e-ISSN 2795-3272
p-ISSN 2795-3264

10.5281/zenodo.14569276 Vol. 07 Issue 12 Dec - 2024 Manuscript ID: #01699

Effect of flipped classroom instructional strategy on secondary school student achievement and retention in computer studies

Inyama Chukwuemeka Macleo
Department Of Science Education, Chukwuemeka Odumegwu Ojukwu University, Igbariam
Email*: inyama_c@yahoo.com*

Chinyere Francisca Okafor
Department Of Science Education, Chukwuemeka Odumegwu Ojukwu University, Igbariam
Email*: cf.okafor@coou.edu.ng*

Okwutu Sarah Damilola
Department Of Science Education, Chukwuemeka Odumegwu Ojukwu University, Igbariam
Email*: okwutusarah@gmail.com*

Nwadike Sharonrose ogochukwu
Nnamdi Azikiwe UniversityAwka
Email*: so.nwadike@unizik.edu.ng*

Abstract

The study was on effect of flipped classroom instructional strategy on secondary school students' achievement and retention in computer studies in Anambra State. Six research questions and six hypotheses tested at .05 level of significance guided the study. A quasi experimental design, specifically the non equivalent group design was adopted for the study. The population of the study consisted of 10, 257 computer students that registered for the 2022/2023 academic session in the Anambra State post primary schools. A total of 300 computer students participated in the study. A researcher made Computer Achievement Test developed and validated at a reliability coefficient of 0.92 served as both achievement and retention test. Meanwhile, mean and standard deviation was used to answer research questions while ANCOVA was used to test the hypotheses. The findings of the study revealed significant improvement on the mean achievement and retention scores of the experimental group. It was therefore recommended that computer teachers should consider full implementation of the flipped classroom instructional strategy in the teaching and learning of computer.

Keywords:

Effect, Flipped Classroom, Instructional, Strategy, Achievement, Retention.

***How to cite*:** Macleo, I., Okafor, C., Damilola, O., & ogochukwu, N. (2024). Effect of flipped classroom instructional strategy on secondary school student achievement and retention in computer studies. *GPH-International Journal of Educational Research*, 7(12), 59-76. https://doi.org/10.5281/zenodo.14569276

INTRODUCTION

BACKGROUND TO THE STUDY

In line with the demands of the fast growing society, education of the 21st century has become multifaceted and focused on enhancing global complexities. It has become more complex and interdisciplinary, navigating to the direction of problem solving. Hence, the focus of contemporary education is classical discovery as well as output of individuals who are capable of solving human problems through expanded knowledge creation, sustained skill acquisition and inventions (Okoye, 2019). Also, through enhanced cognitive, affective and psychomotor development, contemporary education among others seeks to promote the output of problem solving individuals who can transform classroom instructions into real life situations (Ahmed, 2020).

Science is the systematic study of the natural environment. It is the basic and fundamental study of nature. It is the scientific study of the natural environment in relation to reoccurring phenomena which affects life. It is the quantitative and objective knowledge of the natural environment, whose core principle is embedded in fostering first hand understanding of nature which will in turn be manipulated to favour life (Opara, 2015). Science is a method and an instrument for knowledge acquisition and understanding of nature, which enables us to practically transform the world in accordance with our purpose.. Science, overtime has penetrated every branch of modern life ranging from medicine, engineering, finance, trading, manufacturing, commerce, security among others.

Computer literarily, is an electronic machine. It is an electronic device for storing and processing data based on a set of instruction given to it (Ezeh, 2020). Offor (2022) viewed computer as *a device that accepts information (in the form of digitalized data) and manipulates it for some result based on a program* or software. From the forgoing, inherent in the concept of computer is an electronic device capable of receiving, processing, interpreting, storing and retrieving data..

In line with global trend and growing interest in computer, the study of computer was introduced in Nigerian school system to foster first hand understanding of computer operations and manipulations and at same time help individuals adapt to the competitive computer age. The study of computer which is known in the secondary schools as computer studies has become more popular to both science and art students which has continued to enjoy high patronage both at the junior, senior secondary and tertiary levels of education. Among others, computer studies curriculum is structured to foster computer based literacy and experiences that will trigger scientific profiling as well as manipulative abilities in students, such that they can participate actively in our technology driven society in preparation for knowledge advancement in related fields and as well become lifelong learners who can transfer acquired skill to real life situations.

Lecture Method of Instruction (LMI) is an entirely teacher centered pedagogy, where learners are mere receptors of knowledge (Obi, 2016). It is an instructional methods that are

duly characterized by a one way channel of communicating information which recognizes the teacher as the main figure and cardinal participant, the information supplier and knowledge originator. In LMI, active involvement or participation of learners as well as conceptual understanding are usually lacking. It is duly characterized by the teacher introducing content and skills on a blackboard accompanied by oral or verbal explanation. Thus, students are viewed as empty vessels whose role is to passively receive knowledge and information with the aim of being assessed on what they were taught at the end of a lesson or term.

