regarded as failure
Source: *West African Examination Council, Research and Statistics Unit (2018).*

Table 1 shows the statistics of biology achievement in May/June Secondary School Certificate Examination (SSCE) from 2009 to 2018. Students' performance in biology has consistently been reportedly low over the years in Nigeria especially in Senior Secondary School Certificate Examination (WAEC Chief Examiners' Reports, 2009 - 2018). In light of the above, Adebanjo (2019); Adebanjo and Omoniyi (2018); Raji (2017) attributed the causes of these prevalent poor performance and negative attitude of students towards biology in Nigeria to many factors, prominent among are poor usage of instructional materials. This is because according to Awobodu (2016), the responsibility of the classroom teacher is to help students attain maximum achievement in their learning tasks and also the ability to use appropriate instructional materials and strategies in teaching is among the competencies of a teacher. Though, 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 external examinations.

Instructional media encompass all the materials and physical means an instructor might use to implement instruction and facilitate students' achievement of instructional objectives (Omoniyi, 2005). Obielodan (2015) defined instructional media as the collection of materials that a teacher uses in the teaching and learning situation to concretise learning experiences so as to make learning more exciting, interesting and interactive to all categories of learners with the ultimate aim of achieving the learning objectives. When instructional media are rightly used by the teachers in any teaching and learning situations, it makes teacher's job easier and makes presentation of facts clearer to learners. It also ensures that all categories of learners are properly carried along in the teaching and learning situations for better performance. Therefore, the teaching and learning biology requires a lot of instructional media because media help to reduce the abstract nature of difficult concepts and also enhance students' achievement and retention of biology concepts.

Therefore, projected instructional media are those channels of communication which promote the effectiveness of instruction and help the teacher to communicate ideas effectively to the students via the screen with the projector (Onasanya, 2015). Also, projected instructional media helps in supporting the students with living examples and visual elaboration, which makes classroom learning environment enjoyable (Isola, 2010). Projected instructional media are those channels, ways or medium by which information, skills; knowledge among others is translated to learners during teaching-learning process. They assist in achieving the stated behavioural objectives when evaluation is carried out at the end of the lesson or programmes and help students to retain knowledge for longer periods. (Awolaju, 2015).

Several researches had shown that using projected instructional media in classroom have positive effect on students' academic achievement when compared to lecture method. For instance, Okwara, Anyagh and Ikyaan (2017) investigated the effect of projected instructional media on senior secondary school students' achievement in biology in Benue State, Nigeria. The results indicated that the students taught with projected instructional media achieved significantly better in post test achievement mean scores than their counterparts taught without using projected instructional media. This finding indicated biology could be taught and learnt meaningfully through the use of projected instructional media

because it is more learner-friendly and exiting. However, there was no significant difference reported in the posttest performance scores of male and female students taught biology using projected instructional media.

In another study, Okwara, Anyagh and Ikyaan (2019) examined the effect of projected instructional media on senior secondary school students' retention in biology in Benue State, Nigeria. The result indicated that students that were taught biology using projected instructional media retained the biology concepts learnt better than those that were taught without projected instructional media. This showed that projected instructional media enabled students to retain better what was learnt over a period of time because projected instructional media were able to retain the concepts been taught as it removes boredom and abstraction in classroom learning thereby aiding assimilation and retention. Also, the projected instructional media improved the achievement of both male and female students taught.

Nsofor and Momoh (2013) examined the effects of developed electronic instructional medium on students' achievement in biology in Minna, Nigeria. The finding of this study showed the mean achievement score of students in the experimental group was higher than that of the control group and the developed electronic instructional medium favoured the experimental group. This is because the developed electronic instructional medium stimulated students' learning environment and also motivated them to take a greater interest in learning. Also, their finding indicated that the use of developed electronic instructional medium enhanced the performance of male students than the female students.

The influence of students' gender in their academic achievement had been a concern to researchers in education, yet no consistent result had emerged. Adebanjo (2019); Okwara, Anyagh and Ikyaan (2017) who reported that gender had no significant influence on academic achievement of students in biology while Awobodu (2016); Nsofor and Momoh (2013); Oludipe (2015) who reported that gender difference has influence on the academic achievement in biology and chemistry respectively. These contradictory results showed that the issue of gender in students' achievement in biology has not yet been resolved. Hence, the purpose of the study is to investigate whether projected instructional media could positively and significantly improve students' academic achievement in biology.

