EFFECT OF FLIPPED CLASSROOM METHOD ON SECONDARY SCHOOL STUDENTS' ACADEMIC ACHIEVEMENT IN PHYSICS IN CALABAR EDUCATION ZONE, NIGERIA.

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Abstract

The study investigated the Effect of Flipped Classroom Method Secondary School Students' Academic Achievement in Physics in Calabar Education Zone, Nigeria. In pursuance of this purpose, two research questions were form from which two research questions and hypotheses each were formulated. The study adopted the pre-test, post-test, non-randomized quasi-experimental, design. The population of the study consisted of 1,430 senior secondary two science students from four secondary schools in Calabar Education Zone of Cross River State. A sample size of 109 science students from the four intact classes, drawn from 84 secondary schools in two local Government Areas in Calabar Education Zone, using stratified and purposive sampling techniques. The study used three instruments: Physics Achievement Test (PAT), for data collection. The instruments were validated and the reliability determined using Kuder-Richardson formula (K-R_{20}) method and Cronbach-coefficient and the calculated reliability coefficient for PAT was 0.73. Data analysis was carried out using the Two -way Analysis of Covariance (ANCOVA). All the hypotheses were tested at 0.05 level of significance. The following findings were obtained: Male students in flipped classrooms have the highest gain score followed by female students in flipped classrooms, female students taught with conventional method and finally male students taught with flipped classroom method. Apparently there is no significant difference between the mean score achievement of students' when taught physics with flipped classroom method and conventional method with respect to gender. Based on the findings, it was recommended that Physics teachers and students should be exposed to Flipped classroom through seminars or trainings to improve their inputs during teaching/learning in other to facilitate truthfulness and gender equality.

Keywords: Flipped classroom; gender; Physics; academic achievement

Introduction

Physics is the branch of natural science that deals with the behavior and properties of matter, energy and their relationship. It is sometimes referred to as the science of measurement (Sani, 2012). Physics remains the fundamental science among other science subjects, because many of the tools on which scientific and technological advancement depends on, are the direct

products of Physics. The knowledge and principles of Physics had led to sustainable development in the area of industrialization as well as improvement of wellbeing of human race.

Apart from the general knowledge of physics principles which enhances daily living in the modern society, students are required to obtain a pass at credit level as one of the requirements, to be eligible for admission into various science courses like Mechanical Engineering, Electrical Engineering, medicine, Electrical Electronics, Pure physics and many more (Khan, Quarashi, Hussain & Hayee, 2005). In spite of the usefulness and numerous applications of Physics, academic achievement of students in physics has continued to be generally low for the past years (West African Examination Council (2022). Chief examiners' also reported that core subjects (Physics inclusive) recorded mass failure. Therefore, the percentage of students' academic achievement was observed to be low.

According to Williams (2018), talking about academic performance is often associated with students' GPA. However, academic performance can also be regarded as an accomplishment of scientific achievements and skills, impressive test scores, extracurricular achievements, students' ability to lead if assigned to. Academic achievement, according to Ghanney and Aniagyei (2014), is something capable of achieving by students when they are tested with what has been taught. The academic performance here focuses more on intellectual capacity. According to Siqueira and GurGe-Giannetti (2011), poor academic achievement can also be interpreted as a result of school achievement below expectations. The explanation from different scholars maintained that poor academic achievement refers to something measured, but does not meet the expectations or standards of achievement.

Estes, Ingram and Luis (2014), posited that, flipped learning is a learning approach that can improve students' retention. As confirmed by Kerr (2015) in one of his studies, Kerr found that there was a rapid improvement in students' learning retention because of the flipped learning intervention. According to Chianson (2008), retention cannot be obtained through rote memorization but through an appropriate teaching method.

Gender related issues in science education have continued to receive serious attention judging from the number of studies done to that effect. Ogunleye and Babajide (2011) opined that science subjects, which include Physics, Biology and Chemistry are given masculine outlook by educational practitioners. A survey study carried out by Azman (2014) established that the issue of gender played a major role in student's choice of core science subjects and their performances.

Similarly, Godpower-Echie and Amadi (2013) in a research work involving four hundred (400) senior secondary (SS2) chemistry students found out that there was a positive correlation between gender and students' achievement in chemistry. A research conducted by Ingels and Dalton (2008) showed that female students tend to perform better in areas of standardized science assessment that address the human application of science such as life science.

