

## Educational Application of Flipped Classroom Instruction: Impact on Students' Academic Achievement in Lagos State, Nigeria

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### Abstract

This study examined the impact of flipped classroom instruction on senior secondary school students' academic performance in Biology in two Local Government Areas of Lagos State. A pre-test, post-test non-equivalent control group design of quasi experimental design was adopted for this study. Two research questions and hypotheses were raised. The population of the study comprised all students from Lagos State and sample comprised 32 senior secondary school students from two secondary schools. The instruments used were Flipped classroom instructional on Biology (FCIB) and Students Achievement Test (SAT) with reliability coefficient of 0.75 using Kuder-Richardson formula. The data were analyzed using mean and standard deviation and analysis of covariance. The results showed that students exposed to flipped classroom instruction FCIB ( $F(1,29) = 54.21, p=0.000$ ), had better academic performance on Biology and that the gender has no significant influence on their academic performance when taught with FCIB ( $t(15)=0.206 <p0.05$ ). Based on the findings of the study, recommendations were made to implement the use of flipped classroom instructions.

**Keywords:** Flipped Classroom Instruction, Academic Performance, Biology,

### Introduction

Information and Communication Technology (ICT) has enhance teaching and learning through its dynamic, interactive, and engaging content and it has provided real opportunities for individualized instruction. ICT has added value to education through the use of computer assisted instruction (CAI), the use of videos and audios for instructional material, conference or online lecture rooms used in distant learning, presentations using power point and web-blog to mention a few. ICT constitutes a major factor revolutionizing global economy and bringing about paradigmatic shift in educational practice (Omoniyi & Adedapo, 2014). There is no doubt that ICTs provide productive teaching and learning in order to increase learner's creative and intellectual resources especially in today's information society (Ajuzie & Amah, 2014). Information and Communication Technology (ICT) can be defined as a diverse set of electronic technologies and technological tools and resources used to communicate, create, store, disseminate and manage information (Ikwuka & Adigwe, 2016).

If the goal of teaching is to engender understanding, teachers must move from rote memorization of knowledge and facts known as surface learning to deep learning in which teaching is not done in abstract but where understanding and retention is developed through active and constructive process. To achieve this, teachers must shift from a teacher centered paradigm towards a learner-centered paradigm. To achieve the above, researchers have found innovative teaching methods which help in promoting learner's achievement and retention by allowing students do things on their own. There are different approaches the teachers can adopt in integrating ICT to teaching and learning process, among these are flipped classroom, Web-blogs, computer assisted instruction, and many more. The flipped classroom is a pedagogical model in which a traditional learning environment and its activities are reformed, or at least rearranged. Flipped classrooms utilize the blended learning model to reverse the traditional

learning environment such that the learners receive the bulk of the instructional content online (OpenLearn, 2019). With instructional lecture material delivered online prior to class time, and in-class time used for more active group learning tasks than those undertaken in a traditional lecture (Wikipedia, 2020). Flipped classroom has become one of emerging technologies in education and it can be a standard of teaching-learning practice to foster students' active learning. The flipped classroom is an approach to teaching and learning activities where students watch a video lesson outside the class through distance learning and have hands-on activities in the class. Zainuddin and Halili (2015) noted that the flipped classroom or reverse classroom is an element of blended learning, integrating both face-to-face learning in the class through group discussion and distance learning outside the class by watching a synchronous video lessons and online collaboration. Flipped classroom instruction can be integrated into teaching and learning in Nigeria particularly in Biology.

In Nigeria, Biology occupies a central position among all science subjects. It is a core subject like Agricultural Science, Medical Science, Pharmacy and textile Science. Research evidences have proven that Biology contributes to the quality of life and the nation building in all aspects of human endeavours (Dummies, 2020). Biology is quite popular at all levels of education in Nigeria. It also has a large students' enrolment than any other science subjects. In spite of the importance of Biology, it is pertinent to note that most students still see and learn Biology as an abstract subject especially in teaching and learning cell theories. The performance in Biology as illustrated in the statistical analysis of students' performance in final year Biology examinations of West African Secondary School Certificate Examinations (WASSCE) requires urgent attention, if critical look is taking to cross check students' performance from 2012 till 2016, students struggled to maintaining average performance in some years (WAEC, 2016).