2. Statement of the problem

Studies have shown that the performance of biology students in both internal and external examinations was declined and the primary causes of the poor performance are the use of conventional method of teaching and also poor usage of projected instructional media. The increasing failure rate of students from year to year in biology, in school examinations are becoming alarming. Observations and investigations on students' performance in biology in the SSCE had revealed that only a few percentages of the students perform well in examination. The observed poor trend of students' performance in biology therefore calls for concern. Hence, this study investigated the effect of projected instructional media and gender influence on students' academic achievement in biology.

3. Hypotheses

The following hypotheses were formulated to guide the study and tested at 0.05 level of significance.

Ho_1: There is no significant difference in the performance of students taught biology using projected instructional media and conventional method of teaching.

Ho_2: There is no significant difference in the performance of male and female students taught biology using projected instructional media.

4. Methodology

The design adopted pre-test, post-test, control group quasi-experimental design. The population for the study consisted of all senior secondary year one (SS I) students offering biology in public secondary schools in Ogun State, Nigeria. Fifty nine (59) students (27 males and 32 females) offering biology participated in the study. A two-stage sampling technique was use in selecting the sample. Firstly, a purposive sampling technique was use in selecting two public senior secondary schools in Ijebu East Local Government Area, Ogun State using the four criteria: (i) equivalence (laboratories, facilities and manpower), (ii) school ownership (public schools), (iii) gender composition (mixed schools) and (iv) candidates' enrolment (Senior Secondary School Certificate in Education in biology for a minimum of six years). Secondly, a simple random sampling was used in assigning the students in two of the selected schools into either experimental or control group. The experimental group (n = 29) was taught using projected instructional media, and control group (n = 30) was taught using conventional method of teaching for four weeks.

The instrument for data collection is a Biology Achievement Test. A draft of 75 multiple choice objectives items was first developed the researchers

on photosynthesis and presented to two experts in Educational Evaluation with the table of specification for perusal and advice. Their suggestions and corrections were used to modify the items for adequacy, simplicity of language and relevant to content. Twenty five (25) items which survived the item analysis constituted the Biology Achievement Test (BAT). The BAT was meant to measure students' achievement in photosynthesis. The BAT is a multiple choice test-items with four options lettered A – D. The test items were constructed in such a way to reflect three categories of cognitive tasks of knowledge, comprehension and application. The face and content validity of the instrument was determined by the perusal of two experts in biology and it was confirmed that the instrument was relevant, unambiguous, detailed and capable of eliciting the needed responses from the target population. Then, the Twenty five (25) items BAT was administered on a sample of 20 SS I students different from the students used for the main study and its reliability coefficient determined as 0.62 using Pearson Product Moment Correlation.

The intervention used for the experimental group was projected instructional media (Appendix) on photosynthesis which was downloaded from the Internet while the slides were made by the researchers for classroom usage. Design elements of colour, animation and manipulation were introduced to influence learners' attention, interest, motivation and aspiration. The face and content validity of the instrument was determined by the perusal of two biology teachers and educational technologists' experts. Their comments and recommendations helped to improve the instrument.

4.1 Treatment Procedure

In collecting the data for this research, the objectives and the modalities of the study were specified and operational guide was produced before the commencement of the treatment. In all, two biology teachers from the selected schools served as research assistants. A biology teacher in the experimental group was trained in the use the projected instructional media while the teacher in the control group uses conventional method of teaching. The treatment period for all groups covered four weeks. At the beginning of the study, Biology Achievement Test (BAT) was administered to both experimental and control groups. Scores on BAT served as pre-test scores (O_1) and as covariates for ANCOVA analysis. At the end of teaching, both experimental and control groups, the teachers re-administered the BAT as post-test (O_2). The following are the specific procedure for each group.

Experimental Group: This group was taught using projected instructional media on photosynthesis. The teacher explained the objectives of the lesson to the learners. The teacher projects information on photosynthesis to the learners. Lesson demonstration was done by teacher and also learning tasks are projected in the classroom. At the end of each unit, students were evaluated based on the content taught. Lastly, the assignments were given to the students.

Control Group: The control group was exposed to conventional method of teaching. The research assistants taught students in control group the concept of photosynthesis without projected instructional media.

Immediately after four weeks of treatment, BAT was administered as post-test to measure the achievement of different groups. Scores from the post-tests (O_2) as well as those from already collated pre-test (O_1) were collated for analysis.

4.2 Data Analysis

The two hypotheses formulated were tested using the univariate analysis of covariance (ANCOVA) and t-test.

5. Results and Discussion

Hypothesis 1: There is no significant difference in the performance of students taught biology using projected instructional media and conventional method of teaching.

