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EFFECT OF FLIPPED CLASSROOM INSTRUCTION VIA GOOGLE CLASSROOM ON SECONDARY SCHOOL STUDENTS' ACADEMIC ACHIEVEMENT CHEMISTRY IN ONITSHA EDUCATION ZONE

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ABSTRACT

The study investigated the effect of flipped classroom instruction via Google classroom on secondary school students' academic achievement on chemistry in Onitsha educational zone. The study was conducted at Onitsha education zone of Anambra State. The influence of gender on students' achievement was determined. Two research questions were raised to guide the study and two hypotheses were tested at 0.05 alpha levels. A quasi-experimental of research design was adopted; specifically the pre-test and post-test non-randomized control group design was used. The population of the study was 3192 senior secondary year two students offering chemistry in Onitsha education zone out of which a sample size of 102 students was drawn using purposive and random sampling techniques. Also two schools were chosen through simple random sampling techniques as experimental and control group centre. The instruments for data collection were Chemistry Achievement Test (CAT). The instruments were validated by two experts in departments of science education and one in educational foundation from Nnamdi Azikwe University, Akwa. The reliability of CAT was established using Kudder-Richardson formula (K-R20) with internal consistency of 0.82. The data for the study were obtained by administering the instrument to the respondent as pretest posttest, data gathered were analyzed using mean and standard deviation to answer research questions and the null hypotheses were tested using Analysis of covariance (ANCOVA). The findings from the results showed that there is a significant difference in the academic attitude achievement of students taught chemistry using FCIVGC and those taught lectured method in favour of the FCIVGC group. There is significant interaction effect of instructional approach and gender on students' achievement in chemistry. This implies that FCIVGC is gender unbiased and favour both male and female chemistry students'. Generally, the study has shown that FCIVGC of Brame is effective in enhancing achievement in chemistry. It was concluded that FCIVGC is more effective for male students academic achievement and encourages positive attitude of male chemistry students in learning chemistry. It was recommended that teachers should employ FCIVGC in teaching and learning of chemistry.

Keywords: Flipped Classroom Instruction; Google Classroom; Students' Academic Achievement; Chemistry.

Introduction

The study of science in general and chemistry in particular has led to the improvement of life in every aspect of human endeavour. Chemistry is the branch of science concerned with the substances of which matter is composed, the investigation of their properties and reactions, and the use of such reactions to form new substances (Izuegbunam and Osuafor, 2021).

Chemistry has it center influence to every filed of life. From the food we eat the clothes we wear, the book and paper we read, to the medication and transportation all have something or the other to do with chemistry. Chemistry has made tremendous contribution in the world; it has helped man to understand the complexity of his body, the environment, benefit and hazard of this world. It has been increasingly used in providing solution to problems such as health, agriculture, food, shelter and manufacturing. There is scarcely a single area of our daily lives that is not affected by chemistry.

To study chemistry daily, in this modernized digital world, good teacher apply effective instructional mode to help learner construct their knowledge at anytime, anywhere, and at their own pace. The instructional mode should be appropriate for their developmental and era level, so that they will not only improve their academic achievement but also have positive attitude towards chemistry. That is why , Hanan, (2021) stated that, looking at advancement in modernization of the world, the Nigeria educational system requires learners who could have acquired the necessary attitude and skill of digital instructional modes in learning science, and chemistry in particular.

However, it is disheartening to note that chemistry students' academic achievement in the subject in senior secondary school certificate examination has remained poor in this digital era. This is supported by WAEC Chief Examiner's report (2020) (see appendix). The poor academic achievement in 2020 and 2021 assessments as asserted by, the Unified Tertiary Matriculation Examination (UTME) 2021, according to the Registrar of Joint Admission and Matriculation Board, Professor Ishaq Oloyede on National Television Authority (NTA) announcement, 2021 6th July, stated that candidate performed below expectation in 2021 JAMB compared to previous years for obvious reasons, especially the covid 19 pandemic leading to the closure of schools and emergency online learning.

