

Effects of Lecture Method Supplemented with Powerpoint Presentation on Students' Academic Achievement in Biology

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Abstract. The effect of lecture method supplemented with powerpoint presentation and the moderating effect of learning style on students' achievement in biology were examined in the study. Randomized pre-test, post-test, control group, quasi-experimental design, involving 2x3 factorial matrix was adopted. The sample consisted of seventy four (74) SS 2 students offering biology in two purposively selected secondary school from Sagamu local government areas of Ogun State. Three hypotheses were formulated and tested at 0.05 level of significance. Three instruments were used to gather required data: Biology Achievement Test ($r=0.69$), Learning Style Self-Assessment Test ($r=0.82$) and Lecture Method supplemented with Powerpoint Presentation guide. Data were analyzed inferentially by analysis of covariance (ANCOVA). Multiple classification analysis (MCA) was used to analyze the data. Lecture method supplemented with powerpoint presentation had significant effect on students' achievement in biology ($F_{(1,61)}=10.652$, $P< 0.05$). However, no significant main effect of learning style was found on students' achievement in biology ($F_{(1,61)}= 0.594$, $P>0.05$). No significant 2-way interaction effect of learning style was found in students' achievement in biology ($F_{(2,61)}= 0.312$, $P>0.05$). In view of the findings, it was recommended that teachers should be encouraged to incorporate and integrate the use of lecture method with powerpoint presentation in the teaching of biology at senior secondary schools in Nigeria.

Keywords: Lecture Method, Powerpoint Presentation, Academic Achievement, Learning Style, Biology.

1. Introduction

The quality and effectiveness of teachers in the teaching – learning process at all levels of education are highly important to the learning outcomes. Teachers are indispensable in any educational system, and no educational system can rise above the quality of its teacher (Federal Republic of Nigeria, 2014). Good teachers are necessary for good education which in turn is indispensable for social change and national development. The teacher is learning facilitator, a consultant, guide, innovator, mentor, inspirator and moderator. Therefore, teachers constitute the pivot upon which schooling rotates. Teachers play an important role in terms of implementation of school curriculum, and influencing students' academic achievement (Ajayi, 2017; Oni, 2017).

The instructional delivery mode employed by the teachers play an important role in the academic achievement of the learners. In Nigeria, most teachers in secondary schools use lecture method which do not promote their critical thinking and aid retention; makes students passive and focuses mainly on memorization (Adebanjo, 2019; Awobodu, 2015; Olurinola, 2015).

Biology is one of the science subjects taught at senior secondary school level in Nigeria. According to Raji (2017), biology covers a wide scope, and serves as a spring board for many future careers in science and technology and has application, nearly in every field of life. It is a natural science that deals with the living world; how the world is structured, how it functions and what these functions are, how it develops, how living things came into existence, and how they react to one another and with their environment (Bilesanmi-Awoderu, Afuwape & Jolaosho, 2017).

Biology serves as a prerequisite subject for the study of medicine, pharmacy, nursing, agriculture, textile and clothing, forestry, biotechnology, nanotechnology and this implies that biology is involved in industrial set-up and the improvement of quality of life of the citizenry, hence it is said to be a catalyst of sustainable national growth and development (Adebanjo & Omoniyi, 2018). According to Adebanjo (2019), despite the importance of biology to the nation, the achievement of students in the subject has been very poor which has continued to be a major cause of concern to all stakeholders in Nigeria.