Table 1: ANCOVA of students' achievement in Biology according to Treatment

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Covariates (pre-test)	38.012	1	38.012	4.065	0.000
Main Effect (treatment)	71.201	1	71.201	10.124	0.000*
Model	1204.514	2	75.008	7.429	0.000
Residual	761.321	56	14.508		
Total	1632. 910	59			

*** Indicate significant F at 0.05 level**

Table 1 reveals that an $F_{(1, 56)} = 10.124$, $P < 0.05$ for the main effect (treatment) was significant at 0.05 level, this indicates that the method of instruction produced a significant effect on the performance scores of students when covariate effect was controlled. The results indicated that projected instructional media (PIM) and conventional method of teaching (CMT) accounted for the difference in the performance scores of the students. Based on these results, performances of students in the two groups were further compared using mean gain scores between the pre-test and post-test for each group and the results are shown in Table 2.

Table 2: Main Gain Scores of Students Taught Biology using PIM and CMT

Group	Pre-test	Post-test	Mean Gain Score
CSIP	28.95	72.35	43.40
CMT	26.88	58.08	31.20

From Table 2, it was observed that both groups had improved performance in post-test. For instance, PIM had highest mean gain scores of 43.40 while the CMT had least mean gain scores of 31.20. This indicates that the two groups benefitted from the treatment with PIM having best performance. Therefore, the results indicated that the projected instructional media was more effective in promoting performance than the conventional method of teaching. As a result, the null hypothesis one (H_{01}) is rejected.

This agrees with the findings of Okwara, Anyagh and Ikyaan (2017); Okwara, Anyagh and Ikyaan (2019) who found that projected instructional media improved students' achievement and retention in biology. Furthermore, this finding is supported by the findings of Nsofor and Momoh (2013) who reported that developed electronic instructional medium fostered higher achievement in biology than the conventional approach.The plausible reason for this outcome might be due to the fact that students exposed to projected instructional media retained better what was learnt over a period of time and also removes boredom and abstraction in classroom learning thereby aiding assimilation and retention.

Hypothesis 2: There is no significant difference in the performance of male and female students taught biology using projected instructional media.

Table 3: T-test Comparism of Mean Performance Scores of Male and Female Students in the Experimental Group (PIM)

Groups	N	Mean	SD	Df	t	Sig.	Remark
Male	13	26.904	5.601	27	3.062	0.770	Not Significant
Female	16	25.714	5.099				

Table 3 above reveals the t-test of male and female students of experimental group (CSIP). The mean scores and SD for male students were X = 26.904 & SD = 5.601 and for female students were X = 25.714 & SD = 5.099. The difference was not significant $t(27) = 0.770$, $P > 0.05$. Hence, the hypothesis which says that there is no significant difference in the performance of male and female students taught biology using projected instructional media. was retained. This finding indicated that the projected instructional media has improving effect on the teaching and learning of biology and was gender friendly. The enhancing effects of the projected instructional media could be found that students were stimulated, motivated and also had interest in the teaching – learning process.

The finding is in support with the work of Adebanjo (2019); Okwara, Anyagh and Ikyaan (2017) who reported that gender had no significant influence on academic achievement of students in biology. Awobodu (2016); Nsofor and Momoh (2013); Oludipe (2015) reported that gender difference has influence on the academic achievement in biology and chemistry respectively. The result however contradicts the findings of Awobodu (2016); Nsofor and Momoh (2013); Oludipe (2015) who reported that gender difference has influence on the academic achievement in biology and chemistry respectively.

6. Conclusion

The study had revealed significant difference in the performance of students taught biology using projected instructional media and conventional method of teaching because projected instructional media was more effective in promoting performance than the conventional method of teaching. Also, there is no significant difference in the performance of male and female students taught biology using projected instructional media because the students find the package interesting and the performance was improved irrespective of their gender.

7. Recommendations

Based on the major findings of this study, the following recommendations are made:

- Secondary school biology teachers should effectively make use of projected instructional media in teaching the students the abstract and difficult concepts in biology irrespective of gender.
- Faculties of Education in the Universities and College of Education should introduce the production and utilization of instructional media into their teacher education curriculum for the pre-service teachers.
- Curriculum planners/developers in their efforts to improve the effectiveness of biology teachers should encourage the utilization of projected instructional media in Nigerian secondary schools for better performance.
- Biology teachers should be sponsor for in-service training, workshop and conferences so as to be acquainted with the production and utilization of instructional media.

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