Also, poor achievement of students has been attributed to some students' factors such as; student sex role stereotyping, negative attitude towards chemistry and teacher related factor such as emergence on line instructional mode in covid 19, poor teacher preparedness and application of inefficient instructional modes (Chukwu, 2021). In Nigeria, efforts are been made by researchers, government organisation to diagnose the problems associated with teaching and learning of chemistry in order to proffer solution that lead to better achievement. However, the WAEC chief examiners (2020) comments indicate that achievement in chemistry at secondary

school remains poor. Again, there are some gender disparities towards the subject as Chemistry has always been seen as a very male dominated field leading to female students having a different attitude towards the subject. Overall, students' academic achievement in the subject has not significantly improved over the years (Ezeanya and Okigbo, 2021; Konyefa and Okigbo, 2021). Could it be that teachers' modes of instruction in this era is not effective to improve student's achievement?

Effective teaching involves classroom teaching behaviour/ interaction between the teacher, the students, the subject matter and combination of these three dimensions (Akuezilo in George, 2021). As it is understood, that for centuries teaching and learning in secondary schools in Nigeria generally tended to be conventional, through face to face communication techniques in the physical classroom based only. Since the dawn of the novel Coronavirus in 2020, the need of a technology-oriented learning has become inevitable. In Nigeria, the increase in security issues, natural disasters like floods have proven to seriously disrupt educational activities. The challenges facing the education systems in Nigeria and Anambra state in particular continue to intensify. The activities of Unknown Gun Men (UGM) and the 2012 and the recent ravaging 2022 flood have affected school days in the state and educational system in Anambra state as in other states of Nigeria. The incessant disruption of academic activities and calendar has incited the need for a flipped classroom.

As the case may be, most students in Onitsha Education zone as well as those in Anambra state in general spends more of their time online using smart phones and tablets for facebook, tweeter, and watching online video whenever academic activities is disrupted. Therefore, these students should trusted with digital instructional mode like flipped classroom, this will makes learning all the more seamless, self-paced, interesting and real in learning science and chemistry in particular. Also, United Nation Educational, Scientific and Cultural Organization UNESCO (2020) stated that, eventually globalization of e-education is bound to happen just as we have witnessed globalization of e-mail, e-commerce and e-government. This implies that our nation's advancement in science depends to a large extent on its strong science education digital instructional mode in this era. Therefore, to achieve effectiveness, in teaching and learning of science in general and chemistry in particular in this digital era, teachers need to adopt some digital instructional mode. One of such mode could be flipped classroom instructional modes via google classroom (FCIVGC).

Flipped classroom is an instructional mode and a type of blended learning that integrates physical classroom with online via digital tool developed by Jonathan and Aaron in 2012. It is a multimedia cognitive instructional mode that focused cognitive processes that the students used to learn, FCIVGC focuses on considering the students mind as a dual channel, limited capacity, and active processing system by presenting instruction as audio, video , narrations , text

and graphics'. So that the learner can actively generate meaningful relationship between instructions in both classrooms and online, since students learn contents at home and practice working through it at school. A side benefit is that teachers can record lessons that emphasis on a given curriculum contents to achieve educational goals. It also allowing students to pause, rewind, review as well as creating already made library for students review make work, (The flipped classroom learning network, 2014). This is unlike the physical classroom only based learning of conventional instructional modes, which ends in physical classroom teaching. Teacher talks, writes, and in fact does everything in the classroom.

There are several versions of flipped classroom learning model as proposed by many researchers like as Jonathan and Aaron (2012), Wesley Baker (2000), Walvoord and Anderson (1998), and Brame (2013). This study focuses on Brame (2013) model which is of Inverted Classroom Assignment Peer Instruction Based Model. This model according to Brame, helps students' learning problem solving, and reasoning skills to improve because they first encounter learning content at home and interacted with each other before physical classroom. Before peer instruction occurs in physical class, learners are first received their first learning exposure before class in new material, completing knowledge based assignments before physical classroom. Here, the instructor coach rather than lectured and learners work on the processing aspect of learning, including the critical thinking processes of analyzing, problem solving, synthesizing, during class. It is an instructional mode with three instructional phase namely; before class, during class and after class. Flipped classroom could be seen as a one useful instructional mode in this digital era that could improve academic achievement.