Computer studies teachers' persistent use of LMI despite students' achievement gap, was further attributed to the fact that it fosters wider content coverage, saves time and enables computer studies teachers to teach large class within a given period. In addition to the problem at hand, Long, (2021) noted that LMI does not provide the hand - on - activity approach required for life long learning and conceptual understanding involved in teaching and learning of computer studies. Also,

Student- Centered Instructional Strategies (SCIS) refers to a group of pedagogies that places the learner at the center of instruction. Student centered instructional strategies, also known as learner-centered education, broadly encompasses methods of teaching that shift the focus of instruction from the teacher to the student. In original usage, it aims to develop learner autonomy and independence, by putting responsibility for the learning path in the hands of students and by imparting to them skills, basis on how to learn a specific subject as well as schemata required to measure up to the specific performance requirement. SCIS focuses on skills and practices that enable lifelong learning and independent problem-solving. Some of these SCIS has been investigated to ascertain their efficiency in sciences on varying capacities. For instance: Okoye (2020) investigated the effect of conceptual change pedagogy on achievement of computer science students, Ahmed and Munawary (2021) experimented on the effect of concept mapping on achievement and retention among biology students while Ahmed in Muhamad (2021) investigated the effect of practical approach on achievement and acquisition of science process skills among computer students. Their findings revealed that to promote interest and achievement among students, it is necessary to deemphasize traditional methods of instruction and navigate to the students centered methods.

Despite these studies and their findings, maximal achievement in computer studies is yet to be attained. Critical research review revealed that, these methods only gave credence to students participation and engagement with little or no attention to learner autonomy and independent knowledge creation.

Flipped Classroom Instructional Strategy (FCIS) is a redefined learning pattern of instruction which moves activities, including those that may have traditionally been considered homework, into the classroom (Falciani, 2020). Flipped classroom is an instructional design that replaces the traditional lecture-in-class with assigned learning activities outside the class and back into the class for interactive learning where the teacher guides the students as they apply concepts and engage creatively in the subject (Willis, 2020). Flipped classroom is an element of blended learning and it is the reverse of the traditional classroom. The students do not listen to the lectures delivered in the classroom but outside the

classroom through online video lecture. The flipped instruction involves helping students to use the class time to enhance what they had studied initially at home by participating in group discussions, engaging in laboratory activities, and projects that involve higher level thinking which is hoped to help enhance retention.

Retention in Concise English Dictionary is the act of retaining: the state of being retained; conferment; the power of retaining, especially ideas in the mind. It is an individual's ability to remember and recall information, materials and experiences learned over time. It also refers to ability to recall or to recognize what has been learnt or experienced over a long period of time (Ezemuoghalu, 2018). Research by Ezeoke (2021) revealed that students with high retentive ability achieve more in examinations. Just as obtained in computers, breakthrough in sciences may not be feasible unless students have the capacity to store, stimulate and retrieve information. Hence the need for alternate ends to retention which is most likely to enhance achievement in computer studies.

Achievement in science is a term of consistence importance which has been in use for decades to designate the total performance outcome indicating the extent to which a student has successfully accomplished specific goals that were the focus of instruction in an instructional environment (Marcel, 2017)..

It is believed that achievement in computer studies may not be feasible unless students' learning autonomy, preferences, senses of learning as well as independent knowledge creation are adequately taken care of. Perhaps as computer students are drilled through the series of activities embedded in flipped classroom instructional strategy, their achievement may improve irrespective of one's gender.

Gender is a socially constructed component of human sexuality, an inner feeling that one is either a male or a female (Mark, 2019). In those days, it has been undisputedly believed that secondary school boys were most effectively good in sciences and technology but not in arts where girls measure up most (Anyaegbunam, 2021). However, revolutions caused by renaissance in education has given rise to gender balance in both arts and sciences, thus filling some previously existing gender gap. Although some empirical findings such as Okafor (2020) revealed that gender issues in sciences acts in favor of males, others such as Obi (2021) observed that gender issues act in favor of the females. In contract, Okoye (2022) argued that gender has no significant effect on the achievement of male and female students. Some researchers submitted that gender has no significant influence on achievement and interest others opined the contrary. Hence, inclusion of gender in the current study that is set to determine the effect of flipped classroom instructional strategy on secondary school students' achievement and retention in computer studies.