The poor performance of students in Biology despite its importance was attributed to poor teaching approach and poor learning environment (Mamalanga & Awelani, 2014). Many research studies suggested a complete refurbishment of the public education system, while some opined that teachers should explore substitutes to the traditional classroom (Gibson, 2017; Abah, Anyagh & Age, 2017). Teachers are now applying mixed curricula that include artificial intelligence software, multimedia assisted instruction, and even the inverted curriculum. Research suggested flipped classroom as one solution to this problem (Strayer, 2012). All over the nation, revisions and improvisations to traditional curricula are being proffered wherein technologies, discovery learning, and student collaboration are being implanted into curricula in an effort to increase students' academic performance in Biology through the use of ICT. The flipped classroom is an ICT-based instructional strategy which is described as using technology to provide lectures outside of the classroom, while assignments with concepts are provided inside the classroom through learning activities. The flipped classroom is a classroom where homework is done at school and school work done at home.

Gender roles are culturally influenced stereotypes which create expectations for appropriate behavior for males and females. Gender roles are influenced by the media, family, environment, and society (Wikipedia, 2020). Gender roles and relations refer to those ways in which women and men are taught to behave in specific ways related to their biological sex, including in terms of how they relate to one another (UNICEF, 2011). Gender disparity has been seen in various fields such as business, politics and education (Fomsi & Orduah, 2017). Several studies found gender differences in students' attitudes, and academic achievement toward ICT. Some research works have showed that boys had more positive attitudes towards ICTs tools than girls as well as academic achievement (Graff, 2003; Jana, & Pavol, 2008). There is need for this study to find

out the influence of gender and academic achievement on the performance of students taught using FCIB.

### **Statement of Problem**

The performance of students in science and particularly in Biology has been quite unsatisfactory as being reported in some external examination results. This indicated that there are existence of lack of interest and focus of students in learning Biology, this showed in the various external results where the students performed below average. This problem was as a result of inappropriate method of teaching biology and inadequate appropriate educational media in the teaching and learning of biology. If this trend continues, students in various secondary schools in Nigeria may be losing interest as well as show a negative attitude towards learning biology. Findings have been proven that flipped classroom instructions have positive effect on student's academic performance and if properly integrated to teaching/learning Biology, it will bring positive changes to students' academic achievement and promote their attitude positively. Therefore, this study examined the impact of flipped classroom instruction on Biology student's academic performance at the Senior Secondary school in Lagos State Nigeria.

### **Objectives of the Study**

The study sets to achieve the following objectives.

1. To find out the effect of flipped classroom instruction (FCIB) and conventional method of teaching (CMT) in Biology?
2. To determine if the gender influence the academic achievement of students taught with Flipped Classroom Instruction?

### **Research Questions**

The following research questions were used to collect data for the study

1. What is the difference between the mean scores of students taught Biology using flipped classroom instruction (FCIB) and those taught conventional method of teaching (CMT)?
2. Is there any difference in the academic achievement of male and female students taught using flipped classroom instruction?

### **Research Hypotheses**

1. There is no significant difference in the mean achievement scores of student taught Biology using flipped classroom instruction and those taught using conventional method of teaching.
2. There is no significant difference between the mean scores of male and female students taught using flipped classroom instruction.

### **Methodology**

The study employed a pretest, posttest non-equivalent control group design of quasi-experimental research design. The population of this study consisted of all the secondary schools in Lagos State, particularly secondary schools in Kosofe and Surulere Local Government Areas of Lagos State. Purposive sampling technique was adopted in selected two private secondary schools from two local government areas in Lagos state. In each of the schools, Senior Secondary School (SS2) students were considered appropriate because these categories of students are believed to have familiar and already have basic knowledge of utilizing computer before and Biology was selected since it is regarded as one of general subject across the senior secondary school classes. New Era Senior Secondary School in Surulere Local Government Area

of Lagos State was used as experimental group selected purposively because of the ample opportunity of ICT facilities available in the school with 17 students (10 males and 7 females), while Ikorodu Local Government school served as control group with 15 students participated with nine (9) males and six (6) female students. In all, 32 students participated in this study.