The minimum entry requirement into Nigerian tertiary institutions is that candidates wishing to study science - related courses must possess credit passes in ordinary level subjects, which include biology. In Ogun State, indices from examinations organised by WAEC showed that we have low enrolment and poor achievement in biology. Biology results of the May/June West African Senior School Certificate Examination (WASSCE) from 2014 to 2018 revealed a low percentage pass at credit level. In 2014, 9026 candidates enrolled for biology in the WASSCE, 3581 candidates passed at credit level representing 39.65% while 5445 candidates failed representing 60.35%. In 2015, 6128 candidates enrolled, 2686 candidates passed at credit level representing 40.45% while 3442 candidates failed representing 59.55%. In 2016, 6894 candidates enrolled, 2270 candidates passed at credit level representing 32.90% while 4624 candidates failed representing 67.10%. In 2017, 6035 candidates sat for biology, 1518 candidates passed at credit level representing 15.0% while 5416 candidates failed representing 85.00%. 6274 candidates enrolled for biology in 2018, 1986 candidates passed at credit level representing 31.00% while 3.885 candidates failed representing 69.00%. The implication of the trend in performance is that only a few students would eventually be able to pursue biology related courses in the higher institutions.

Literature search reveals that poor achievement in biology is as a result of the use of poor teaching strategies and inadequate instructional materials (Adebanjo & Omoniyi, 2018; Awobodu, 2016). Again, activity-oriented instructional strategies are not usually employed in biology classroom, as evident in the research findings of Adebanjo (2019). The lecture method used by most biology teachers involves only oral presentation of ideas and the teacher did most of the activities in form of talking while the students were passive listeners or slightly involved which resulted into rote learning.

These findings have led a number of science educators to conclude that science subjects are not effectively taught in our schools (Adebanjo, 2019; Raji, 2017). In addition to teaching problems, students perform poorly biology due to some biological concepts which are complex, abstract and difficult to comprehend especially in the area of genetics. Among such complex and difficult biology concepts are ecology and genetics (Adebanjo, 2019; Raji, 2017; WAEC, Chief Examiners' Report, 2018). Genetics is a topic in biology that is taught at the senior secondary school level. Genetics is a science of heredity and variation. The knowledge of genetics is important in the area of agriculture, inbreeding, outbreeding, animal breeding, plant breeding, medicine, counsellor, genetic engineering etc. It is important to point out that proper understanding of genetics by the students could assist in improving their performance in biology.

Questions on genetics have continued to pose difficulty for candidates as noted by WAEC Chief Examiners Report (WAEC, 2014, 2015, 2016, 2017 & 2018). A survey was carried out by the researcher on some SS II biology students in Ijebu North Local Government Area of Ogun State in order to confirm or refute this assertion that genetics is a difficult topic for learners to understand. The researcher posed the following question to students: "List the topics in biology that is difficult for students of SSII to grasp?" Survey report from the schools selected indicated that, genetics was ranked the most difficult topic in SSII to study; next was ecology. This implies that much attention should be given to this topic by biology teachers; hence the need for innovative and improved student centered teaching techniques to enhance teaching and learning of genetics.

Therefore, effective teaching connotes the ability of the teachers to communicate effectively and this cannot be done without knowing the characteristics of a learner and his problem and also by using the appropriate methods. According to Babayemi, Ahmed, Yisau and Babalola (2016) a combination of the lecture method with other approaches may improve the understanding and performance of biology concepts which will be more learner-friendly and student-centered. Also, it may remove the notion that lecture method is weak, thus increasing understanding and hence better achievement in biology. This implies that teachers should use the lecture method and supplement it with other innovative methods that may improve the students' achievement and retention. Therefore, in order to alleviate the problem of teaching of biology concepts, particularly genetics, the use of lecture method

supplemented with powerpoint presentation has been suggested by the researcher as innovative teaching methods.

Powerpoint is part of the Information and Communications Technology (ICT) programme developed by Microsoft in 1987. It consists of slides allowing the user to present messages (Asogwa, 2014). Powerpoint presentation could be used in the classroom for supporting students learning by combining computer and liquid crystal display (LCD) projector to display slides for illustrating a lesson (Effiong & Ekpo, 2016). Potentials of microsoft powerpoint include: its ability to do spell check, allowing the user to add, correct, make changes to the lessons, and finally use printout materials for students' personal use (Asogwa, 2014).