Statement of the problem

Over the years, students' achievement in computer studies has continued to derail. As released by the WAEC Chief Examiner, poor grasp of concept as well as inability to demonstrate internalization and mastery of content have continued to cost computer studies students wholesome score. Research effort so far itemized persistence use of lecture method

of instruction among others as causal factors of achievement gap among computer studies students. In addressing the problem of achievement gap in computer, researchers called for a shift to novel instructional strategies that will critically engage learners. Although research has recorded minimal improvement with the novel methods, evidence abounds indicating that achievement in computer studies needs to be improved. A critical analysis revealed that some of the novel methods widely in use have credence to engaging learners through some hands on mind on activities. This therefore gave credence to an instructional strategy that have been revealed by researchers to engage learners and at the same time account for their autonomy, accommodate their learning preferences and also give room for independent knowledge creation as obtained in flipped classroom instructional strategy (FCIS). Hence, the research on effect of flipped classroom instructional strategy on students' achievement and retention in computer studies.

Purpose of the study

The purpose of the study was to investigate the effect of flipped classroom instructional strategy on secondary school students' achievement and retention in computer studies. Specifically, the study sought to determine the:

1) Difference in mean achievement scores of students taught computer studies using flipped classroom instructional strategy and those taught using lecture method of instruction.
2) Difference in mean retention scores of students taught computer studies using flipped classroom instructional strategy and those taught using lecture method of instruction.
3) Difference in mean achievement scores of male and female students taught computer studies using flipped classroom instructional strategy and those taught using lecture method of instruction.
4) Difference in mean retention scores of male and female students taught computer studies using flipped classroom instructional strategy and those taught using lecture method of instruction.
5) Interaction effect of flipped classroom instructional strategy and gender on students' achievement in computer studies.
6) Interaction effect of flipped classroom instructional strategy and gender on students' retention in computer studies.

Research Questions

The following research questions guided the study

1) What is the difference in the mean achievement scores of students taught computer studies using flipped classroom instructional strategy and those taught using lecture method of instruction?
2) What is the difference in the mean retention scores of students taught computer studies using flipped classroom instructional strategy and those taught using lecture method of instruction?

3) What is the difference in the mean achievement scores of male and female students taught computer studies using flipped classroom instructional strategy?
4) What is the difference in the mean retention scores of male and female students taught computer studies using flipped classroom instructional strategy?
5) What is the interaction effect of teaching methods and gender on students' achievement in computer studies?
6) What is the interaction effect of teaching methods and gender on students' retention in computer studies?

Hypotheses

The following null hypotheses were formulated and tested at 0.05 alpha levels to guide the study:

Ho_1: There is no significant difference in the mean achievement scores of students taught computer studies using flipped classroom instructional strategy and those taught using lecture method of instruction.

Ho_2: There is no significant difference in the mean retention scores of students taught computer studies using flipped classroom instructional strategy and those taught using lecture method of instruction.

Ho_3: There is no significant difference in the mean achievement scores of male and female students taught computer studies using flipped classroom instructional strategy.

Ho_4: There is no significant difference in the mean retention scores of male and female students taught computer studies using flipped classroom instructional strategy.

Ho_5: There is no significant interaction effect between teaching methods and gender on students' achievement in computer studies.

Ho_6: There is no significant interaction effect of teaching methods and gender on students' retention in computer.

METHODS

The research design for the study was a quasi- experimental design of pretest-posttest, and non randomized groups. The choice of this design is also justified by the submissions of Osegbo, Ifeakor and Enemuo (2009) that quasi experimental design is best where the researcher has no absolute control over the participants.

Research Design Illustration

$\underline{E} \rightarrow \underline{O_1} \rightarrow \quad \underline{X_1} \rightarrow \underline{O_2}$

$C \rightarrow O_1 \rightarrow \quad X_2 \rightarrow O_2$

Where:

E = Experimental Group,

C= Control Group,

O_1 = Pretest,

O_2 = Posttest,

X_1 = Treatment,

X_2 = Control variable or placebo.

