VIRTUAL ONLINE AND FLIP CHARTS CLASSROOMS ON CHEMISTRY STUDENTS' ACADEMIC ACHIEVEMENT USING THE CONCEPT OF GREEN-HOUSE GAS EMISSION IN ITU LOCAL GOVERNMENT AREA, NIGERIA.

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ABSTRACT

This study examines the Virtual Online and Flip Charts Classrooms on Chemistry Students' Academic Achievement Using the Concept of Green-House Gas Emission in Itu Local Government Area. Four purpose of study, four research questions and four null hypotheses were carefully formulated to guide the study. The study also adopted a quasi-experimental research design with a non randomized pre-test, post-test design. The population of the study consisted of 1800 SS2 chemistry drawn students from 2024/2025 academic session drawn from the eight (8) co-educational secondary schools in Itu Local Government Area of Akwa Ibom State. The study sample comprised of one hundred and forty seven (147) SS2 chemistry students selected using purposive sampling technique. Researcher constructed an instrument called: Green House Gas Emission Achievement Test (GHGEAT) was used for data collection. The instrument was validated by three research experts from Science Education Department and Department of Chemistry, University of Uyo respectively. The reliability coefficient of the GHGEAT, was determined using Kuder-Richardson's formular 21(KR-21) with a statistics of 0.81. The data obtained from all the tests were analyzed using mean, Standard Deviation and Analysis of Covariance (ANCOVA) statistics. The result showed that there is a significant difference in chemistry students' academic achievement scores taught the concept of greenhouse gas emission using flip charts classrooms strategy. It was also revealed that there is a significant difference in the achievement scores of male and female chemistry students taught green house gas emission using flip charts. The result also showed that there is a significant interaction effect of visual-online classroom, flip charts and gender on chemistry students' academic achievements on the concept of green-house gas emission. The recommendations made indicate that flip charts instructional strategy should be adopted and use by chemistry teachers in the teaching and learning of the concept of green-house gas emission in public secondary schools to enhance their achievements and understanding in learning the concept.

KEYWORDS: Virtual Online, Flip Charts, Chemistry, Students' Academic Achievement, Green-House Gas Emission.

Introduction

Science Education is a field concerned with the production of scientifically literate citizens. Brain (2025) defined Science education as the study of the interrelationships between science as a discipline and the application of educational principles to its understanding of its teaching and learning of science subjects.

Chemistry is one of the most important subjects in science, and contains a number of abstract concepts that students often find difficult to understand. Thus, students sometimes lose interest in learning Chemistry as a subject. One of the objectives of Science Education is to develop students' learning interest in science and technology as today's society depends largely on developments in science and technology (FGN 2015). Teachers are expected to devise ways of making their students to develop positive interest towards science and science-related disciplines (Cox 2019).

Chemistry is a science that systematically studies the composition, properties and activities of organic and inorganic substances and the various elementary forms of matter. Chemistry, by its nature, is the central science because diverse subjects share essential links with it. It is one of the core science subjects offered in senior secondary schools in Nigeria. The teaching of Chemistry develops student manipulative and experimental skills to make them competent and confident in conducting experiments. Chemistry is regarded as a difficult subject by many students, teachers and science teachers because of the abstract nature of many chemical concepts, inappropriate teaching strategies, lack of teaching materials and the difficulty in the language of Chemistry. Both science teachers and cognitive researchers agree that efforts to understand and improve students' academic performance in Chemistry should be focused on teaching strategies. Research has shown that many students do not correctly understand fundamental concepts in Chemistry (Kamisah and Nur, 2023).

A flip chart is a stationery item consisting of a pad of large paper sheets. It is a series of large paper sheets containing charts information, fastened loosely to allow them to be turned over and held by a frame for display as to illustrate a lesson. It is typically fixed to the upper edge of a whiteboard and mostly supported on a tripod stand. Flip chart is a set of large pieces of paper that are connected at the top of a whiteboard and supported on a tripod stand. According to Umar (2020), flip chart is a useful instructional resource. It can be used in the classroom to teach concepts that are difficult to understand using verbal codes only as well as explain, illustrate, classify and reinforce certain points in specific lessons. Such charts are commonly used for presentations. The pages are flip or brought up and to the back as they are used. Flip chart is a useful teaching aid that can be purchased or prepared. According to Adesina (2017), flip charts promote interaction between teachers and students. They allow teachers to elicit ideas and responses from students, list them on the chart, and use these responses to facilitate discussions or solve problems together. This kind of direct engagement can significantly enhance the retention of information and encourage participation. Flip charts, being non-digital and tangible, also offer the benefit of flexibility and spontaneity, allowing instructors to write or draw in real-time during the lesson.