Powerpoint gives the user the opportunity to incorporate visual and auditory aspects to a presentation. It permits variety of manipulations by editing or text modification, removal of existing slides and addition of new slides to make lesson more organized and flexible. It can be regarded as a good instructional medium and a key for facilitating an effective teaching-learning process (Gambari, Yusuf & Balogun, 2015). Some researchers reported that powerpoint presentation increases visual quality in the learning process. They also contended that it takes less time to present a subject matter; therefore, more materials can be covered in the classroom. They also believed that it helps to keep students' interest and attention on the lecture; improves student learning and aids explanations of complex illustrations (Apperson, Laws, & Scepansky, 2006; Szabo & Hastings, 2000).

Several researches had shown that lecture method with powerpoint presentation has a positive effect on students' academic achievement when compared to lecture method. For instance, Babayemi, Ahmed, Yisau and Babalola (2016) examined the effect of enhanced conventional lecture method (conventional lecture method + powerpoint presentation) on students' academic achievement in basic science in Oyo State. The results indicated that the students taught basic science using enhanced conventional lecture method performed significantly better in post test achievement mean scores than their counterparts taught basic science using conventional lecture method. This finding indicated basic science could be taught and learnt meaningfully through the use of enhanced conventional lecture method because it is more learner-friendly and student-centered.

Bolorunduro (2005) determined the effectiveness of lecture method supplemented with powerpoint

presentation on students' learning outcomes at junior secondary school level in integrated science. Findings revealed that there was significant difference between the mean achievement scores of the two groups in favour of those taught with lecture method + powerpoint presentation. Also, the attitude of those in lecture method + powerpoint presentation group was improved because the learners were delighted with what is being taught.

Gambari, Yusuf and Balogun (2015) examined the effectiveness of powerpoint on students' cognitive achievement in technical drawing in Minna, Nigeria. Influence of gender was also determined. Findings revealed that there was significant difference between the mean achievement scores of the two groups in favour of those taught with powerpoint presentation. Also, the powerpoint presentation improved the achievement of both male and female students taught.

Effiong and Ekpo (2016) determined the interactive effect of powerpoint instructional package and academic performance of educational technology students in the university of Calabar. The finding revealed that there was a significant difference between the performance of students taught educational technology using powerpoint instructional package and those taught using the conventional expository method, in favour of those taught using powerpoint instructional package.

However, although lecture method with powerpoint presentation seems to attract learners' attention and increase their motivation to learn. In addition to the possible influence of this package on students' achievement, some other factors inherent in students can also affect academic achievement. One of such factors investigated was the learning style of the learners.

The moderating effect of learning style was also considered in this study. Learning styles are concerned with how learners prefer to learn and how information should be presented using such styles as visual, auditory and kinesthetic (Clark, 2011). This allows learners the opportunity to become involved, no matter what their preferred style may be. Adebajo (2019); Olurinola (2015); Omoniyi, Adebajo and Olurinola (2018) found that there was no significant main effect of learning style on the students' achievement in biology and visual arts respectively. However, Hattie (2011) reported that learning style has significant effects on students' cognitive achievement in learning physics concepts. There is, therefore, a need to investigate how lecture method supplemented with powerpoint presentation

can interact with learning style in enhancing students' achievement in biology.

Therefore, effectiveness of lecture method supplemented with powerpoint presentation in biology has not been examined in Ogun State. This is the gap this study intends to fill. It is against this background that this study investigated effects of lecture method supplemented with powerpoint presentation and learning style on students' academic achievement in biology.

2. Statement of Problem

Research reports on the status of teaching biology in secondary schools in Nigeria showed that biology classroom activities are still dominated by teacher-centered methods, such as lecture and teacher demonstration methods, which have been found to be ineffective in promoting science teaching and learning in schools. The resultant effect has been students' persistent poor achievement in biology at both internal and external examinations in Nigeria. A combination of lecture method with powerpoint presentation can be used to enhance better understanding in biology concepts. Students at this level are prone to distractions and so the most important challenge facing teachers is to capture their attention and interest which will facilitate interactive class instruction. Probably, if powerpoint presentations are properly integrated into the teaching of biology topics, students will perform maximally in class or examinations. Therefore, this study aimed at finding out if lecture method is supplemented with powerpoint presentation could enhance effective teaching and learning of biology to improve students' academic performance.

