



IMPACT OF FLIPPED CLASSROOM INSTRUCTIONAL STRATEGY ON STUDENTS' ACADEMIC PERFORMANCE IN BIOLOGY IN EKITI STATE, NIGERIA

BY

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Abstract

This paper examined impact of flipped classroom strategy as a method in the teaching, learning process, characteristics, benefits and drawbacks of flipped classroom on senior secondary school students. Also examined gender issues and students' academic performance in biology and future directions. The study adapted a quasi-experimental pre-test, post-test and control group design three null hypotheses were generated and tested at 0.05 level of significance. The targeted population for the study consisted of all the 12,690 SS2 students offering Biology in 205 public secondary schools in Ekiti State. The sample consisted of 81 SS2 students found in the intact classes of the schools selected for the study. Selected through multistage random sampling technique. The instrument used to collect data for the study was the "Biology Performance Test" (BPT) which consist information on the bio-data of the respondents and as well 30 objective items. The data obtained were analyzed using descriptive statistics of mean and standard deviation (to answer the research question) and inferential statistics of t-test (to test the stated hypotheses). Findings of the study revealed that the flipped classroom method is more effective in teaching Biology than the conventional method and that the flipped classroom method is not gender sensitive. Based on these finding it was recommended that teachers should be encouraged to use the flipped classroom method over the conventional so as to concretize some of the concepts in Biology. It was also recommended that the government should regularly organize seminar and in -service training for teachers on how to make use of computer systems in their teaching processes.

Keyword: Flipped classroom, Instructional strategy, Academic performance, Students

Introduction

Nigeria today is undergoing major transformations which are multidimensional, affecting the technological, economic, social, cultural and political development of human communities. Education in the generic and global context is a strategic instrument for technological and economic transformation. The focus of education system all over the world is the development of the human capital required to meet present and future challenges of globalization (Dike, 2014). The enviable position of science

education system of most countries of the world. Including Nigeria is perhaps justifiable. The reason is that science can exert a dominant influence on individual as well as on the developmental effort of a nation. The Universal recognition of the above submission is responsible for the prime position that has accorded science and in particular Basic Science which serve as a pivot upon which other sciences rotate.

The importance of Basic Science cannot be over stressed. All students

must learn and pass it as the Junior Secondary School level before they can advance to the senior level. Despite the importance of Basic Science to mankind and the efforts of researchers to improve on its teaching and learning the performance of students in the subject is still not encouraging. The rate and degree of failure could not be specifically determined but may be as a result of factors like teacher's qualification and School environment teaching strategies among others (Adu & Adeyanju, 2013). Research evidences have proved that Science contributes to the quality of life and nation building in all aspects of human endeavour (Abimbola, 2013). Therefore, for any meaningful development to take place every nation must embark on knowledge and skills of science and technology for rapid sustainable social, economic, political and technological advancement. Teacher's teaching strategies play a significant role towards improve teaching and learning process. Students -centred approach supported in educational media could enhance effective teaching and learning. Among the new educational media for teaching and learning is flipped classroom instructional strategy. A flipped classroom is an instructional strategy and a type of blended learning that reverses the traditional learning environment by delivering instructional content, when online, outside of the classroom. It is one such learning strategy that creates learning through technology, especially online video media, which help reduce lecture time and increase the time for in-class activities where learners can learn cooperatively through practice (DeLozier, S. J. & Rhodes, M. G. 2017). Technology can support flipped classroom by letting students gain first by exposure to new material outside of class usually via reading or lecture videos and then using class time to do the harden work of assimilating that knowledge perhaps through problem solving, discussion, or debates. The growing accessibility and sophistication

of educational technologies open up increasing possibilities for students to explore, share, and create content. In addition, a flipped classroom has also been shown to promote not only students' sense of responsibility for their own work and self -regulation in assignment submission, but also their responsibility toward group assignments and classroom activities Yilmaz, R. (2017).