According to Brain (2025) opined that online instructional strategy enhances student academic achievement and retention in the concept of population in Itu Local

Government Area and its goes long away in enhancing student retention and interest in the subject.

The Virtual online learning classroom is an ICT based teaching strategy. Virtual learning classroom is a way of taking advantage of capability that computer technology has provided. Virtual learning classroom is used as visual to illustrate, provide meaning and give organization to the material being taught. The advancement in Virtual learning classroom allows realistic scenes to be generated and provision of interactive tools that students are able to control. This provides the opportunity for a better understanding and improved achievement of instructional materials (Akpan, 2020). Virtual classroom create special effects to stimulate images that would be impossible to show with non-virtual classroom. Example is space craft flying by the planet Saturn. It produce images from scientific data, used to visualize large quantities of data in the study of interactions in complex systems, such as fluid dynamics, particle collisions and the development of severe storms. These mathematically based models use virtual classroom to help researchers see relationships that might otherwise be overlooked.

Academic achievement is the outcome of education. The extent to which a student, teacher or institution has achieved their educational goals. Academic achievement is commonly measured by examinations or continuous assessment. According to Essien (2020), Individual differences in academic achievement have been linked to differences in intelligence and personality. Students with higher mental ability as demonstrated by IQ tests and those who are higher in conscientiousness tend to achieve highly in academic settings. A recent meta-analysis suggested that mental curiosity (as measured by typical intellectual engagement) has an important influence on academic achievement in addition to intelligence and conscientiousness. Ajayi and Angura (2021) observed that the achievement rate of students is as a result of instructional modalities adopted by teachers. In this regard, inappropriate instructional models such as use of flip charts and virtual learning methods used by Chemistry teachers invariably translates to students' inability to achieve better academically.

Esan (2021) in his studies observed that boys have higher academic achievement than girls and Ajibola (2020) indicates that female students have higher academic achievement than male students. Giginna (2022) observes that there was no significant difference in the academic achievement of both male and female students. Studies on gender difference in achievement in Chemistry continue to yield inconsistency results and it has been usually attributed to unequal exposure of boys and girls to learning instructions relevant to Chemistry. Essien (2021) reported that the relative superiority of male to female in scientific attitudes, retention, participation and overall achievement is a world-wide phenomenon.

Greenhouse gas (GHG) emissions is the release of certain gases into the Earth's atmosphere that trap heat, leading to the greenhouse effect and contributing to global warming and climate change. The primary greenhouse gases include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), fluorinated gases, and water vapor. While water vapor is a natural component of the atmosphere, human activities primarily contribute to the increased concentrations of the other greenhouse gases.

Carbon Dioxide (CO_2) Emissions

Sources: The combustion of fossil fuels for energy production, deforestation, and industrial processes are the main sources of CO_2 emissions (Friedlingstein et al., 2019).

Impact: CO_2 is the most significant contributor to the enhanced greenhouse effect due to its long atmospheric lifetime (Houghton et al., 2019).

Methane (CH_4) Emissions

Sources: Methane is released during the production and transport of coal, oil, and natural gas. Agricultural practices, such as rice cultivation and livestock digestion, also contribute significantly (IPCC, 2019).

Impact: While methane has a shorter atmospheric lifetime than CO_2, it is much more effective at trapping heat, making it a potent greenhouse gas.

Nitrous Oxide (N_2O) Emissions

Sources: Agricultural and industrial activities, as well as the burning of fossil fuels, contribute to nitrous oxide emissions (Ravishankara *et al.,* 2019).

Impact: Nitrous oxide has a longer atmospheric lifetime than methane and is a potent greenhouse gas with a significant impact on global warming.

Fluorinated Gases

Sources: Fluorinated gases, including hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), and nitrogen trifluoride (NF_3), are synthetic gases used in various industrial applications (Prinn *et al*., 2018).

Impact: While these gases are present in much smaller quantities compared to CO_2, they have high global warming potentials, contributing significantly to climate change (Montzka et al., 2021).

Water Vapor

Sources: Water vapor is a natural component of the atmosphere and is influenced by natural processes such as evaporation and condensation (IPCC, 2013).

Impact: While human activities do not directly emit water vapor, changes in other greenhouse gas concentrations can indirectly influence water vapor levels, amplifying the overall greenhouse effect (IPCC, 2013). According to the authors, the traditional approach being used alone in teaching chemical bonding is problematic and ineffective. Could flip chart and virtual online classroom when used with expository method improve students' achievement and retention in Green-house gas emission?

