

EFFECTS OF FLIPPED CLASS ON ACADEMIC ACHIEVEMENT AND ATTITUDE OF PHYSICS STUDENTS IN TERTIARY INSTITUTIONS

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ABSTRACT: This study determined the effects of the flip-class method of teaching physics on the academic achievement of physics students and their attitude towards the flip-class method. The study answered three research questions and two null hypotheses were tested at 0.05 level of significance. The population of the study comprises all the physics students in tertiary institutions in the Oyo metropolis, a sample of 68 intact class physics students of Federal College of Education (Special) Oyo was used as a sample of the study this sample consisted of (male=52 and female=16) in both experimental and control group. A pretest-posttest non-equivalent quasi-experimental research design was adopted for this study. The instruments used in this study are the Physics Achievement Test (PAT) with a reliability coefficient of 0.86 and the Students' Physics Attitude Questionnaire used for data collection. The data were analyzed using mean and standard deviation to answer the research questions and analysis of covariance to test the hypothesis. The findings showed that there was a significant difference in the mean achievement score of students, where the experimental group attained a significantly higher mean than the students in the control group ($F_{1,65}=75.82$, $p=0.01$). The result also revealed that the mean achievement score of male did not significantly differ from their female counterpart when exposed to the flip class method ($F_{1,34}=2.95$, $p=0.12$). It also revealed that students show a positive attitude toward to flip class method of teaching physics. The study concludes that the flip class method can significantly improve the academic achievement of physics students. It is recommended that teachers should be encouraged to use the flip class method of teaching physics at the level of education, parents should give their children ample opportunity during their out-school hours to engage themselves in the flip learning activities, government should provide the necessary learning materials like laptops and steady power supply for effective learning in the flip class method of teaching.

Keywords: Flipped Classroom, Academic Achievement, Physics Education, Student Attitude.

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INTRODUCTION

Physics is an important subject for science students all over the world. It is one of the core science subjects which is important for understanding the world around us. It challenges the imagination of new concepts and theories which leads to great discoveries and technologies that change people's lives (Agommuoh & Ifeanchio, 2012). So, it is an urgent and important need to develop and improve the performance of physics students using a diverse learning method. The use of ICT in teaching is also a relevant and functional way through which learners are equipped with the required capacity for the worth of work (Adeyemo, 2010). This will help in making the teaching/ learning process fun and interesting for both teachers and students. Introducing Flipp's

class method in physics education can play a vital role in getting students' attention to the physics topic, engaging and motivating them which will lead to a good understanding of the topic. Introducing different styles of ICT in the Flip class method such as slide show presentations, simulations, videos, spreadsheets, Web 2.0 applications, World Wide Web, etc. will motivate the students to think critically which improves their achievement.

The most suitable learning theory for implementing the Flip class method for high school Physics students is the constructivist (constructivism) theory that supports active learning which leads to the student-centred learning approach (Lobdell, 2013). The flipped classroom, which is also referred to as the inverted classroom provides an alternative approach to the traditional method, where learning primarily takes place in class during face-to-face sessions, and separate sessions are dedicated to practising new topics (Sams & Bergmann, 2012). Finkenberg and Trefzger (2019) affirmed that in flipped classrooms the traditional teaching methods are inverted by delivering direct instruction in online videos to be watched at home while typical homework activity is moved into the classroom.

Statement of the Problem

Studies have shown that the poor performance of physics students in secondary schools is a result of a lack of effective teaching strategies (Agommuoh & Ifeanacho, 2012). Other researchers affirmed that the teacher-centred approach to learning physics creates boredom because students do not participate in the learning process (Rodrigues & Oliveira, 2008; Zakaria & Iksan, 2007). However, Aina (2013) and Adeyemo (2010) believed that physics is also classified as a difficult subject therefore there is a need for effective teaching strategies inside the classrooms for students to understand physics concepts well (Agommuoh & Ifeanacho, 2012). Utilizing effective strategies in teaching Physics by flipped class method is important to provide students with the necessary mental tools to examine and understand the physics concepts and principles involved. However, the researcher didn't find any study about the use of flipping Physics classrooms to address the challenges. This encourages this study to determine the effects of flip class on the academic achievement and attitude of physics students.

Objectives of the Study

The general objective of the study is to determine the effect of flipped classes on the academic achievement and attitude of physics students. However, the specific objective is to determine the:

- Difference between the academic achievement of physics students exposed to flipped classes and those exposed to conventional class.
- The attitude of physics students towards the flipped class method.
- Gender differences in the academic achievement of physics students exposed to flipped class.

Research Questions

The following questions were raised to guide the study:

- What is the difference in the academic achievement of physics students exposed to flip class and those exposed to conventional methods?
- What is the attitude of physics students towards the flip class method of teaching?
- What is the difference in the academic achievement of male and female physics students exposed to the flip class method?