Flipped classroom instructional practice is a new model for effective teaching. Leo and Puzio (2016) referred to it as a form of blended learning in which learners learn content online by audio lectures or watching the video lectures, mostly at their various home and assignment is done together in the class with teachers and students discussing and solving questions. Students can work together on a task, exchange their opinion, experiences, views, discuss and negotiate strategies, actions and results through flipped classroom. These actions can provide students with opportunity to help, discuss, review, teach, influence each other and thereby enhance a motivational situation for developing a learning community. In flipped classroom, teacher's role is of a mentor or facilitator of the learning process. The achievements of individual member within the group are shared among the group members (Zhonggen and Guifang, 2016).

This model of flipped classroom is designed to improve students' motivation since it promotes competence, independence, and self-motivation. The flipped classroom strategy is probably designed to address the students' needs of self-efficacy and competence through an integrated system. According to studies conducted in the last two decades, students feel self-effective when they participate activity in spreading knowledge unlike receiving knowledge from the instructor through traditional teaching (Abey, 2015). In addition, analysis, synthesis and evaluation which are all mental



skills and processes not covered by the traditional curricula. It also contributes to what is known as ownership for learning, where students can watch video or lecture several times.

This model led to building the confidence and enjoying the content and it provided more chances for interaction learning positive change and responsibility towards education (Mok, 2014). The flipped classroom strategy integrates two learning theories, i.e., traditional learning and active learning being based mainly on flipping the learning process where students receive the lesson's new concepts at home through 5-10 minutes video clips or social media networks by modern technologies such as smart phones and laptops (Bishop, 2013).

Olatunji and Olusola (2016) did survey research on Students' Attitude and Gender as Correlations with Students' Academic Performance in Biology in Senior Secondary Schools in the Ikere Local Government Area of Ekiti State, Nigeria. One hundred and eighty (180) students in their second year of biology were selected at random from six different secondary schools located in the Ikere Local Government Area of Ekiti State. The Biology Attitudinal Scale (BAS), the Gender and Academic Performance in Biology (GAPB), and the findings of the terminal continuous assessment were the instruments that were used for the gathering of data. Validity and reliability testing were performed on these instruments, and the results indicated that they were appropriate for use in the study. According to the results of the study, there was not a statistically significant difference between the genders of the students in terms of their academic performance in biology.

Despite this, Chang, Chen, Lin, and Sung (2008) found that even while there has been a reduction in the gender gap in student performance in the sciences, female participation in the sciences is still very low in contrast to that of their male counterparts. Since

gender issues and their impact on students' academic success and interest in science have persisted throughout the years with contradictory results, this topic has emerged as a contentious subject in the field of science education due to the diverse reports that have been produced by various researchers. Fennema (2017) conducted more research and found that there are variations between boys and girls in terms of both success and engagement in Senior Secondary School Biology courses. As an illustration of the attitudes that were investigated, it was discovered that males had a higher level of self-assurance in their capacity to study biology than females did, and that males thought that biology was more relevant to their lives than females did. (Bol, 2023).

The idea that "women are qualitative, and men are quantitative" is one example of such a misconception. The linking of a science gene in males is an additional urban legend. Girls in science are held to a lesser standard of achievement by both their parents and their teachers than are boys. According to Banaji, Greenwald, and Nosek (2011), one of the most important factors in determining the future biological performance of females is the transmission of gender stereotyped attitudes from one generation to the next. These attitudes are held by instructors and are internalised by their students.

The study by Kenna (2014) was conducted at the North Dakota State University of Agriculture and Applied Science with 22 high school students who were enrolled in a private school. The purpose of the study was to investigate the influence of flipped classroom education on student self-efficacy and gender differences in attitudes towards physics. The primary objective of the study was to investigate the impact that FCI has on the academic performance of students. The instructor who was also the researcher was responsible for both of the classes that were taught to the students, but



they were separated into their own groups. The school has a total of 306 students, with female students making up 48.4% of the population and male students making up 51.6%. The sample consists of nine female students (41%) and 13 male students (59%). The results showed that students' average levels of self-efficacy increased when they were taught in a flipped classroom, but those levels decreased when they were taught in a regular classroom. When analysed independently, the results of employing the flipped classroom indicated that the students' levels of self-efficacy increased for the girls but decreased for the boys.