Nwagbo (2020) carried out a study on the effects of flip charts, virtual online classrooms and Students' Academic Achievement in Chemistry of different levels of scientific literacy. A pre-test, post-test non-equivalent control group design was used for the study. One Hundred and forty-seven (147) SS 11 students from 4 secondary schools (two schools assigned to treatment and the other two schools assigned random sampling techniques. Three instruments: Scientific Literacy Test (SLT), Attitude to Chemistry Scale (ACS) and Chemistry Achievement Test (CAT) were used to collect data. The data were collected using mean, standard deviation and ANCOVA. The findings of the study indicated among others that there is no significant

difference between flip charts, virtual online classrooms and Students' Academic Achievement in Chemistry for all levels of scientific literacy students.

The above studies and the present study are related in the sense that they deal with effects of flip charts and virtual learning strategies on students' achievement. However, the study seeks to investigate the influence of flip charts and virtual online classrooms on chemistry students' academic achievement on the concept of green-house gas emission in Itu Local Government Area, Akwa Ibom State, Nigeria.

Statement of the Problem

The teaching and learning of science subjects especially Chemistry, which is a core science subject, is very vital as it enhances students' admission into science oriented courses in universities and other institutions of higher learning. The persistent of poor academic achievement of students in Chemistry in external examinations is a major problem. WAEC Chief Examiners report as at 2021, 2022 and 2023 showed a high percentage of secondary school students' poor achievement in Chemistry during external examinations.

The poor achievement of students in Chemistry may be attributed or linked to poor teaching and learning strategies adopted by teachers during classroom instructions. Researchers in Chemistry education have continually sought for better teaching strategies that would provide a bridge between some Chemistry concepts that appears to be difficult, abstract, impracticable, ambiguous and unfamiliar, and the concept of Green House Gas Emission in Chemistry is not exempted.

There is therefore need for Chemistry teachers in Nigerian secondary schools to ensure our youths are properly taught by employing learner friendly instructional strategies that can guarantee better achievement of the concepts learned. It is on this note that, the present study seeks to examine the influence of virtual online and charts classrooms approach on students' academic on the concept of Green House Gas Emission in Chemistry in public secondary schools in Itu Local Government Area, Akwa Ibom State.

Purpose of the Study

The study investigated the relative effect of flip charts and virtual online classrooms on chemistry students' academic achievement on the concept of Green-house gas emission. Specifically, the study seeks to:

1. Determine the difference in the mean scores of chemistry students taught Green-house gas emission using flip charts, virtual online classrooms in public secondary schools in Itu Local Government Area.
2. Examine the difference in achievement mean scores of male and female chemistry students taught Green-house gas emission using flip charts in public secondary schools in Itu Local Government Area.
3. Examine the difference in achievement scores of male and female chemistry students taught Green-house gas emission using virtual online classrooms in public secondary schools in Itu Local Government Area.
4. Determine the interaction effects of flip charts, virtual online classrooms and gender on chemistry students' academic achievement on the concept of Green-house gas emission in public secondary schools in Itu Local Government Area.

Research Questions

The following research questions were posed for the study:

1. What is the difference in the mean scores of chemistry students taught Green-house gas emission using flip charts and virtual online classrooms in public secondary schools in Itu Local Government Area?
2. What is the difference in the achievement scores of male and female chemistry students taught Green-house gas emission using flip charts in public secondary schools in Itu Local Government Area?
3. What is the difference in the achievement scores of male and female chemistry students taught Green-house gas emission using virtual online classrooms in public secondary schools in Itu Local Government Area?
4. What is the interaction effects of flip charts, virtual online classrooms and gender on chemistry students' academic achievement on the concept of Green-house gas emission in public secondary schools in Itu Local Government Area?

Hypotheses

The following null hypotheses were formulated to guide the study:

1. There is no significant difference in the mean scores of chemistry students taught Green-house gas emission using flip charts and virtual online classrooms in public secondary schools in Itu Local Government Area.
2. There is no significant difference in the achievement scores of male and female chemistry students taught Green-house gas emission using flip charts in public secondary schools in Itu Local Government Area.
3. There is no significant difference in the achievement scores of male and female chemistry students taught Green-house gas emission using virtual online classrooms in public secondary schools in Itu Local Government Area.
4. There is no significant difference in the interaction effect of flip charts, virtual online classrooms and gender on chemistry students' academic achievement on the concept of Green-house gas emission in public secondary schools in Itu Local Government Area.

Significance of the Study

The findings of this study when published will be significant to the following persons learners, researchers, federal and state ministry of education, curriculum developers, proprietors of schools and authors of textbooks and science teachers, especially during the teaching of difficult concepts in sciences.