The study was conducted in Anambra state, Nigeria. Anambra is one of the 36 states that made up the Federal Republic of Nigeria and is situated at the Southern-Eastern part of the country. It is a core Igbo state predominated by economic conscious citizens such as farmers, scholars, traders, civil servants etc. Anambra state is made up of 21 local government areas which are politically grouped into three senatorial districts with each of the senatorial districts housing two education zones each, thereby giving rise to the six education zones to include: Aguata, Awka, Nnewi, Onitsha, Ogidi, and Otuocha education zones. Anambra state houses a total of 267 public secondary schools, 161 coeducation schools, 45 boys schools, 48 girls schools and numerous private secondary schools (Post Primary Secondary School Service Commission, 2022).All the schools has same characteristics such as: same computer textbooks, having averagely same teacher/student ratio and computer studies teachers still using conventional method of teaching and students performing averagely the same in SSCE in computer (WAEC Chief Examiner, 2020 - 2022). The population of the study comprised 10, 257computerstudies students (4, 988 males and 5, 269 females) registered in the 267 public secondary schools across the six education zones in Anambra state (Post Primary School Service Commission Awka, 2022). This as obtained was the actual number of computer studies students that registered for the 2022/2023 academic session in public secondary schools of Anambra state. A total of 300 computer studies SS2 students participated in the study. At first, the six education zones in Anambra state (Nnewi, Onitsha, Awka, Aguata, Ogidi and Otuocha) was stratified from where three education zones (Nnewi, Awka and Ogidi) was sampled. The education zones were arranged as contained in the map of Anambra state. One education zone is chosen, the next is jumped sequentially till three are successfully sampled to represent the whole. The education zones included: Nnewi, Awka and Ogidi education zones. Justification for the stratified method was to ensure that closely related education zones which may share common characteristics are not selected. Of the three education zones, Awka has five Local Government Areas (Anaocha, Awka North, Awka South, Dunukofia and Njikoka) with a total of 44 public secondary schools (30 coeducational, 5 boys and 9 girls schools). Nnewi has four Local Government Areas (Ekwusigo, Nnewi North, Nnewi South and Ihiala) with a total of 44 public secondary schools (27 coeducational, 7 boys and 10 girls schools). Ogidi has three Local Government Areas (Idemili North, Idemili South and Oyi) with a total of 30 public secondary schools (20 coeducational, 4 boys and 6 girls schools). From the sampled zones, lucky deep was used to draw one local government each from where two schools that satisfied major criteria of the study (such as adequate and functional computer laboratory, qualified computer studies teachers, reliable power source as well as lesson timetable among others) were purposively sampled to participate in the study. Out of the sampled schools, 4 has double streams of about 22 to 34 students per class while the remaining 2 has single classes each of between 30 to 35 students per class summing to 10 classes of 300 students to participate in the study. Also, lucky deep method was used to assign 3 schools into experimental and 3 as control groups respectively. Justification for the lucky deep is to ensure that each of the sampled schools stands a chance of being selected for either experimental or control group. The researcher's choice of class of respondents was justified because, the subject content adopted by the study was covered by their class curriculum. Also, the choice of coeducation schools is attributed to gender as a moderating variable to the study. The instrument for data collection was a

researcher structured test "Computer Studies Achievement Test" (CAT) which comprised of sections "A" and "B". Section "A" comprised of the respondent's demographic variable such as name of school, age, gender among others. Section "B" comprised 50 multiple choice test questions from the topic adopted for the study, which helped in elucidating information on the achievement of computer Studies students especially on the mean achievement scores of students taught computer Studies using flipped classroom instructional strategy and those thought using the lecture method. The instruments was used for pretest and after the treatment, the same instrument was reshuffled and used as post test. The same instrument was reshuffled a second time and re-administered to the students after a period of three weeks to measure their retention abilities. All the research questions were answered using mean and standard deviation while Analysis of Covariance (ANCOVA) was used to test the hypotheses at .05% level of significance. The choice of ANCOVA was because of the nature of the design of the study i.e. quasi experimental (specifically non-equivalent control-group design). This was because the design permits the use of pre-test, which acts as covariate, therefore, ANCOVA helps to establish the homogeneity or equivalence of the two groups before treatment. Besides this, since intact classes will be used for the study, ANCOVA will also help to increase the power of the test because of type 1 error that may occur because of non-randomization of the subject of the study.

Discussion of Findings

Research Question 1

What is the difference in the mean achievement scores of students taught computer studies using flipped classroom instructional strategy and those taught using lecture method of instruction?

Table 1

Mean and standard deviation (SD) of pre-achievement test and post-achievement test scores of students taught computer studies

Variance		Pre-test		Post-test		
Method of Teaching	**N**	**X**	**SD**	**X**	**SD**	**Mean Gain**
FCIS	132	21.50	3.84	43.63	3.49	22.13
Lecture Method	160	8.16	2.86	11.63	2.40	3.47

Analysis from table 1 indicated that the group taught computer studies using flipped classroom instructional strategy had a pre-achievement test mean of 21.50 with a standard deviation of 3.84 and a post-achievement test mean of 43.63 with a standard deviation of 3.49. The difference between the pre-test and the post-test mean was 22.13. The group taught computer studies using lecture method had a pre-achievement test mean of 8.16 with a standard deviation of 2.86 and a post-achievement test mean of 11.63 with a standard deviation of 2.40. The difference between the pre-test and the post-test mean was 3.47.

Invariably, for each of the groups, the post-test mean were greater than the pre-test mean with the group taught computer studies using flipped classroom instructional strategy having a higher mean gain. This is an indication that flipped classroom instructional strategy had more effect on students' achievement in computer studies than the lecture method of structure

Research Question 2

What is the difference in the mean retention scores of students taught computer studies using flipped classroom instructional strategy and those taught using the lecture method of instruction.