3. Hypotheses

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

H₀₁: There is no significant difference between the mean achievement scores of students taught biology using lecture method supplemented with powerpoint presentation and those taught with conventional teaching method.

H₀₂: Learning style will not significantly influence the effect of instructional package on students' academic achievement in biology.

H₀₃: The interaction effect of instructional package and learning style on students' academic achievement in biology is not significant.

4. Methodology

A quasi-experimental design using non-randomized, non-equivalent, pretest, posttest experimental group design was adopted for this study with 2 x 3 factorial matrix. Two levels of independent variables (experimental and control groups) and three levels of learning style (audio, visual and kinesthetics). The population for the study consisted of all senior secondary year two (SS II) students offering biology in public secondary schools in Ogun State, Nigeria. Seventy four (74) students offering biology participated in the study. A two-stage sampling technique was used in selecting the sample. Firstly, a purposive sampling technique was used to select two schools in Sagamu Local Government Area, Ogun State based on facilities and manpower and school type (public schools). Secondly, the two schools were randomly assigned to experimental group and control group respectively. The experimental group (n = 38) was taught using lecture method + powerpoint presentation, and control group (n = 36) was taught using conventional lecture method.

4.1 Instrumentation

The three instruments used to collect relevant data for the study were:

- Biology Achievement Test (BAT)
- Learning Styles Self-Assessment Test (LSSAT)
- Instructional Guide for lecture method supplemented with powerpoint presentation (LMP)

4.2 Biology Achievement Test (BAT)

A draft of 90 multiple choice objectives items was first developed 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 (30) items which survived the item analysis constituted the Biology Achievement Test (BAT). The BAT was meant to measure students' achievement in genetics. The items were selected from the past questions of Senior Secondary Certificate Examination (WAEC and NECO) from 2014 to 2018 that corresponded to genetics (heredity and variation). 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 (30) items BAT was administered on a sample of 30 SS II students different from the students used for the main study and its reliability coefficient determined as 0.69 using Pearson Product Moment Correlation.

4.3 Learning Styles Self-Assessment Test (LSSAT)

LSSAT is an adapted version of Clark (2011). It was designed to help identify how students prefer to learn. The instrument was used to categorize students into of the three groups identified in the study (visual, auditory and kinesthetic). The inventory contains 30 items whose answers provide students with an indication of what their personal learning preference might be. The students were asked to respond to the thirty items to detect their learning style. Ten items each, representing the three categories, visual, auditory and kinesthetic were developed, and shuffled to control against respondents' fixation on any of the categories. The statements required respondents to indicate how each applied to him or her. Specifically *1* means Not Like Me, *2* means A Little Like Me, *3* means Like Me, *4* means A Lot Like Me. Scores were totalled to determine students' learning style preference. Copies of LSSAT were administered on a sample of 20 SS II students outside the main study but similar in characteristics to the students for whom the instrument was intended in order to re-establish its reliability for the present study. A Cronbach alpha coefficient of 0.82 was obtained. LSSAT was administered at the beginning of the treatment to categorized students into three learning style groups (visual, auditory and kinesthetic).

4.4 Instructional Guide for Lecture Method + Powerpoint Presentation (LMP)

This instrument was developed by the researcher and was meant for the experimental group. It is a student-centered instructional package that promoted active learning so that the interaction between the teacher and the students could be optimal. It contained lessons for four weeks of the treatment. Design elements of colour, animation and manipulation were introduced to influence learners' attention, interest, motivation and aspiration. The general information on the guide was: subject, class, topic, sub-topic, duration, instructional objectives, previous knowledge, instructional aids and reference book. The specific features of the guide were teachers'

activities which are: daily review, assessment of students' previous work, brief introduction, teacher presenting learning tasks using powerpoint. 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.