Methodology

Research Method

In this subsection, the research method is presented under the following subheadings: research design, area of the study, population of the study, sample and sampling technique, instrumentation, validation of the instrument, reliability of the instrument, scoring of the instrument, research procedure and method of data analysis.

Design of the Study

A quasi-experimental design was adopted for the study, specifically the study used a non-randomized pretest, posttest design with three levels of instruction methods digital online and flip charts classrooms teaching strategies with two levels of gender (male and female).

Area of the Study

The study was conducted in Itu Local Government Area of Akwa Ibom State. Itu is one of the 31 Local Government Areas of Akwa Ibom State. It is bounded to the North by Ibiono Ibom Local Government Area, East by Odukpani Local Government Area of Cross River State, and in the South by Uyo Local Government Area and West by Abak Local Government Area. Presently, there are 12 public secondary schools in the Local Government Area. The choice of this area was based on the fact that the researcher is versed with the environmental and educational challenges and problems in the study area.

Population of the Study

The population of the study comprised of all the senior secondary school one (SS 1) chemistry students in Itu Local Government Area in 2024/2025 academic session. The total number of SS II chemistry students in Itu Local Government Area is 1800 of which 800 are males and 1000 are females (Akwa Ibom State Secondary Education Board, 2023). This population comprised the whole students in the 8 public secondary schools in Itu Local Government Area.

Sample and Sampling Technique

The sample for this study comprised one hundred and forty seven (147) senior secondary two (SS2) chemistry students in the intact classes from two sample schools randomly selected using purposive sampling technique.

Instrumentation

The instrument that was used for collecting data for the study was Green House Gas Emission Achievement Test (GHGEAT). This instrument was developed by the researcher was designed to measure secondary school students' academic achievement in green-house gas emission. The instrument (GHGEAT) consisted of 40 test items, with options A-D. The items were used as the pretest and posttest.

Validity of the Instrument

To ensure that the items selected for inclusion in the instrument were capable of eliciting relevant responses from the respondents. The researcher presented the instrument for face and content validation to three experts – one expert which was selected was drawn from the department of Science Education, University of Uyo another was selected from the department of Test, Measurement and Evaluation, faculty of Education, University of Uyo as well as the department of chemistry, faculty of physical sciences, University of Uyo respectively.

Reliability of the Instrument

The reliability of Green House Gas Emission Achievement Test was determined by trial testing the instrument on a group of 25 SSII chemistry students who were not part of the study sample. After two weeks, the same instrument was re-administered to the same set of respondents. The data collected from the pilot study was computed using Pearson Product Moment Correlation with a reliability estimate of 0.81 for the instrument which indicated that the instrument was internally consistent in measuring what it was designed to measure.

Scoring of the Instrument

The Green House Gas Emission Achievement Test has each correct answer scored two (2) marks making a maximum mark of 50 and minimum mark of 2; and zero (0) mark each when answered wrongly.

Experimental Procedure

The researcher administered the instrument to the respondents with the help of three (3) research assistants. Before starting the data collection exercise, permissions were obtained from the sample secondary school principals through letters of introduction from the researchers' institution. The researcher met the chemistry teachers and the students to brief them about the purpose of the exercise in selecting the public secondary schools in Itu LGA and administered the instrument to them as pre-test. The sampled students were exposed to 80 minutes teaching period on the concept of green house gas emission, each using the two teaching strategies. The researcher administered a post-test immediately after the treatment. Thereafter, the researcher and the assistants retrieved the completed test. Data collected from the two test (pre-test and post-test) were used for analyses.

Method of Data Analysis

The obtained data from the study was analysed using mean, standard deviation and Analysis of Covariance (ANCOVA). Mean and standard deviation was used to answer research questions while Analysis of Covariance (ANCOVA) was used to test the hypothesis at 0.05 level of significance. Analysis of Covariance (ANCOVA) was used to reduce error due to random assignment of subjects to groups, to avoid system bias and also because the students were taught in their intact classes. Pretest scores was used as covariates in measuring students' academic achievement.

Data Analyses and Results

The results of the data obtained and analysed are presented in tables and organized under research questions and hypotheses.

Research Question One

What is the difference in the mean achievement scores of chemistry students taught Green-house gas emission using the concept of flip charts and virtual online classrooms?