Nghambi (2014), Adie et al (2019) and Afriani (2020) stated that, non-use of appropriate teaching methods, inadequate supply of teaching materials and learning processes, insufficient teacher training, inappropriate government policies and lack of care from parents for their children are several factors causing students to have poor academic achievement.

In recent years, educational systems in many countries have experienced a tremendous and rapid change. This change is as a result of teaching and learning strategies being structurally modified (Brien, 2005). The modification leads to the development and introduction of new teaching and learning method or strategies. Some of these methods allow the instructors and learners to focus on their roles, and most strategies are student- centred while some are teacher-centred. One of such modern strategies is the Flipped Classroom Method (FCLM).

Mull (2012) defined flipped classroom method as that in which learners prepare themselves for the lesson by watching and listening to the videos via media. Clark-Ibanez and Scot (2010) defined flipped classroom method as a pedagogical approach that employs blended knowledge. It is a method where learners are provided with the contents through a video form,

to be used outside the school environment or at home (Robb & Rudy, 2012). Flipped classroom method aims at making the learning and teaching processes active and thereby giving the learner opportunities to use his or her knowledge or idea in the classroom. However, flipped classroom method enables students to be acquainted with new information with the aid of different technological tools that have been prepared and distributed by teachers and other educators. For example, a teacher prepares a video that contains some physics concepts such as simple machines and electricity using Teacher You-tube or Adobe presenter. This video which may last for about 20 and 40 minutes affords students first-hand learning even before physical contact with the teacher and classmates

Theoretical background

This study is anchored on Trace Decay Theory by Hermann Ebbinghaus (1850)

The important tenet of trace decay theory is that, memory fades away with time if not being accessed regularly. Hermann Ebbinghaus (1850) posited that the length of time between the memory and recalling of information determine whether the information will be retained or forgotten. The Hermann Ebbinghaus (1850) stated that, if the interval is short, more information will be recalled, but if a longer period of time passes, more information will be forgotten and the memory will be poorer. The author also posited that, neurochemical changes, known as memory traces, occur in an individual's brain when they learn new information. Therefore, whenever they conduct memory retrieval, they must revisit the traces the brain has used during encoding. Memory retrieval depends on the time between encoding and the recall of that information. The sooner we retrieve the memory, the more quickly we can recall it and vice versa.

Trace decay theory focuses on the time and the limited duration of short memory. This theory suggest that, short term memory can duly hold information for 15 -30 seconds unless it is rehearsed. In this theory Hermann Ebbinghaus (1850) posited that, forgetting is a function of time, repetition leads to strengthening of memory traces and the associative bond weaken with passage of time.

The implication of the theory in this study is that students should learn not to forget and teachers should teach using appropriate teaching method that will cause the information acquired to be store using long term memory. This is because if information is stored in short term memory, it can be forgotten. It also implies that, students should be rehearsing whatever information they received during learning process. This is avoid the decay of such information and to be able to retrieve such information as at when needed. In study the students in flipped classroom should form the habit of rehearsing the videos sent be the teacher.

Statement of the problem

Low students' retention and academic achievement of science students in secondary schools has been an unresolved issue in Calabar Education Zone and Cross River State as a whole. The academic achievement and interest had witnessed a deplorable trend in the past decade. This problem of poor students' academic interest and achievement in physics persistently occurs and become worse as years elapses. The problem of this low interest and academic achievement of physics students had long been observed by different research studies and examination bodies like West African Examination Council (WAEC) and National Examination Council (NECO). Observations and reports from these examination bodies showed that, a high percentage of secondary school students continue to perform poorly in physics examinations. Considering the analysis of the results of the examination conducted by the WAEC in Nigeria in May/June 2018-2022, out of 24,754 candidates who sat for Physics, only 10,505(42.44%) had high grades while 14,249(57.56%) had low grade in physics. Empirical research reports indicated that, gender and persistent use of the lecture method of instruction by many physics teachers in secondary schools has contributed to low academic achievement of science students in secondary schools over the years.

Although, various steps had been taken by government, teachers, school authority and the parents in an attempt to surmount this problem of poor academic achievement of science students in our schools, but the efforts have only yielded minimal results. Moreover, it is the belief of the researcher that if flipped classroom method is deliberately adopted in teaching physics, it will enhance achievement of physics students in secondary schools. Therefore, the study is designed to investigate the Effect of Flipped Classroom Method, Gender on Secondary School Students' Academic Achievement in Physics in Calabar Education Zone, Nigeria.