Hypotheses

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

- **H₀₁** There is no statistically significant difference in the mean academic achievement of students exposed to flip class and those exposed to the conventional method, and
- **H₀₂** There is no statistically significant difference in the academic achievement of male and female students when exposed to flip classes.

METHODOLOGY

The quasi-experimental pretest-posttest research design is used in this study to experiment with the effect of video lessons of the flipped class on physics students' academic achievement. A descriptive survey was used to determine the attitudes of students towards the flip class method. The population of the study consisted of all the physics students in tertiary institutions in the Oyo metropolis. An intact class of 68 students in the Department of Physics in Federal College of Education (Special), Oyo were used as a sample for this study. The sample was divided into two groups, the experimental group (N=37) which is exposed to the intervention under investigation (flip class method) and the control group (N=31) which is not exposed to the intervention. Two instruments were administered for this study, the Physics Achievement Test (PAT) with 20 multiple choice questions to test the academic achievement of students in both experimental and control groups. The Physics Achievement Test (PAT) was subjected to a reliability test and a reliability coefficient of 0.86 was obtained using the Kuder-Richardson coefficient (r). The researcher questionnaire, comprises of 15 items to determine the attitude of students towards flip class method. The questionnaire was rated on four Likert scales of strongly agreed (SA=4), agreed (A=3), disagreed (D=2), strongly disagreed (SD=1), and a criterion mean of 2.5 is considered for decision making. Items with positive statements that have mean values above 2.5 were taken as positive, while items with negative statements that have mean values above that were considered to be negative and vice versa.

RESULTS

Research Question 1: What is the difference in the academic achievement of students who are exposed to flip class and those exposed to conventional methods?

Table 1: Mean and standard deviation of achievement scores of students in the experimental and control group

Group	N	Pre-test		Post-test		Mean gain
		Mean	SD.	Mean	SD.	
Experimental	37	11.56	2.29	25.73	3.20	14.17
Control	31	12.34	2.70	19.16	3.62	6.82
Mean Difference		-2.22		6.16		7.35

Table 1 indicates that the mean achievement score of the experimental and control group before administering treatment (pre-test) is 11.56 and 12.34 respectively, this gives a difference of -2.22 in favour of the control group. After the treatment (post-test) the mean difference between experimental and control groups is 6.16 in favour of the experimental group.

Research Question 2: What is the attitude of students towards the flip class method of teaching?

Table 2: Attitude of students toward a flip class method of teaching Physics

SN	ITEMS	Mean	SD	Decision
1	I always knew where I was and where the course was going.	3.04	1.02	Positive
2	This approach to teaching increased my motivation when studying this subject.	2.84	0.86	Positive
3	I found this approach intellectually challenging and stimulating.	2.43	1.12	Positive
4	My interest in this subject increased as a consequence of this learning method.	2.67	0.96	Positive
5	I have learned and understood the contents of the course using this approach.	2.94	1.20	Positive
6	This approach enables active student's participation in the learning process	2.45	0.87	Negative
7	It is always boring while watching the flipped class video	1.64	1.06	Positive
8	Students having prior knowledge of the content makes them not to pay attention to teachers guide	2.56	0.85	Negative
9	Better questions and deep thinking from students are the results of using the Flipp class method	3.21	1.11	Positive
10	Make learning flexible in terms of spatial and temporal dimensions.	2.86	0.92	Positive
11	The flip class method makes students stay continuously motivated throughout the semester	2.35	1.21	Negative
12	The method makes students come into a personal exchange with fellow students.	2.67	1.13	Positive
13	This learning method can also make physics learning interesting because using video is a new thing	2.15	0.76	Negative
14	It's limited to asking the teacher and working with that teacher."	3.13	1.24	Negative
15	The method allows students to learn through video so that what is used is free time, which should not be used to learn new material."	2.65	1.04	Positive

In Table 2, items like I always knew where I was and where the course was going, My interest in this subject increased as a consequence of this learning method, I have learned and understood the contents of the course using this approach, and I found this approach intellectually challenging and stimulating, were considered to be a positive attitude towards flip class method while items like this approach enable active student's participation in the learning process, Students having prior knowledge of the content make them not to pay attention to teachers guide, the flip class method makes students stay continuously motivated throughout the semester, the flip class method make students stay continuously motivated throughout the semester, this learning method can also make physics learning interesting because using video is a new thing, It's limited to asking the teacher and working with that teacher." Were considered to be negative.

Research Question 3: What is the difference in the academic achievement of male and female students who are exposed to the flip class method?