Overmyer (2014) conducted a study to determine the impact that using a flipped classroom had on the academic performance of students studying algebra. In addition, the study investigated the primary and interaction effects that gender and treatment had on the academic performance of students. The researcher decided to use a design that was almost like an experiment. The sample consisted of seventy students who were enrolled in collegiate Algebra at the University of Columbus. A total of thirty-five students were split evenly between a lecture-based classroom and a flipped classroom. The students' Algebra performance was evaluated with the use of their scores on the Mathematics Achievement Test. The data analysis consisted of finding the mean, the standard deviation, and doing multiple regressions. According to the findings of the study, having students learn in flipped classrooms had a substantial impact on their overall academic performance. There was not a statistically significant difference between the scores that males and girls obtained on the standard final examination. In a similar vein, there is not a statistically significant interaction between the treatment and gender on final test results. This indicates that students did not respond differently to the flipped classroom based on their gender. Overmyer advocated for the

implementation of FCI across a variety of subject areas and suggested that instructors do so.

Gross, Pietri, Anderson, Moyano-Camihort, and Graham (2015) conducted a study with the purpose of determining the effect of traditional instructional methodologies and the flipped classroom on the engagement and performance of students, in addition to the influence of gender on these factors. The research was conducted at Columbus University in the United States using a sample of 133 students who were enrolled in biochemistry, molecular biology, and chemistry. A test as well as a questionnaire was used to obtain the data. The mean, standard deviation, and ANCOVA were the statistical methods used to analyse the data that was obtained. They made the discovery that students who attended classes taught in flipped classrooms participated in more activities related to the curriculum than those who attended classes taught in conventional settings. They spend more time preparing for class and interacting with the course's online components than students who attend more traditional classes.

Furthermore, it was shown that there is no significant connection between the gender of the students, the teaching technique, and the examination performance of the students. However, when the results of the research were broken down according to the different methods of instruction, it was revealed that male students in traditional classrooms did much better than their female counterparts, however in flipped classrooms there was no discernible difference in the performance of male and female students.

Gender and ethnicity differences in Chemistry Achievement and Self-Regulated Learning were the subject of a research by Veloo, Hong, and Lee (2015). The research was conducted in the form of a survey, and 358 students from a one-year matriculation science curriculum were chosen for the study



using a random selection approach. According to the findings of the study on gender inequalities, male students had much greater academic accomplishment in chemistry than their female counterparts. However, there was no discernible gender gap in terms of one's ability to self-regulate their learning.

In addition, Ezenda and Obi (2013) conducted research to determine the impact of factors such as gender and geographic location on the academic performance of secondary school students studying chemistry. The study followed a quasi-experimental approach with a control group that was not equal before and after the exam. The sample included 125 students who were enrolled in chemistry at the senior secondary (SS) 2 level. The investigation was directed by three research questions as well as three null hypotheses. The findings of the research indicated that there is a discernible gap, in terms of academic performance, between the levels of success attained by male and female students studying chemistry. In chemistry, the male students' overall performance was higher than that of their female counterparts.

Purpose of the Study

The purpose of the study was to examine the impact of flipped method on the academic performance of senior secondary school students in Biology in Ekiti State. Specifically, the study examined:

- i. which of the methods (flipped or conventional) would be more effective in the teaching of Biology;

- ii. the performance in Biology of students exposed to flipped and conventional methods;
- iii. the difference between the academic performance of male and female students exposed to flipped and conventional methods.

Research Question

One research question was raised to guide the study:

- 1. Which of the methods (flipped or conventional) will be more effective in the teaching of Biology?

Research Hypotheses

The following null hypotheses were generated and tested.

- 1. There is no significant difference in the pre-test mean scores of students exposed to flipped and conventional methods respectively.
- 2. There is no significant difference in the post-test mean scores of students exposed to flipped and conventional methods respectively.
- 3. There is no significant difference between the academic performance of male and female students exposed to flipped method.

Methodology

This study adopted the quasi – experimental pre-test and post-test two group design (one experimental group and one control group). The homogeneity of the groups used for the study was established by pre-test while post-test was used to measure students' performance after the treatment.

The paradigm for the experimental design is as shown below.