Purpose of the study

This study investigated the Effect of Flipped Classroom Method on Secondary School Students' Academic Achievement in Physics in Calabar Education Zone, Nigeria. Specifically, the study sought to determine the;

i. Effect of flipped classroom method on secondary school students' academic achievement in physics..
ii. Difference in post-test mean achievement scores of male and female students' when taught with flipped classroom method and conventional method.

Research questions

The following questions were generated to guide the study

i. What is the difference in the academic achievement of secondary school students taught physics concepts with flipped classroom method and conventional method?
ii. What is the difference in the mean academic achievement scores of male and female students taught physics concepts with flipped classroom method and conventional method?

Statement of hypotheses

On the basis of the research questions posed, the following null hypotheses were formulated to guide this study.

i. There is no significant difference on the academic achievement of secondary school students taught physics concept with flipped classroom and conventional methods.
ii. There is no significant difference between post-test mean academic achievement of male female science students taught physics concepts with flipped classroom method and conventional method

Literature Review

Gender and students' academic achievements in science

Gender is one of the contemporary issues in research; the issue of gender has been linked to academic achievement in many of the research work. Gender is one of the important factor that has significant effects on students' academic achievement. Finding on the effects of gender on students' achievement are inconclusive.

A study conducted by Uduosoro (2011) on the effect of gender and mathematics ability on academic achievement of chemistry students. The study uses a sample size of 100 chemistry students in senior secondary one (SSI) in Uyo. Two research instruments (Chemistry Achievement Test and Mathematics ability achievement test) were used in the study to obtained data. Data collected were analysed using independent t- test statistical tool. The result showed that, the calculated t-value was 1.48 while its corresponding table value (t-critical) was 1.96, tested at 0.05 alpha levels. The calculated t-value was observed been less than the t-value, which means that there was no significant difference in the academic achievement of male and female chemistry students. This implies that, gender does not have a significant effect on the academic achievement of SSI chemistry students.

Another study conducted by Chinwe and Ugwuebulam (2015) on gender disparity of the creative performance of senior secondary school students. A hundred and eighteen (118) female and 117 male were selected making it a total 235 students, which was used as sample size in the

study. Research questions were set and four hypotheses were formulated. Data were collected and analysed using Z-test and the result showed that, there was a significant difference in the mean scores of male and female students.

Etim, Etim Heilman, Mathiyalakan and Ntukidem (2016) reported that, achievement in English Language, Mathematics and Biology of female students were higher than that of their male counterparts. Research has shown that, there are gender differences existing in students' academic achievement in science including physics (Singh, 2010). Ajai and Imoko (2015) undertook a study to assess gender differences in mathematics achievement, which result showed that male and female students did not significantly differ in achievement scores.

Julie (2017) also carried out a study on the effect of a flipped classroom on students' academic achievement and the gender gap in high school physics. The research adopted a quasi-experimental design. Two groups of students were taught with flipped classroom method and lecture teaching method, these groups acted as experimental and control groups. The sample size for the study was 59 physics students, selected using simple random sampling technique. Data were collected and analyzed using independent t-test. Result from the findings showed that, there was no significant difference between female and male students taught with flipped classroom instruction. This implies that, flipped classroom gain scores did not differ by gender, $t_{56} = 0.54$, $p = 0.59$.

In addition, a study conducted by Elian and Hamaidi (2018) on the effect of flipped classroom strategy on the academic achievement in science subject among fourth grade students in Jordan. The study adopted a quasi-experimental design with a population that consists of all grade-four students in directorate of private education in Amman area; the targeted students were 2134 in the first semester 2015-2016 academic session. The study used a sample size of 44 students, 23 males and 21 females; this was distributed into two groups, the experimental and the control groups. The experimental group consisted of 23 male students and the control group consisted of 21 female students respectively. Data were obtained using a validated and reliable instrument. Two research questions were asked and two hypotheses were formulated based on the research questions. Data collected and analyzed using ANOVA and descriptive statistical tools. The results of the finding showed that, there was statistically significant difference between male and female students in their academic performance. The result also showed that the mean scores for male was 17.56 and SD = 2.44 while that of female was 17.80 and SD =2.29.