4.5 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 of lecture method + powerpoint presentation 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, Learning Style Self-Assessment Test (LSSAT) and Biology Achievement Test (BAT) were administered to both experimental and control groups. Means scores on the LSSAT) was used to classify students into the (visual, auditory and kinesthetic) learning style groups, while 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 lecture method with powerpoint presentation. The teacher explained the objectives of the lesson to the learners. The powerpoint with biology contents were presented using laptop via liquid crystal display (LCD) projector. The teacher presents information and displays animation of the biology contents in 2-dimensional view to the learners using PPT. Lesson demonstration was done by teacher and also learning tasks are presented using powerpoint presentation in the classroom. At the end of each unit, students attempted 10 (ten) multiple choice objectives questions after which the teacher then marked and scored accordingly. Lastly, the assignments were projected on the screen via the LCD projector.

Control Group: The control group was exposed to conventional method of teaching. The research assistants taught students in control group using some instructional charts to explain the concept of biology. 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.

4.6 Data Analysis

The three hypotheses formulated were tested using the univariate analysis of covariance (ANCOVA) test

with pre-test scores serving as covariates. The analysis was done at 0.05 level of significance. Multiple classification analysis (MCA) was used to show and explain the magnitude of the mean post-test achievement scores across the different levels of instructional package and learning style.

5. Results and Discussions

H_{01} : There is no significant difference between the mean achievement scores of students taught biology using lecture method supplemented with powerpoint presentation and those taught using conventional teaching method. The results of the main and interaction effects of lecture method supplemented with powerpoint presentation and learning style on students' achievement in biology is presented in table 1.

Table 1: ANCOVA of Students' Achievement in Biology According to Treatment and Learning Style Levels

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Main Effects	195.680	1	195.680	28.926	0.000
Covariates (pre-test)	439.290	1	439.290	30.216	0.000
Treatment	180.607	1	180.607	10.652	0.000*
Learning Style	4.016	2	4.016	0.594	0.432
2 Way Interaction					
Treatment * Learning Style	14.603	2	14.603	2.312	0.141
Explained	678.068	12	84.821	12.642	0.000
Residual	750.899	61	17.508		
Corrected Total	1429.645	73			

* Indicate significant F at 0.05 level; R Squared =.475; (Adjusted R Squared =.437)

The result in table 1 shows significant outcome for treatment ($F_{(1, 61)} = 10.652, P < 0.05$) and this implies that there is significant difference in the mean post-test achievement scores of the students after exposure to the two levels of instructional strategy. As a result, the null hypothesis one (H_{01}) is rejected.

Table 2: Multiple Classification Analysis of students' achievement in Biology according to Treatment and Learning Style
Grand Mean = 25.403

Variable+ Category\ Treatment	N	Unadjusted Deviation	Eta	Adjusted for Independent + Covariates	Beta
1. Lecture Method + Powerpoint Presentation (LPP)	38	0.980		1.005	
2. Conventional Method Teaching (CMT)	36	-0.760	0.284	-1.080	0.270
Learning Style					
1. Visual	45	0.243		0.302	
2. Auditory	19	-0.233		-0.304	
3. Kinesthetic	10	-0.318	0.082	-0.399	0.100
Multiple R Square					0.096
Multiple R Square					0.309

* Indicate significant F at 0.05 level

Table 2 presents the summary of the MCA analysis and showed the magnitudes of the adjusted mean post-test achievement scores of students in biology after exposure to the two levels of learning strategy. The result showed that with a grand mean of 25.403,

the students exposed to lecture method supplemented with powerpoint presentation recorded higher adjusted mean post-test achievement score, 26.408 (i.e. 25.403 + 1.005) than the students exposed to conventional method of teaching who recorded

adjusted mean post-test achievement score of 24.323 (i.e. 25.403 -1.080). This outcome thus shows that lecture method supplemented with powerpoint presentation, with the higher adjusted mean post-test achievement score appears to be a better strategy for teaching and improving students' achievement in biology than the conventional method of teaching.