Table 2:

Mean and standard deviation of post achievement test and retention test scores of students in computer studies

Variance		Pre-test		Post-test		
Method of Teaching	**N**	**X**	**SD**	**X**	**SD**	**Mean Gain**
FCIS	132	43.63	3.49	55.34	7.24	11.71
Lecture Method	160	11.63	2.40	12.06	2.63	0.43

Table 2 showed the difference in the mean retention score of students taught computer studies using flipped classroom instructional strategy and those taught computer studies using lecture method instruction. The result indicated that the group taught computer study using flipped classroom instructional strategy has a post achievement test mean of 43.63 with a standard deviation of 3.49 and a retention mean score of 55.34 with a standard deviation of 7.24. The difference between post test and retention mean score was 11.71. The group taught computer studies using lecture method instruction had a post achievement tests mean of 11.63. with a standard deviation of 2.40 and retention means of 12.06 with a standard deviation of 2.63. The difference between the post test and retention mean score was 0.43. Although, for each of the groups, the retention means scores were greater than post test mean achievement scores with the group taught computer studies using flipped classroom instructional strategy having a higher retention gain. This implied that flipped classroom instructional strategy had more effect on students' retention in computer studies than lecture method instruction.

Research Question 3

What is the difference in the mean achievement scores of male and female students taught computer studies using flipped classroom instructional strategy?

Table 3:

Mean and standard deviation of pre-achievement test and post achievement test scores of male and female students in computer studies

Variance		Pre-test		Post-test		
Gender	**N**	**X**	**SD**	**X**	**SD**	**Mean Gain**
Male	54	23.30	3.16	44.67	3.05	21.37
Female	78	20.26	3.79	42.91	3.61	22.65

Result in table 3 the depicted that male students had a pre-achievement test mean of 23.30 with a standard deviation of 3.16 and a post achievement test mean of 44.67 with a standard deviation of 3.05. The difference between the pre test and post test achievement score for male students was 21.37. The female students taught computer studies had a pre achievement test mean of 20.26 with a standard deviation of 3.79 and a post achievement of 42.19 with a standard deviation of 3.61. The difference between the pre test and post test achievement score for female students was 22.65. Nevertheless for each of the groups, the post achievement mean was greater than the pre achievement tests mean with the female students having higher mean gain. The study deduced that female students achieved slightly higher than male students.

Research Question 4

What is the difference in the mean retention scores of male and female students taught computer studies using flipped classroom instructional strategy?

Table 4:

Mean and standard deviation of post achievement test and retention test scores of male and female students in computer studies

Variance		Pre-test		Post-test		
Gender	**N**	**X**	**SD**	**X**	**SD**	**Mean Gain**
Male	54	44..67	3.05	54.83	6.07	10.16
Female	78	42.91	3.61	55.69	7.98	12,78

Findings in table 4 indicated that male students had a post achievement test score of 44.65 with a standard deviation of 3.05 and a retention mean score of 54.83 with a standard deviation of 6.07. The difference between the post test achievement score and retention score of male students was 10.16. The female students taught computer studies had a post achievement means score of 42.91 with a standard deviation of 3.61 and a retention mean score of 55.69 with a standard deviation of 7.98. The difference between post achievement score and retention score of female student was 12.78. Albeit, for each of the groups, the

retention mean were greater than the post test achievement mean with the female students having a higher mean in the retention.

Research Question 5

What is the interaction effect of teaching methods and gender on students' achievement in computer studies?

Table 5:

Mean and standard deviation of students pre-achievement test and posts achievement test scores in computer studies by teaching methods and gender

	Variance		Pre-test		Post-Test		
Methods	**Gender**	**N**	**X**	**SD**	**X**	**SD**	**Mean Gain**
FCIS	Male	54	23.30	3.16	44.67	3.05	21.37
	Female	78	20.26	3.79	42.91	3.61	22.65
LMI	Male	68	8.56	2.62	11.53	2.69	2.97
	Female	92	7.86	3.00	11.70	2.16	3.84

As can be seen from table 5, male students taught computer studies using flipped classroom instructional strategy had a pre achievement mean of 23. 30 with a standard deviation of 3.16 and a post achievement mean of 44.67 with a standard deviation of 3.05. The difference between the pre test and post test of male students was 21.37. The female students taught computer studies using flipped classroom instructional strategy had a pre-achievement mean of 20.26 with a standard deviation of 3.79 and a post achievement mean of 42.91 with a standard deviation of 3.61.

The difference between pre test and post test mean was 22.65. Finding from table 5 deduced that male students taught computer studies using lecture method instruction had a pre achievement mean score of 8.56 with a standard deviation of 2.62 and a post achievement mean of 11.53 with a standard deviation of 2.69. The difference between pre test and post test of male students was 2.97.The female students taught computer studies using lecture method instruction had a pre-achievement means score of 7.86 with a standard deviation of 3.00 and a post achievement test mean of 11.70 with a standard deviation of 2.16. The difference between the pre test and post test means was 3.84. In the same vein, for each of the groups, the post test mean were greater than the pre test mean. Male and female students taught computer studies using flipped classroom instructional method outperformed their counterparts in lecture method of instruction.