The instruments used for the collection of data were Flipped Classroom Instruction Package on Biology (FCIB) and Student Achievement Test on Biology (SATB). The flipped classroom instruction was developed by the researcher. This was used as the intervention in the experiment group. It was an offline DVD presentation which was developed because of the students who don't have computers and might have access to internet. Students were supplied with software package of FCIB on to watch on the DVD player at home. They were given task to perform after watching and to submit their observations to the school the next day. The flipped classroom instruction contains two lessons from SS Biology scheme of work. The total time frame for flipped classroom lesson per period was between 5 to 10 minutes at most. This is to prevent students from being bored since the focus of this research is to investigate the effect of flipped classroom instructions on student's academic performance, hence the students were allowed to use offline flipped classroom based on availability DVD players' electronic device and television available to them at home. CMT was used for control group with the assistance of Biology teacher in the school selected for the group. The lesson plan developed and used for this group has the same lesson content with the FCIB group. FCIB was exposed to experts in educational technology to ensure the conformity in line with development of instructional design as well as contents contained in the package were also subjected to content validity by experts in computer education.

SATB developed by the researcher measured students' achievement in Biology which contained twenty (20) multiple-choice items with one correct answer and three distracters for each set. Each correct response attracts a score of one mark. The items were drawn from the concepts of Cell with concentration on Animal and Plant Cell. SATB was given to experts in Biology and educational evaluation for face and content validity.

The test items were thirty before it was reduced to twenty based on the corrections offered by the experts. The reliability SATB was determined by administering it on a trial group of 11 secondary school students of another school within the study population but not included in the main study using test-re-test method. A reliability test using Kuder Richardson (KR-21) revealed a reliability of 0.75 which was considered very adequate for the study

Permission was sought from the schools' principals in the two secondary schools to allow their students to participate for the study. The students in the two schools were equally informed about the study and exposed to pretest in the first week of the study. A three-week was used to train and teach students computer education in experimental group using FCIB. In control group, a trained Biology teacher exposed the students to conventional teaching method for another three weeks. In all, seven weeks were used to administer the instruments. The data analyzed was done using mean score, standard deviation and analysis of covariance.

### **Results of the Study**

Research Question 1: What is the difference between the mean gains of students taught with flipped classroom instruction (FCIB) and those taught with conventional method of teaching (CMT)?

**Table 1:** Mean Gain Scores of Students' Pre and Post Performance Test Scores in Biology

Groups	N	Pretest		Posttest		Mean Gain
		X <sub>1</sub>	SD <sub>1</sub>	X <sub>2</sub>	SD <sub>2</sub>	
FCIB	17	7.059	1.088	15.529	1.231	8.470
CMT	15	7.267	1.033	11.867	1.642	4.600

Table 1 showed that pretest mean score of students in experimental group taught using FCIB was 7.059 and posttest mean score of 15.529 respectively giving a mean gain of 8.470, while students in the control group taught using CMT had pretest mean score 7.267 and posttest mean score of 11.867 with a mean gain of 4.600. The result indicated that students in the experimental group performed better in the achievement test than those in the CMT group. This implied that the treatment (FCIB) had positive effect on students' mean performance score in computer education.

### Research Hypotheses

**Hypothesis One:** There is no significant difference in the mean achievement scores of student taught computer using FCIB and those taught using conventional method of teaching (CMT)

**Table 2: Analysis of covariance (ANCOVA) of mean achievement scores of student taught Biology using FCIB and those taught using CMT**

Source	Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	115.434 <sup>a</sup>	2	57.717	31.320	.000
Intercept	193.416	1	193.416	104.958	.000
Pretest	8.528	1	8.528	4.628	.040
Groups	99.890	1	99.890	54.206	.000
Error	53.441	29	1.843		
Total	6274.000	32			
Corrected Total	168.875	31			

a. R Squared = .684 (Adjusted R Squared = .662)

Table 2 showed the analysis of covariance on mean achievement scores of student taught Biology using FCIB and those taught using CMT. After adjusting for pretest scores, there was a significant effect of the subject between factor groups,  $F(1,29) = 54.21$ ,  $p = 0.000$  at 0.005 level of significance. The result revealed that there was a significant difference between the mean performance score of students taught with FCIB and their counterpart in the CMT group.

**Research Question 2:** Is there any difference in the academic achievement of male and female students taught using flipped classroom instruction?