Academic achievement describes academic outcomes that indicate the extent to which a student has achieved their learning goals (Ejiofor and Osuafor, 2019). According to Konyefa and Okigbo (2021), academic achievement is the grade obtained through achievement test through which the teacher evaluates the extent to which instructional objectives have been achieved. Academic achievement or academic performance is the extent to which a student, teacher or institution has attained their short or long-term educational objectives. Students' achievement refers to performance in a school subject as designated by a score or mark obtained in an achievement test (Abd, Andi and Muhammad, 2020). It represents performance outcomes that indicate the extent to which a person has accomplished specific goals that were the focus of education. Academic achievement is often measured through continuous assessments or examinations such as those of the West African Senior School Certificate Examination (WASSCE) administered by West African Examination Council (WAEC)

Evidence from the WAEC Chief Examiner's report showed that from 2013-2016, there was a persistent decline in the percentage of those who made a credit pass from 72.34% in 2013, to 62.49% in 2014, to 60.6% in 2015 and 57.74% in 2016. From

2017 to 2019, reports on the worst performances of students in chemistry were observed (Appendix A, p. 98). Although, a lot of factors such as inadequate laboratory facilities, the abstract nature of the subject and lack of adequate teaching staff has been implicated, the instructional methods adopted by chemistry teachers stand out as the most prominent factor (Konyefa and Okigbo, 2021; Nwanze and Okoli, 2021).

Problems statement

Science teaching and learning in Nigeria education system has been done conventionally, where the teacher is the principal instructor while the students are the recipient of the information. Students mostly are passively learning rather than been active in the classroom activities. Chemistry teaching and learning tends to be more teacher oriented than students oriented. Teaching and learning activities are as revolve around the teacher and most of the time students lose interest in the learning activities and most of the time see science and chemistry as an abstract subject. This has greatly affected the achievement of students in chemistry.

As the chalk and board teaching and learning method are gradually phasing away in different quarters across the ends of the world, so many people are embracing the need for technology in teaching and learning. Technology is a good way to harness the interest of young minds toward learning new information. It makes them actively, passionate and can engage their time meaningfully towards effective learning, improved achievement.

But the need for the application of digital instructional mode was made relevant with the dawn of the novel coronavirus and its effect, and natural disasters which have serious disrupted academic programmes and have led to poor academic achievement and poor attitude of secondary school students in Onitsha Education zone and Anambra state at large.

Again, given that the gender disparity in the subject area has remained inconclusive, the researcher saw the need to further explore the gender difference in achievement and attitude towards the subject when flipping the classroom via google classroom. There arises whether the instructional mode will be effective for improving achievement and enhancing the attitude of students towards science oriented subjects like chemistry. The researcher seeks to determine whether flipping the classroom via google classroom would improve students' achievement.

Research Question

1. What are the differences in the pretest and posttest mean achievement scores of students taught chemistry using Flipped Classroom Instruction via Google Classroom (FCIVGC) and those taught using Lecture method (LM)?
2. What are the differences in the pretest and posttest mean achievement scores of male and female students taught chemistry using FCIVGC and LM?

Hypotheses

The following hypotheses will be tested at 0.05 level of significance:

1. There is no significant difference in the mean achievement scores of students

taught chemistry using Flipped Classroom Instruction via Google Classroom (FCIVGC) and those taught using conventional method (LM).

2. There is no significant interaction effect of instructional approaches (FCIVGC and LM.) and gender on students' achievement in chemistry.

Research Method

The study adopted a quasi-experimental design, specifically, the pretest-posttest non-randomized control group. The study was carried out using Onitsha Education zone of Anambra state. The population consists of 3,192 senior secondary year two (SS2) students offering chemistry in Onitsha education zone of Anambra state. The sample consisted of one hundred and two (102) SS2 students offering chemistry in Onitsha Education Zone Anambra state which was drawn from the population using purposive sampling technique. The validity of the CAT was ascertained by using experts' opinion. One expert in Educational Psychology and two lecturers from Science Education Department all from Nnmdi Azikiwe University, Awka. The reliability of the instrument was esabilished Kuder-Richardson Formula 20 (KR-20) a coefficient of internal consistency of 0.71 for CAT.