Another study was conducted by Efe (2015) to determine how academic achievement and retention in chemistry is improved using the two instructional methods among SSII students and the difference in academic achievement of male and female students in chemistry. The study was conducted in Gboko Local Government Area of Benue State. The study adopted a non-equivalent pre-test, post-test control quasi-experimental design. A total sample of 118 senior secondary-II intact class students were chosen from three schools using purposive random sampling. Data were collected using Chemistry Achievement Test, this test consisted of 30- item multiple choice in organic chemistry. Students were assigned to two groups, the experimental and the control groups. Three hypotheses were formulated and tested at .05 level of significance. The data obtained were analyzed using descriptive statistics, t-test, spearman's correlation coefficient and analysis of variance (ANOVA). The results of findings showed that, there was significant difference in the performance of male and female students in the two groups ($t_{cal} = 3.621 > t_{crit} = 2.000$ at $P < 0.05$).

A study carried by Salihu, Usman and Buhari (2020) to examine the effects of gender on upper basic social studies students' academic achievement in educational field trips learning environment in Kaduna State, Nigeria. The design of the study was the non- equivalent, pre-test, post-test control group type of quasi experiment. The population of the study consisted of junior secondary school students in Zaria Education Zone, Kaduna State, Nigeria numbering 26,322. Also, 60 students consisting of 30 males and 30 females were purposively sampled for the study.

The instrument for data collection was Social Studies Achievement Test (SOSAT). The content and construct validity was ascertained by experts in Social Studies, language and test and measurement. The reliability coefficient index power of the instrument stood at 0.81 determined using Pearson Product Moment Correlation Coefficient (PPMC). The data analysis tools were mean and standard deviation, and was used in answering the question posed while t-test independent samples was used in testing the null hypothesis postulated at 0.05 alpha. The study found no significant difference between the mean academic achievement scores of male and female students.

A study Oluyemo Musbahu, Kukwil , Anikweze and Shaluko (2020) to assess the influence of gender differences in mathematics interest and achievement of Junior Secondary School Students (JSS) in Niger State, Nigeria. Correlation Survey design was adopted for the study. The target population study consists of 5,368 (2,705 male and 2,663 female) JSS 1 students in 2012/2013 academic session selected from 92 public and private Junior Secondary Schools in Zone 'B' of Niger State. The sample of the study consisted 361 (182 male students and 179 female) and multi-stage stratified random sampling technique was employed in the selection. Two instruments were developed for the study which consists of an Inventory on Students' Interest in Mathematics (ISIM) and a Mathematics Achievement Test (MAT). Descriptive statistic (mean and Standard Deviation), Chi square, t test, bi-serial correlation and it is associated simple regression of Ordinary Least Square (OLS) method were used to establish relationship between the variables and to test null hypothesis at the 0.05 level of significance. The instruments were validated and the reliability coefficient was established using the test-retest method. The data obtained were analyzed using mean with the criterion mean set at 2.5.The findings of the study showed that male students excel in Mathematics more than their female counterparts. Based on the findings of the study, it was recommended amongst others that teachers should make use of alternative teaching methods like the use of games and simulations to motivate students' interest (both male and female) in the learning of Mathematics.

Methodology

This study adopted the quasi-experimental pre-test, post-test, non-randomized design. This is because the study involves the manipulation of the independent variable (teaching methods) in order to determine its impact on the dependent variables. The study was conducted in Calabar Education Zone of Cross River State which is one of the three Education Zones in Cross River State, Nigeria. The population of study consisted of 1,430 senior secondary school two (SSII) physics students in Calabar Education Zone. There are 84 secondary schools in the seven Local Government Area in Calabar Education Zone, and the 84 secondary schools comprises of 810 male and 620 female physics students, making it total of 1430 senior secondary two (SSII) physics. A stratified random sampling technique was used to select two Local Government Areas from the seven (7) LGA in Calabar Education Zone. From the two LGA_s selected, four schools out of 84 schools in Calabar education zone were selected using purposive sampling technique. The selection of the four schools (school A, B, C and D) was based on the following criteria: The school must have electricity, in order to power the electronic devices (Projector, and lap-top before and during the discussion class. The selected school must have up to senior secondary (SS2). Then from the schools selected, three intact classes in schools A, B and C were used as experimental group while one intact class in school D was used as control group. This is because the control is used in checking the experimental group. The sample for the study consisted of 109 science students (57 for experimental group and 52 for control group) selected from the four intact classes selected from the four (4) schools. The study used three instruments: Physics Achievement Test (PAT), Physics retention Test (PRT) and Students' self-efficacy