Experimental group (E):	O ₁	X ₁	O ₂
Control group(C):	O ₃	X _c	O ₄ :

Where

O ₁ , O ₃	→
Observations before treatment	

O ₂ , O ₄	→
Observations after treatment	



X₁
Treatment via Flipped Method
X_c
Treatment via Conventional Strategy

Population

The targeted population for the study consisted of all the 12,690 SS2 students offering Biology in 205 public secondary schools in Ekiti State. The choice of SS2 students is considered more appropriate because they had been exposed to some basic concepts in Biology while they were in SS1 and they were not preparing for any external examination.

Sample and Sampling Techniques

The sample consisted of 81 SS 2 students available in the intact classes that were selected from two public secondary schools in Ekiti State. The sample was selected using multistage sampling procedure. In stage one; one senatorial district was selected from the three senatorial districts in Ekiti State using simple random sampling technique. The next stage involved the selection of two local government areas from the selected senatorial district through simple random sampling technique. In stage three, one public secondary

school was selected from each of the selected local government areas. In stage four, the students found in the intact classes of each of the two schools were used for the study.

Research Instruments

The research instrument used for this study was the “Biology Performance Test” (BPT) The Biology Performance Test is self-designed and based on the four topics that were the focus of this study and is in two sections. Section A consisted of bio data of the respondents while Section B consisted of 30 objective items adapted from WAEC and NECO past questions. The contents of the objective items were based on the Biology concepts taught during the treatment. BPT was used for both pre-test and post-test with the test questions reshuffled for the post test in order to prevent carry over effect.

Results

Research Question 1: Which of the methods (Flipped or Conventional) will be more effective in teaching of Biology?

Table 1: Mean and Standard Deviation showing the Performance of Students Taught Using flipped classroom and conventional methods

Teaching Methods	N	Pretest		Posttest		Mean Difference
		Mean	SD	Mean	SD	
Flipped	46	6.90	2.83	9.95	3.65	3.05
Conventional	35	6.80	3.06	8.11	3.57	1.31

Table 1 showed the mean and standard deviation of the performance of students taught using flipped classroom and conventional methods before and after treatment respectively. The mean and standard deviation of the performance of students exposed to flipped classroom before and after

treatment were 8.80 (SD = 2.83) and 9.95 (SD = 3.65) respectively, with a mean difference of 3.05 while the mean and standard deviation of the performance of students exposed to the conventional method were 6.80 (SD = 2.96) and 8.11 (SD = 3.57) respectively, with a mean difference of



1.31 respectively. From this result, it could be concluded that the flipped classroom method is a more effective method of teaching Biology than the conventional method.

Table 2: t-test analysis on pre-test scores of students exposed to flipped classroom and conventional methods respectively.

Teaching Methods	N	Mean	SD	df	t-cal	p
Flipped	46	79	8.80	1.913	0.06	
Conventional	35	6.80				

p>0.05

Table 2 showed that t =1.913, p-value of 0.06 is greater than 0.05 at 0.05 level of significance. The hypothesis was therefore not rejected. This implies that, there was no significant difference in the pre-test score of students exposed to flipped and conventional methods, indicating that the two groups

Table 3: t-test analysis on post-test score of students exposed to flipped classroom and conventional methods respectively.

Teaching Method	N	Mean	SD	df	t-cal	p
Flipped	46	79	9.95	3.053*	0.003	
Conventional	35	8.11				

*p<0.05

Table 3 showed that p-value of 0.003 is less than 0.05 at 0.05 level of significance. The hypothesis was therefore rejected. Therefore, there was a significant difference in the post-test mean score of students exposed to flipped and conventional methods.

Table 4: t-test analysis on the academic performance of male and female students exposed to flipped classroom method.

Gender	N	Mean	SD
Male	44	1.78	0.083
Female	27		

p>0.05

Table 4 showed that p-value of 0.083 is greater than 0.05 at 0.05 level of significance. The hypothesis was therefore not rejected. This implies

Hypothesis 1: There is no significant difference in the pre-test scores of students exposed to flipped and conventional methods respectively.

are homogeneous at the beginning of the experiment.

Hypothesis 2: There is no significant difference in the post-test scores of students exposed to flipped and conventional methods respectively.