The experiment was conducted in two phases. Phase one was be training of research assistants who will be the regular SS2 chemistry teachers in the selected schools. Phase two involved the treatment using the different lesson plans prepared for the experimental and control groups and their respective instructional approaches. Before the treatment, the students will be given the instrument (CAT) for the study as a pre-test. In other to use the Google classroom effectively for treatment a 'Google Workspace for Education' account was created by the research to enable her use Google Classroom. From there a Google classroom was created, the researcher will further create google email accounts for all students in the intact class selected for the study. The e-mail address name and passwords was given to the students as their login Id. And invitation hyperlink was created by the research and given to the students to enable them participate in the google classroom. The classroom created by the researcher to be used by the regular chemistry teacher who will be given the classroom account details.

The chemistry teacher taught the concepts in a noiseless laboratory in the school using the lesson plan and the videos of the lessons was shot. The lesson videos was shot within the space of 3 days, 2 and half hour per day. After the videos are shot using ring light and 48 megapixel Camon S16 techno android phone, the videos was edited using viva video application to remove the noises, edit and delete time gaps during the lectures to reduce the video overall duration. The videos was divided into short clips of 15 minutes so that students can watch the content and attend to the assignments or class work relating to the lesson content of each video. The videos was posted one per day for each concept until one week with corresponding class works and assignment which was monitored, graded and uploaded by the

researcher for the students to receive their feedbacks while at home. Each day in the classroom, the teacher will only give further exercise to the students in the classroom and intimate them with the objectives for the next class while further orienting them on the effective ways to navigate and use the google classroom on the parents or guardians phone or laptops. The students received the post test in the classroom in printed papers at the end of the treatment.

Presentation of Results

Research question 1: What are the differences in the pretest and posttest mean achievement scores of students taught chemistry using Flipped Classroom Instruction via Google Classroom (FCIVGC) and those taught using Lecture method (LM)?

Table 1: Difference on Mean, Standard Deviation and Mean gain score of students taught Chemistry using Flipped Classroom Instruction via Google Classroom (FCIVGC) and Lecture method (LM)

Subjects		Pretest		Posttest		Mean gain	Mean diff.
	№	X	SD	X	SD		
FCIVGC	59	47.47	13.21	65.90	12.53	18.43	
LM	50	32.42	8.92	48.38	9.95	15.96	2.47

Table 1 shows the mean achievement and standard deviation, mean gain and mean difference on the pretest and posttest scores of students who were taught chemistry using FCIVGC and LM. As obtained from the table it is imperative that students who were taught using FCIVGC has mean gain score of i8.43 from the pretest and posttest means of 47.47 and 65.90 respectively. On the other hand students who were taught using lecture method (LM) had mean gain of 15.96 from the pretest and posttest mean scores of 32.42 and 48.38 respectively. A mean difference of 2.47 was obtained in the favour of students taught using FCIVGC.

Research question 2: What are the differences in the pretest and posttest mean achievement scores of male and female students taught chemistry using FCIVGC and LM?

Table 2: Standard Deviation and Mean of male and female students taught Chemistry using FCIVGC and LM

Teaching method	Gender	N	Mean	S.D
	Male	27	71.41	10.10
FCCIVGC	Female	32	61.25	12.63
	Male	28	45.57	9.59
LM	Female	22	51.95	9.42

Table 2 shows the mean standard deviation, of male and female students taught Chemistry using FCIVGC and LM. Male students who were taught chemistry using FCIVGC had mean 71.41 in their posttest scores their female counterparts had mean of 61.25 in posttest scores with a mean gain of 17.97 chemistry using FCIVGC which favoured male students. Male and female students who were taught using LM posttest score of 45.57 and 51.95 for male students' for female students.

Hypothesis 1: There is no significant difference in the mean achievement scores of students taught chemistry using Flipped Classroom Instruction via Google Classroom (FCIVGC) and those taught using conventional method (LM).