Research Question 6

What is the interaction effect of teaching methods and gender on students' retention in computer studies?

Table 6:

Mean and standard deviation of students post achievement test and retention test scores in computer studies by teaching method and gender

	Variance		Post-test		Retention		
Methods	**Gender**	**N**	**X**	**SD**	**X**	**SD**	**Mean Gain**
FCIS	Male	54	44.67	3.05	54.83	6.05	10.16
	Female	78	42.91	3.61	55.69	7.98	12.78
LMI	Male	68	11.53	2.69	12.21	2.93	0.68
	Female	92	11.70	2.16	11.95	2.40	0.25

Results from table 6, revealed that male students taught computer studies using flipped classroom instructional strategy had a post achievement mean of 44.67 with a standard deviation of 3.05 and a retention mean of 54.83 with a standard deviation of 6.07. The difference between the post test and retention mean score was 10.16. The female students taught computer studies using flipped classroom instructional strategy had a post - achievement test mean of 42.91 with a standard deviation of 3.61 and a retention mean of 55.69 with a standard deviation of 7.98.

The difference between post test and retention mean was 12.78. The Finding in table 6 also revealed that male students taught computer studies using lecture method instruction had a post achievement test score of 11.53 with a standard deviation of 2.69 and a retention mean score of 12.21 with a standard deviation of 2.93. The difference between post test and retention mean was 0.68. The female students taught computer studies using lecture method instruction had a post -achievement test score of 11.70 with a standard deviation of 2.16 and retention mean of 11.95 with a standard deviation of 2.40. The difference between the post test and retention means was 0.25. Although, for each of the groups, the retention means were greater than the post achievement means but male and female students taught computer studies using flipped classroom instructional method retained what was learnt in computer studies more than their counterparts in lecture method of instruction.

Test of Hypothesis

In order to make decision of effects of flipped classroom instructional strategy on secondary school students achievement and retention and computer studies the following hypothesis were tested at 0.05 level of significance.

Hypothesis 1

There is no significant difference in the mean achievement scores of students taught computer studies using flipped classroom instructional strategy and those taught using lecture method of instruction.

Table 7:

Analysis of covariance (ANCOVA) of significance difference in the mean achievement scores of students taught computer studies using flipped classroom instructional strategy and those taught using lecture method instruction

Source	Type III Sum of square	Df	Mean Square	F	Sig
Corrected Model	74506.560	2	37253.280	5146.505	.000
Intercept	6938.114	1	6938.114	958.494	.000
Pretest	424.367	1	424.367	58.626	.000
Group	10723.684	1	10723.684	1481.467	.000
Error	2091.944	289	7.239		
Total	275397.000	292			
Corrected Total	76598.503	291			

R squared = .973 (adjusted R squared = .973)

Table 7 showed that with respect to achievement of the group taught computer studies using flipped classroom instructional strategy and those taught computers studies using lecture method instruction and F-ratio of 1481. 467 was obtained with associated p-value of .000. Since the associated probability value (p-value) of 0.000 was lesser than 0.05 level of significance, the null hypothesis was rejected

However, the study concluded that there was a significant difference in the mean achievement scores of students taught computer studies using FCIS and those taught using LMI with those taught using FCIS having a higher mean. Invariably, FCIS increased students' achievement in computer studies than LMI.

Hypothesis 2

There is no significant different in the mean retention score of student taught computer studies using flipped classroom instructional strategy and those taught using lecture method of instruction.

Table 8:

Analysis of covariance (ANCOVA) of the significant difference in the main retention scores of student taught computer studies using FCIS and those taught using LMI

Source	Type III Sum of square	Df	Mean Square	F	Sig
Corrected Model	135901.184	2	67950.592	2584.802	.000
Intercept	1700.382	1	1700.382	64.682	.000
Post test	388.775	1	388.775	14.789	.000
Group	2240.132	1	2240.132	85.213	.000
Error	7597.378	239	26.289		

Total	**435508.000**	**292**
Corrected Total	**143498.562**	**291**

R squared = .947 (adjusted R squared = .947)

Table 8 deduced that with respect to retention of the group taught computers studies using FCIS and those taught computers studies using LMI, an F-ratio of 85.213 was obtained with associated probability value (p-value) of .000. Since the associated probability value (p-value) of 0.000 was lesser than 0.05 level of significance, the null hypothesis was rejected. Hence, there is a significant difference in the mean retention scores of student taught computer studies using FCIS and those taught using LMI.

Hypothesis 3:

There is no significant difference in the mean achievement scores of male and female students taught computer studies using flipped classroom instructional strategy.