questionnaire (SEQ) for data collection. PAT which was used to collect data on academic achievement and was designed to measure students' achievement in physics and students' retention which measure students' retaining ability respectively. PAT consists of sixty (60) items each with multiple choice questions and with four Options A, B, C and D. It has one correct option and three others as detractors. In this study, face and content validity was established. The two instruments were validated by three experts from test and measurement and four physics teachers from four selected secondary schools. The Kuder-Richardson formula (K-R_{20}) method was used to determine the reliability of PAT0, this is because scores obtained from PAT are dichotomous with right = 1 and wrong = 0 (Joshua, 2012), while Cronbach-coefficient Alpha (α) method was used for determining the reliability of SEQ because the scores generated are not polytomous (Joshua, 2012). The calculated reliability coefficient for PAT.

Data was gathered using three instruments namely: Physics Achievement Test (PAT). The sampled schools were visited by the researcher to seek permission from the school authorities and to select one physics teacher from each school who was used for the study. At the commencement, PAT and Stu.

The experimental group was taught using flipped classroom method. In this method, the researcher created a video and sent to the subjects through WhatsApp group platform. After watching the videos, the students were asked to prepare their questions for class discussion. Thereafter, the researcher assistant gathered the subjects in experimental groups into smaller group based on the class size. The researcher then requested the students to discuss and ask their questions based on the video watched. The researcher then fielded all questions by answering them in the classroom. At the end of the treatment, a post-test was then administered on both groups with the same PAT.

Result/Data Analysis

The data collected was analysed using IBM statistical package for the social sciences (SPSS) version 20. The results are presented and interpreted for each research question and hypothesis. All the hypotheses were tested at .05 significance level.

Research question 1

What is the difference in the academic achievement of secondary school students taught physics concepts with flipped classroom method and conventional method?

Table 1: Mean and standard deviation of the pre-test and Post-test scores in physics of students with two treatment groups

Treatment Group	Pretest mean	S	Posttest Mean	S	Gain score
Flipped classroom Method	15.895	3.222	21.579	6.07	5.684
Conventional Method	11.981	3.734	15.096	2.99	4.115
	3.914		6.483		1.569

The results on Table 1 indicate the difference in the mean between the two group at Pre-PAT as 3.914 at Post-PAT, the table showed the difference at 6.483 in favour of the experimental groups, the gain score between the experimental and the control groups were 5.684and 4.115 respectively. The difference in their gain score is 1.569 in favour of the experimental group.

Research question 2
What is the difference in the mean academic achievement scores of male and female students taught physics concepts with flipped classroom method and conventional method?

Table 2: Mean and standard deviation of the academic achievement of male and female physics students in the two treatment groups

Treatment	Gender	Pretest Mean	S	Posttest Mean	S	Gain score
Flipped classroom	Male	15.720	3.680	23.000	6.474	7.280
Method	Female	16.031	2.868	20.469	5.59	4.438
Conventional Method	Male	13.409	3.699	16.091	2.34	2.660
	Female	10.933	3.453	14.367	3.24	3.434

The results on Table 2 indicate that the mean gain scores of male and female students taught with flipped classroom method are in each case more than that of those taught with the conventional method. Male students in flipped classrooms have the highest gain score followed by female students in flipped classrooms, female students taught with conventional method and male students taught with conventional method. Apparently. Gender positively influences students' academic achievement when taught Physics concepts with flipped classroom method (FCLM).

Hypothesis 1
There is no significant difference on the academic achievement of secondary school students taught physics concept with flipped classroom and conventional methods.

Table 3: Summary of the ANCOVA of students' academic achievement in physics when taught with flipped classroom and conventional method

Source	Type III sum of squares	Df	Mean square	F	Sig.	Partial Eta square
Corrected method	1216.970	2	608.485	26.323	.000	332
Intercept	11410.364	1	11410.364	61.013	.000	.365
Pretest	74.154	1	74.154	3.208	0.76	0.29
Treatment	632.341	1	632.341	27.356*	.000	.0205
Error	22450.259	106	23.116			
Total	40917.000	109				
Corrected Total	3667.229	108				

*P<05.