Table 3: Analysis of Covariance Test on the Effect of Instructional approach on the Achievement of Students in chemistry when taught with FCIVGC and LM

Dependent Variable: post-test

Source	Type III sum of square	df	Mean of square	F	Sig
Corrected model	17074.17[a]	2	8537.08	174.34	.000
Intercept	5304.43	1	5304.43	108.32	.000
Pretest	8768.40	1	8768.40	179.06	.000
Method	593.18	1	593.18	12.11	.001
Error	5190.77	106	48.97		
Total	387203.00	109			
Corrected total	22264.94	108			

Table 3 is show the main effect of teaching method on the academic achievement of students. F (1,106)=12.11, P = 0.01 <α=0.05, there is a significant difference in the mean achievement scores of students taught using FCIVGC and those

taught using LM. Therefore the null hypothesis that there is no significant difference in the mean achievement scores of students taught chemistry using FCIVGC and those taught using LM is not accepted, the alternative hypothesis holds.

Hypothesis 2: There is no significant interaction effect of instructional approaches (FCIVGC and LM.) and gender on students' achievement in chemistry.

Table 4: Test of interactive effect of Instructional approach and gender on the achievement of students taught chemistry

Dependent Variable: posttest

Source	Type III sum of square	df	Mean of square	F	Sig
Corrected model	10318.61[a]	3	3439.54	30.23	.000
Intercept	35415.28	1	35415.28	3115.95	.000
Gender*method	10318.61	3	3439.54	30.23	.000
Error	11946.33	105	113.78		
Total	387203.00	109			
Corrected total	22264.94	108			

Table 4 shows the interaction between gender and treatment (FCIVGC and LM) on the achievement of the students in chemistry. From the table there is a significant interactive effect between method and gender on the achievement of the students thus F (3,105) =30.23, p=0.000 < α= 0.05. This means that the method of teaching and the gender of the students had its effect on the achievement of the students thus the null hypothesis that there is no significant interactive effect of gender and treatment on the achievement of students taught chemistry is not accepted.

Discussion of findings

In this study students were exposed to treatment using Flipped Classroom Instruction via Google Classroom (FCIVGC) and Lecture method (LM), the effect of the treatment was observed on the achievement of the students. it imperative to note that students who were taught using FCIVGC had posttest mean of 65.90 while those taught with LM has posttest mean of 48.38. With a mean difference of 2.47 from their various mean gain, those taught with FCIVGC had achieved more than those taught with LM. However there was also a significant difference in the mean achievement score of students taught using FCIVGC and those taught with LM in favour of FCIVGC group. This implies that FCIVGC improved the achievement of students in chemistry. As a matter of fact FCIVGC is an innovative teaching approach where students take responsibility for their learning and also get committed towards solving their learning difficulties with the as the teacher help them facilitate their learning. To this end students

were more committed to improving their learning ability and also getting inclined to technological devices gave them opportunity to explore their learning needs beyond the classroom. This has helped the improved on their achievement in chemistry.

The study was in line with the work Ramadhani, Umam, Abdurrahman and Syazali (2019) who found that the average Chemistry learning outcomes of students taught using the FPBLM based on Google Classroom LMS experienced a significant increase in academic achievement compared to conventional learning. Also Oyarinde and Komolafe (2020) and Warman (2021) found out that Google classroom platform as an online learning delivery positively affected students' academic achievement which was in line with the findings of this study.

There was a significant interaction effect of gender and method on the academic achievement and attitude of student in chemistry. This implies that the method of teaching and gender contributed to the effect observed in achievement of students in chemistry.

Conclusion

From the finding of the study and discussion made, it can be concluded that FCIVGC has effect on the achievement and attitude of students more than LM in chemistry.

Recommendation

Based on the findings of this study, the following recommendations are made.

1. Teachers of Chemistry should adopt FCIVGC in teaching Chemistry most especially now that technology is having its way in almost all human activities teaching and learning inclusive.
2. Teachers of Chemistry should train, encourage and motivate students on how to use FCIVGC in learning Chemistry so as to improve achievement in this era.
3. Government and other stakeholders in education should constantly organize seminars and workshops where Chemistry teachers will be trained on the use of technology and innovative classroom teaching methods in chemistry such as FCIVGC that will effectively improve the achievement and attitude of students towards chemistry.

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