The significant effect of lecture method supplemented with powerpoint presentation (LPP) on students' achievement in biology is an indication that this LPP instruction was found to be effective. The superiority of the LPP over CMT in enhancing students' achievement in biology could be attributed to the interest, enthusiasm and active participation in the LPP class and the students had adjusted to the new style of learning. The finding corroborated earlier findings of Effiong and Ekpo (2016); Gambari, Yusuf and Balogun (2015) who reported that powerpoint presentation improves students' achievement in educational technology and technical drawing.

H₀₂: Learning style will not significantly influence the effect of instructional package on students' academic achievement in biology.

The results of the main effect of gender in table 1 shows non-significant main effect of learning style on the students' achievement scores ($F_{(1, 61)} = 0.594, P > 0.05$). This outcome implies that there was no significant difference between the mean achievement scores obtained by the visual, auditory and kinesthetic participants in biology. As a result, the null hypothesis two is retained. However, the result of the multiple classification analysis (MCA) on learning style in Table 2 showed that with a grand mean of 25.403, the visual learners with adjusted mean post-test achievement score of 25.705 (i.e. 25.403 + 0.302), followed by the auditory learners with adjusted mean post-test achievement score of 25.099 (i.e. 25.403 - 0.304) while the kinesthetic learners with adjusted mean post-test achievement score of 25.004 (i.e. 25.403 - 0.399) recorded the lowest mean achievement score. This outcome shows that the visual learners recorded the highest achievement scores in the experiment, although the obtained difference is not statistically significant. The finding is in consonance with Adebajo (2019); Omoniyi, Adebajo and Olurinola (2018) who reported no significant main effect of learning style on students' achievement in biology. The result however contradicts the finding of Hattie (2011) who reported a significant effect of learning style on students' attitude to learning concepts in physics.

H₀₃: The interaction effect of instructional package and learning style on students' academic achievement in biology is not significant.

The results of the 2-way interaction effect of instructional package and learning style in table 1 showed no significant interaction effect of the instructional package and learning style on the students' achievement scores in biology ($F_{(2, 61)} = 0.312, P > 0.05$) in the experiment. This means there is no significant difference in the mean post-test achievement scores of the participants having visual, auditory and kinesthetic learning styles after exposure to the two learning strategies (lecture method supplemented with powerpoint presentation (LPP) and conventional method teaching (CMT)). Hence, the null hypothesis three (H₀₃) is retained. The reason for this outcome is that students of the three learning styles had similar disposition to the instructional package used in the study since the students tend to show more interest in what they did and this is in agreement with the findings of Olurinola (2015) who reported that there is no significant interaction effect of the instructional package and learning style on the students' achievement scores in visual art.

6. Conclusion and Recommendations

The study had revealed significant difference in the performance of students taught biology using lecture method supplemented with powerpoint presentation and conventional method of teaching because lecture method supplemented with powerpoint presentation was more effective in promoting performance than the conventional method of teaching. Also, there is no significant difference between the mean achievement scores obtained by the visual, auditory and kinesthetic participants taught biology using lecture method supplemented with powerpoint presentation because the students find the package interesting and the performance was improved irrespective of their learning styles. Also, there is no significant interaction effect of the instructional package and learning style on the students' achievement scores in biology.

It is, therefore, recommended that teachers should be encouraged to incorporate and integrate the use of powerpoint presentation with lecture method in the teaching of biology at senior secondary schools in Nigeria. Since the findings of this study show that irrespective of learning styles, they all benefited and performed better when taught using lecture method with powerpoint presentation, therefore, federal and state government should equipped the Nigerian

public secondary schools with necessary information and communication technology facilities.

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