Table 9:

Analysis of covariance (ANCOVA) of the significant difference in the mean achievement scores of male and female student taught computer using FCIS

Source	Type III Sum of square	df	Mean Square	F	Sig
Corrected Model	64375.961	2	32187.981	761.080	.000
Intercept	429.895	1	429.895	10.165	.002
Pretest	64373.684	1	64373.684	1522.105	.000
Gender	593.085	1	593.085	14.023	.000
Error	12222.542	289	42.293		
Total	275397.000	292			
Corrected Total	76598.503	291			

R squared = .840 (adjusted R squared = .839)

From Table 9, it was analyzed that with respect to gender on students achievement, an F-ratio of 14.023 was obtained with associated probability value (p-value) of .000. Thus, the associated probability value (p-value) of 0.000 was lesser than 0.05 level of significance, the null hypothesis was rejected. Furthermore, there is a significant difference in the mean achievement scores of male and female students taught computer studies using FCIS.

Hypothesis 4

There is no significant difference in the mean retention scores of male and female student taught computer studies using flipped classroom instructional strategy.

Table 10:

Analysis of covariance (ANCOVA) of the significant difference in the mean retention scores of male and female student taught computer studies using FCIS

Source	Type III Sum of square	df	Mean Square	F	Sig
Corrected Model	135985.201	4	33996.300	1298.612	.000
Intercept	1475.052	1	1475.052	56.345	.002
Post test	446.600	1	466.600	17.060	.000
Gender	28.370	1	28.370	1.084	.299
Error	7513.361	287	26.179		
Total	435508.000	292			
Corrected Total	143498.562	291			

R squared = .948 (adjusted R squared = .947)

Table 10 depicted that with respect to gender on students' retention, an F-ratio of 1.084 was obtained wit associated probability value (p-value) of .299. Since the associated p-value of .299 was greater than 0.05 level of significance, the null hypothesis was not rejected. At this juncture, there is no significant difference in the mean retention scores of male and female students taught computer studies using FCIS.

Hypothesis 5

There is no significant interaction effect between teaching methods and gender of students' achievement in computer studies.

Table 11:

Analysis of covariance (ANCOVA) of the significant interaction effect of teaching methods and gender of students' achievement in computer studies

Source	Type III Sum of square	df	Mean Square	F	Sig
Corrected Model	74528.093	4	33996.300	1298.612	.000
Intercept	6311.894	1	1475.052	56.345	.002
Pre test	346.381	1	466.600	17.060	.000
Group	9796.110	1	28.370	1.084	.299
Gender	1.483	1	1.483	.206	.651
Group*Gender	21.227	1	21.227	2.942	.087
Error	2070.411	287	7.214		
Total	275397.000	292			
Corrected Total	76598.503	291			

R squared = .973 (adjusted R squared = .973)

Result in table 11 indicates with respect to the interaction between teaching methods and gender on students achievement and F-ratio of 2.942 was obtained with associated probability value of .087. Since the associated probability value of 0.87 was greater than 0.05 level of significance the null hypothesis was not rejected. At the same time, there is no significant interaction effect between teaching methods and gender on students achievement in computer studies.

Hypothesis 6

There is no significant interaction effect of teaching methods and gender on students' retention in computer studies.

Table 12

Analysis of covariance (ANCOVA) of the significant interaction effect of teaching methods and gender on students' retention in the mean retention computer studies

Source	Type III Sum of square	df	Mean Square	F	Sig
Corrected Model	135985.201	4	33996.300	1298.612	.000
Intercept	1475.052	1	1475.052	56.345	.002
Post test	446.600	1	446.600	17.060	.000
Group	1946.996	1	1946.996	74.373	.299
Gender	28.370	1	128.370	1.084	.299
Group*Gender	64.776	1	64.776	2.474	.117
Error	7513.361	287	26.179		
Total	435508.000	292			
Corrected Total	143498.562	291			

R squared = .948 (adjusted R squared = .947)

Table 12 displayed with respect to the interaction between teaching methods and gender on students' retention in computer studies, an F-ratio of 2.474 was obtained with associated probability value of .117. Since the associated p-value of .117 was greater than 0.05 level of significance, null hypothesis was not rejected. In ad much as, there is no significant interaction effect of teaching methods and gender on students' retention in computer studies.

Conclusion

Flipped classroom instructional strategy is an innovative and student-centered teaching strategy that gives computer students the opportunity to pre-intimate with computer concepts before the real class experience. Hence, offering computer students a near mastery of concept before the real class experience. This study has provided empirical evidence on the effectiveness of flipped classroom instructional strategy in improving students achievement and retention in computer studies irrespective of gender. The researcher concludes that: flipped classroom instructional strategy enhanced students' achievement and retention in computer studies. Also concluded is that gender has no significant influence on students' achievement and retention in computer studies using the flipped classroom instructional strategy. Also proved by the study is that flipped classroom instructional strategy is gender unbiased and does not depend on gender to be effective in improving students' achievement and retention in computer studies.