From the table 3 above, it was revealed that significant level of score of students taught using flipped classroom method and conventional method is 0.00 with probability (F) value of 26.323. This means that the null hypothesis which states there is no significant difference on the academic achievement score of students taught physics concepts with flipped classroom method and conventional methods was rejected. Hence there is significant difference between the mean academic achievement score of students' taught physics concepts with flipped classroom method and those taught with conventional method.

Hypothesis 2

There is no significant difference between post-test mean academic achievement of male female science students taught physics concepts with flipped classroom method and conventional method

Table 4: Summary of the one-way ANCOVA of students' in physics concepts when taught with flipped classroom and conventional methods

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Method	1328.994	4	332.248	14.778	.000	.362
Intercept	1383.362	1	1383.362	61.529	.000	.372
Pretest	58.518	1	58.518	2.603	.110	.024
Treatment	663.632	1	663.632	29.517	.000	.221
Gender	92.848	1	92.848	4.130	.045	.038
Treatment * Gender	12.873	1	12.873	.573*	.451	.005
Error	2338.236	104	22.483			
Total	40917.000	109				
Corrected Total	3667.229	108				

*p > .05

Table 4 revealed that the calculated $F_{(1,104)} = 4.130$ and p = 0.38 value for the interaction of treatment and gender is 0.573 which is not statistically significant at .05 level ($p<0.05$). This implies that the mean difference between male and female student who were taught physics concept with flipped classroom method was not significant. This mean that both male and females students' performance better when using flipped classroom method and conventional method. Therefore, the null hypothesis is not rejected.

Discussion of Findings

The result of hypothesis one showed that, students' taught physics concepts with flipped classroom method significantly achieved higher mean score compare to those taught with conventional method. The finding of this study validates the position of Thieu (2020) on the effect of flipped classroom method on students' academic achievement of physics students, but contrary to the finding of Chen (2016) on the effect flipped classroom method the result of Chen revealed that flipped classroom method thus not make significant improvement in the academic achievement. Thompson and Mombourquatte (2014) also reported that there was no significant difference between the academic achievements of the two groups. The result of findings from hypothesis two agrees with the result obtained from a study conducted by Uduosoro (2011) which showed that there was no significant difference in the academic achievement of male and female physics students. Moreover, the result of findings in study is also supported by the result of findings obtained by Salihu, Usman, Buhari, (2020) who found that, there was no significant difference between the mean academic achievement scores of male and female students.

The result of findings in this study contradicted with the results of findings from the studies conducted by Chinwe and Ugwuebulam (2015) who found that, there was a significant difference in the mean scores of male and female physics students taught with flipped classroom method and conventional method. Etim, Etim Heilman, Mathiyalakan and Ntuikdem (2016) reported that, achievement in English Language, Mathematics and Biology of female students were higher than that of their male counterparts. Research has shown that, there are gender differences existing in students' academic achievement in science including physics (Singh, 2010).

In addition, result of hypothesis two revealed that the finding from Elian and Hamaidi (2018) is not support of the findings from this study. Elian and Hamaidi (2018) found that there was statistically significant difference between male and female students in their academic performance. There is no validation of this finding with that of Efe (2015) who found that, there was significant difference in the performance of male and female students in the flipped classroom and that of conventional methods. Result of findings from this study is also not in line with the results of finding from Oluyemo Musbahu, Kukwil , Anikweze and Shaluko (2020), who found that, male students excel more than their female counterparts.

However, the disparity in the result of findings in this study and the results from Chinwe and Ugwuebulam (2015), Efe (2015), Elian and Hamaidi (2018) and Oluyemo Musbahu, Kukwil, Anikweze and Shaluko (2020) could be due to different study area, instruments used and the sample size.

Conclusion

Based on the findings of this study the following was concluded that:

Flipped classroom method is an effective way of enhancing academic achievement of secondary school students' taught physics concepts because it allow for activist participation in class.

There was no significant difference in the achievement of male and female students' taught using flipped classroom method thus indicating gender equality through the use of this method.

Recommendations

Based on the results, the following recommendations were made.

i. Physics teachers should be exposed to flipped classroom method through seminars and trainings.

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