Flipped method group performed better than the control group.

Hypothesis 3: There is no significant difference between the academic performance of male and female students exposed to flipped method.

that, there was no significant difference between the academic performance of male and female students exposed to flipped method.



Discussion

The findings of the study showed that flipped method is a more effective method of teaching Biology than the conventional method. This finding is in consonance with a study by Lo and Hew (2021) which confirmed that students exposed to flipped learning perform better than those in conventional settings due to increased opportunities for self-paced learning and peer collaboration. Also, the effectiveness of the flipped classroom approach is consistent with the findings of Bergmann and Sams (2014), who reported that students in flipped learning environments demonstrate higher critical thinking skills and active participation, resulting in better academic outcomes. Flipped method of teaching thereby reduces the shortcomings of the conventional method that is used in the teaching and learning of Biology.

Another finding of the study showed that there was no significant difference in the pre-test mean score of students exposed to flipped and conventional methods respectively. This is in consonance with the findings of the study carried out by Abdullah, Bakar & Mahbob, (2015) that students' engagement promotes students' academic performance, intellectual growth and critical thinking. Research conducted by Foldnes (2016) found that employing collaborative pairs in the classroom led to higher academic performance, which is consistent with the findings of Peterson (2016). Borne out of an analysis of the findings from two separate investigations that were carried out over a period of two years. In both years, a conventional classroom and a flipped classroom were compared to one another. In the first year (2012), the outcomes of final examinations from a typical class were compared to those from a flipped classroom in which there was no cooperation and students worked problems from an undergraduate statistics course book during class. This

comparison was known as study one. A standard undergraduate mathematics lecture class was compared to a flipped class that utilised a team-based learning model for in-class activities (Foldnes, 2016). The results indicated that there was no significant difference in exam scores for study one; however, the results showed a highly significant increase in performance in study two, which incorporated collaborative and active learning methods (Foldnes, 2016).

The findings of the study further showed that there was a significant difference in the post-test mean score of students exposed to flipped and conventional methods respectively. This is in agreement with the findings of the study carried out by Flipped Learning Network (2014) that students are more engaged and able to respond to questions that demand the application of material knowledge, and generally happier with their overall classroom experience. Also, this is in consonance with the submission of Li, Zhang and Yang, (2017) that flipped learning enables and stimulates students to learn through self-learning exercises that are provided before the start of class, and it eventually enables students to conduct in-depth conversations when they are in the classroom.

The findings of this study also showed that there was no significant difference between the academic performance of male and female students exposed to flipped method. This is in line with the findings of Olatunji and Olusola (2016) that there was not a statistically significant gender difference between in the academic performance of students in Biology. Also, this finding is in consonance with that of Overmyer (2014) that there was not a statistically significant difference between the scores that boys and girls obtained in the standard final examination. In a similar vein, there is not a statistically significant interaction between the treatment and gender on final test results. This indicated that students did not respond differently to

the flipped classroom based on their gender. He then advocated for the implementation of flipped classroom instruction across a variety of subject areas and suggested that instructors do so.

Conclusion

Based on the findings of the study, it was concluded that the flipped classroom method of instruction was more potent than the conventional method in improving students' performance in Biology in secondary schools in Ekiti State, Nigeria and that the flipped classroom method is not gender biased as there was no significant difference observed in the performance of male and female students exposed to the method.

Recommendations

Based on the findings of this study, the following recommendations were made

1. Flipped Classroom Method of teaching should be encouraged in teaching and learning of science subjects especially Biology.
2. Teachers should also be encouraged to use the flipped classroom method of teaching over conventional method so as to concretised some of the concepts in Biology
3. Government should supply more of computer systems into schools.
4. Government should organize seminar and in-service training for teachers on regular basis on how to make use of computer systems in their teaching processes.
5. The curriculum planners should introduce some multimedia and internet packages into the methodologies of teaching science to update teachers' knowledge on the application of the flipped classroom strategy.
6. The videos should be broken down into multiple shorter video file segments (i.e. 2-3 videos of 20 to 30 minutes length each) so that students are able to give their undivided attention and fully

concentrate on the content presented in one sitting.

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