The study found also that there was no significant interaction effect of the teaching methods and gender on students' achievement and retention in computer studies. This reveals that flipped classroom instructional strategy is effective on its own than in interaction with

gender. The implication of the finding of this research work is that flipped classroom instructional strategy creates adequate instructional materials and conducive learning environment needed for achievement and retention optimization in computer studies and allied sciences.

Recommendations

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

1. Computer teachers should employ the flipped classroom instructional strategy so as to give students opportunity to pre-intimate with concepts which will result in mastery of computer concepts.
2. Constant and sustained in-service training for computer teacher so as to develop expertize on effective application of the flipped classroom instructional strategy.
3. Enlightening the students on the novelty of the flipped classroom instructional strategy will result in the students appreciating opportunities inherent in the strategy themselves
4. Curriculum planners must be intimated on the need to incorporate a flipped classroom friendly curriculum. So as to optimize integration of the strategy.

REFERENCES

Ahmed, M. U. (2019). The effects of flipped classroom instructional strategy on the achievement, attitudes and retention in literature .. *Retrieved April 6th, 2013 from http:/www.school-for- champions.come-learning/blended learning.htm.*

Amah, P. (2021). Effect of open inquiry based learning on secondary school students achievement and interest in computer. *Journal of Science Education*.1 (1) 45-51.*proceedings of 49th Annual Conference of Science Teachers' Association of Nigeria (STAN).*

Ezeh, F. (2020). Effects of constructivists instructional approach on students' achievement and retention in basic computer concepts In U. Nzewi (Ed) *STAN Proceedings of the 47th Annual Conference, 253-259.*

Ezemuoghalu, P.C. (2018). Effect of open inquiry teaching approach biology students achievement in Enugu state. . *Journal of the Science Teachers Association of Nigeria,24*(1&2), *94-100issertation at the Department of Education, Ahmadu Bello University, Zaria.*

Ezeoke, S. (2021). Influence of gender and cognitive styles on students achievement in physics essay test. *Journal of Science Teachers association of Nigeria*, *42* (1&2), 133-13.

Ezeudu, A. A. (2018). Gender and acquisition of science process skills among secondary school students: Implications for science teaching. *Journal of Women in Science, Technology and Mathematics Education in Nigeria,* 206-209.

Marcel, J. N. (2017). Effect of class-size on the academic achievement and retention of different ability Groups among senior secondary school chemistry students. *Ph.D. Dissertation, A.B.U., Zaria*

Mark, E. (2019). The effect of computer-assisted instruction on the attitude and achievements of 8th grade primary school children in the subjects of geometric objects' surface areas and their volume.*Unpublished Master's Thesis University of Gazi, Ankara, Turkey*

Muhamad, V. F. T. (2018).Commitment to science and gender as determinants of student's achievement and practical skills in physics. *Journal of Science Teachers association of Nigeria,1*(46), 125-135

Obi, Z. (2021). The need for innovative instructional strategy in the teaching and learning of sciences in Nigeria: the role of school administrators. *Journal of Science Education and Allied Discipline*. *Chukwuemeka Odumegwu OjukwuUniversiy*, *Uli, Anambra state*

Offor, E. N. (2022).Effect of computer assisted instructional package on secondary school students' achievement in introductory technology in Ilorin, Nigerian. *The Nigeria Journal of Educational Media and Technology*, 12(1), 98-107.

Ojike, M.A. (2017) Effects of a conceptual change instructional strategy on the achievement, retention and attitude of secondary school students with varied ability. *Unpublished Ph.D thesis A.B.U. Zaria.*

Okafor, D. A. (2021). Impact of inclusion education on academic performance, students behaviour and self-esteem and parental attitudes. *Journal of Educational Research, 91* (2), 67-80.

Okoye, J. N. (2020). Activity based approach to effective teaching and learning of cellular respiration to secondary school students. *Journal Of Science Teachers Association Of Nigeria, Biology Workshop Series, 4,* 1-8.

Opara, A. J. (2011). Inquiry method and student academic achievement in Biology: lessons and policy implications. *American–Eurasian Journal of Scientific Research*, *6(1)*, 28-31. Retrieved December, 16, 2014 URL: http://www.idosi.org/aejsr/6%281%2911/5.pdf

Opara, F. & Wrinkor, A. (2005).*History and philosophy of science.* Our savior press Ltd.

Opara, F. (2015). Towards sustainable economic development through creative and functional education. *COOU Journal of Education Research, 4*(1), 2-12.

Osegbo, I., Ifeakor, C., & Enemuo, J. (2009). *Research methodology in education: basic issues and techniques.*