Table 3: Mean and standard deviation of male and female students in the experimental group

Group	N	Pre-test		Post-test		Mean gain
		Mean	SD.	Mean	SD.	
Male	11	12.64	1.96	26.73	3.56	14.09
Female	26	11.12	2.30	25.24	2.86	14.12
Mean Difference		1.52		1.49		-0.03

The result in Table 3 reveals that the mean differences concerning gender before the treatment (pre-test) are 1.52 in favour of males, while after administering the treatment it was 1.49 also in favour of male students. The male students after the treatment have a mean gain of 14.09 less than their female counterparts who have a mean gain of 14.12.

Hypothesis 1: There is no significant difference in the academic achievement of students exposed to flip class and those exposed to the conventional method.

Table 4: one way ANCOVA for the effect of flipped class on students' achievement

Source	Type III Sum of square	df	Mean Square	F	sig	Partial Eta Squared
Corrected Model	804.62	2	402.31	39.73	0.00	0.55
Intercept	744.51	1	744.51	73.52	0.00	0.53
Pre-test	100.63	1	100.63	9.94	0.02	0.13
Gp	767.84	1	767.84	75.82	0.00	0.54
Error	658.27	65	10.13			
Total	36430.00	68				
Corrected Total	1462.88	67				

In Table 4, the one-way ANCOVA results indicate that the $F(1,65)=75.82$, was significant at $p=0.00$. The partial eta square for the group was shown as 0.54, indicating that students accounted for 54% of the variance in the scores. This means that the difference in the mean achievement score of students who are exposed to the flip class method and those exposed to the conventional method is significant in favour of students exposed to the flip class method. Since there is a significant difference in the academic achievement of the experimental and control groups, the null hypothesis is rejected.

Hypothesis 2: There is no significant difference in the academic achievement of male and female students who are exposed to flip class

Table 5: One way ANCOVA for the effect of gender on students' achievement in the experimental group

Source	Type III Sum of square	df	Mean Square	F	sig	Partial Eta Squared
Corrected Model	36.460 ^a	2	18.230	1.87	0.18	0.12
Intercept	704.737	1	704.737	72.13	0.00	0.68
Pre-test	2.666	1	2.666	0.27	0.62	0.01
Gender	25.295	1	25.295	2.59	0.12	0.07
Error	332.243	34	9.77			
Total	24658.000	37				
Corrected Total	368.703	36				

The result for one-way ANCOVA in Table 5 shows that the $F(1,34)=2.59$ was not significant at $p=0.12$, with the partial eta square value of 0.07 for gender, it shows that only 7% of the variation in students' scores is attributed to gender, which means the difference between the achievement score of male and female exposed to flip class method is not significant, therefore the null hypothesis is accepted.

DISCUSSIONS OF FINDINGS

The results presented show that students exposed to the flip class method of teaching attain significantly higher mean achievement scores than those exposed to the conventional method, this result agreed with the findings of Atwa et al. (2016) which show that terms of the student's achievement score, it is found that Flipped class students score is better than that of the traditional one; the pretest score was not statistically significant for both groups; while it is significant for posttest score in benefit of Flipped class students. Christian et al. (2019) conducted a pre-post-test study with a total of 64 students divided into two groups. One group was instructed using a flipped approach, while the other received traditional instruction. Analysis of the results indicated that the students who were taught through the flipped classroom approach demonstrated significantly better performance than their counterparts who received traditional instruction. Sengel (2014) conducted a pre-post-test study to investigate the effectiveness of flipped courses in teaching physics topics to university students.

The study revealed that students who were instructed using the flipped classroom approach outperformed their peers who received traditional instruction, despite initial difficulty with the new method. Students expressed a positive attitude toward the flip class method of teaching where the majority of the items in the questionnaire indicated a mean greater than 2.5 for all the positive statements this result agreed with that of Şekercioğlu and Yünkül (2021) which states that Flipp-based physics lessons that lasted one semester elevated students' attitudes towards physics lesson. However, despite the increase in their attitude percentages, students' 67% attitude scores could still be considered to be on a moderate level. In this study, gender had no significant effect on the achievement of students when exposed to the flipped class method, this finding agrees with the findings of Mokuolu and Ojo (2023), which state that there is no significant difference in the academic achievement of males and female physics students taught using Flip class learning strategy.

CONCLUSION

This study concluded that the flip class method of teaching and learning physics is capable of enhancing the academic achievement of physics students. This conclusion is made after the physics students exposed to flip-class method of teaching physics obtained a mean academic achievement score that was significantly higher than their counterparts who were not exposed to flip class method. It is also concluded that the flip class method influences the positive attitude of physics students towards physics. However, the study concluded that gender has no significant effect on the academic achievement of physics students when exposed to the flip class method of teaching.

Recommendations

The following recommendations were made:

- Teachers should be encouraged to use the flip class method of teaching physics at the level of education
- Parents should give their children ample opportunity during their out-school hours to engage themselves in the flip learning activities
- The government should provide the necessary learning materials like laptops and a steady power supply for effective learning in the flip class method of teaching.

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