**Table 3: Mean Gain Scores of Male and Female Students taught Biology using FCIB**

Gender	N	Pretest		Posttest		Mean Gain
		X <sub>1</sub>	SD <sub>1</sub>	X <sub>2</sub>	SD <sub>2</sub>	
Male	10	7.100	1.3703	15.700	1.2293	8.600
Female	7	7.000	0.5774	15.286	1.1547	8.286

From Table 3, it was indicated that both male and female students benefited from the treatment. The main gain score of male students (8.600) was different from the main gain score of female students (8.286) by 0.314. This implied that all the groups benefited from the treatment, with male students having slight better posttest performance than female students.

**Hypothesis Two:** There is no significant difference between the mean scores of male and female students taught using FCIB.

This was tested using the analysis of covariance (ANCOVA). The pretest mean scores of both genders were used as covariate for the analysis. The result of the analysis is as shown in Table 4.

**Table 4: Analysis of Covariance of Mean scores of Male and Female Students Taught Biology using FCIB**

Dependent Variable: Posttest2					
Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	7.114 <sup>a</sup>	2	3.557	2.908	.088
Intercept	134.626	1	134.626	110.080	.000
PrettestFCIB	4.478	1	4.478	3.662	.076
GenderFCIB	2.319	1	2.319	1.896	.190
Error	17.122	14	1.223		
Total	4124.000	17			
Corrected Total	24.235	16			

a. R Squared = .294 (Adjusted R Squared = .193)

Table 4 indicated that an  $F(1,17) = 1.896$ ,  $p = 0.190$  at 0.005 level of significance. The meaning of this was that there was no statistics significant difference between the posttest mean scores of male and female students. The male mean score did not differ significantly from that of the female students' counterpart mean score when both were taught using FCIB. Therefore, the stated hypothesis is accepted.

### Discussion of Findings

The findings of this study revealed that FCIB has significant effect on students' achievement. Students who were taught with FCIB performed better than those taught using CMT. This result has proved the superiority of flipped classroom instruction to teach and learn Biology over conventional method of learning. This better achievement was as a result cooperating and self-pacing strategies that are embedded in flipped classroom instruction. The finding is in agreement with the Barlow and Davison (2016) who reported same in their finding that flipped classroom instruction benefitted engineering education students who found it difficult to comprehend with traditional lectures. Also the finding is in agreement with the findings of Charles-Ogan and Williams (2015) which revealed that there was significant difference in posttest score in favour of the flipped classroom model when comparing performance using traditional classroom instruction in River State Nigeria. From the finding presented on the post-test performance of the experimental group the male students mean did not differ significant from that of the female student counterparts with mean score of when both were taught using the flipped classroom instruction. The gender has no significant effect on the academic performance of male and female students using the flipped classroom instruction. This indicates that gender has no effect on the academic achievement of students taught biology using the flipped classroom instruction. This result agreed with Amatobi and Amatobi (2013) that generally boys tend to perform better than girls when taught using flipped classroom instruction.

## Conclusion

Effectual teaching and learning cannot be accomplished without proper management of learning process. The need to change the classroom orientation from teacher centered to learners centered to a more active involvement as a way of improving students learning skill. Since students taught biology using the flipped classroom instruction had a better mean score than those taught biology using the traditional classroom instruction, there is need for teachers to be trained to make good use of flipped classroom as this will enable the acquire the appropriate skill and technique which is necessary for flipping a classroom. Finding shows a significant difference in the performance of those student taught biology using the flipped classroom. As a result, it can be said that the use of flipped classroom motivates learners to pay more attention to learning activities thereby leading to better academic performance.

## Recommendations

Based on the findings of the study the following recommendations were drawn;

1. Teachers should adopt the flipped classroom instructions because it is a learner centered strategy that involved the students rather than spoon feeding them.
2. Stakeholders in the educational industry should appreciate, support and sustain the use of flipped classroom instructions.
3. The government should supply adequate technological facilities that will sustain flipped classroom integration in all secondary schools both public and private in Lagos state and in Nigeria as a whole.
4. The private and public schools should invite researchers in the field of educational technology to help train their teachers on how to employ the flipped classroom instructions in the teaching and learning process for better performance of the students.

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