Table 1: Mean and Standard Deviation of Chemistry Students Posttest Scores Taught Green House Gas Emission Using Flip Charts and Virtual Online Classroom

Groups	n	Pretest		Posttest		Mean Gain Score
		Mean	SD	Mean	SD	
Virtual online	64	12.56	2.84	15.53	3.70	2.97
Flip charts	83	12.49	2.83	39.52	5.66	27.03

Table 1, shows the pre-test and post-test mean scores and standard deviation of scores of the two groups of students taught using flip charts and virtual online classroom. The post-test and pre-test mean scores of 39.52 and 12.49 respectively, for those in flip charts yielded the best mean gain score of 27.03. This is followed by the post-test - pre-test mean gain scores of 15.53 and 12.56 for those in virtual online classroom. The post-test standard deviation scores of 5.66 and 3.70 for students in flip charts and virtual online classroom.

Hypothesis One

There is no significant difference in the mean achievement scores of chemistry students taught Green-house gas emission using flip charts and virtual online classrooms instructional strategies.

Table 2: Summary of Analysis of Covariance (ANCOVA) of Chemistry Students Posttest Scores Classified by Method with Pretest Scores as Covariate

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Decision at .05 alpha level
Corrected Model	20803.582a	2	10401.791	429.851	.000	S
Intercept	4870.851	1	4870.851	201.287	.000	S
Covariate(Pretest)	12.065	1	12.065	.499	.481	NS
Treatment	20800.574	1	20800.574	859.578	.000	S
Error	3484.595	127	24.199			
Total	148554.000	130				
Corrected Total	24288.177	129				

S = Significant at .05 alpha level, NS = Not significant at .05 alpha level
a. R squared = .475 (Adjusted R squared = .453) *Significant at .05 Alpha level

Table 2 shows that the calculated p-value .000 is less than the alpha level .05. Therefore, null hypothesis one is rejected. This implies that there is a significant difference in chemistry students' academic achievement scores taught greenhouse gas emission using flip charts and virtual online classrooms.

Research Question Two

What is the difference in the achievement scores of male and female chemistry students taught Green-house gas emission using flip charts instructional strategies?

Table 3: Mean and Standard Deviation of Chemistry Students Posttest Scores Taught Green House Gas Emission Using Flip Charts based on Gender

Groups	n	Pretest		Posttest			
		Mean	SD	Mean	SD	Mean score	Gain
Male	40	28.24	6.26	75.29	12.91	47.05	
Female	43	28.18	7.80	73.21	16.29	45.03	

Results in Table 3 shows that male students with mean difference of 47.05 academically performed slightly better than female students with difference of 45.03 when taught Green-house gas emission using flip charts. The post-test standard deviation scores of 12.91 and 16.29 for students in male and female groups indicate that, female students taught using flip charts had the higher mean achievement scores.

Hypothesis Two

There is no significant difference in the achievement scores of male and female chemistry students taught Greenhouse gas emission using flip charts.

Table 4: Summary of Analysis of Covariance (ANCOVA) of Chemistry Students Posttest Scores based on Gender with Pretest Scores as Covariate

Source	Type III Sum of Squares	Df	Mean Square	F	P-cal	Decision
Corrected Model	294.978a	2	147.489	16.718	.000	*
Intercept	1846.110	1	1846.110	209.261	.000	*
Pretest	294.660	1	294.660	33.400	.000	*
Gender	.022	1	.022	.002	.960	NS
Error	644.009	45	8.822			
Total	15807.000	48				
Corrected Total	938.987	47				

a. R squared = .314 (Adjusted R squared = .295) *Not Significant at .05 Alpha level

Table 4 shows that the calculated p-value of .960 is greater than the alpha level of .05. Therefore, null hypothesis two is retained. This implies that there is no significant difference in the achievement scores of male and female chemistry students taught greenhouse gas emission using flip charts.

Research Question Three

What is the difference in the achievement scores of male and female chemistry students taught Green-house gas emission using virtual online classroom instructional teaching strategies?

Table 5: Mean and Standard Deviation of Chemistry Students Posttest Scores Taught Green House Gas Emission Using Virtual Online Classroom based on Gender

Groups	n	Pretest		Posttest		Mean score	Gain
		Mean	SD	Mean	SD		
Male	31	29.14	6.26	40.29	7.57	11.15	
Female	33	28.65	7.80	38.38	8.50	9.73	

Results in Table 5 shows that male students with mean difference of 11.15 academically performed slightly better than female students with difference of 9.73 when taught Concept of Green-house gas emission using virtual online classroom. The post-test standard deviation scores of 7.57 and 8.50 for students in male and female groups indicate that, female students taught using virtual online classroom had the higher mean performance scores.

Hypothesis Three

There is no significant difference in the achievement scores of male and female chemistry students taught Greenhouse gas emission using virtual online classroom.

Table 6: Summary of Analysis of Covariance (ANCOVA) of Chemistry Students Posttest Scores based on Gender with Pretest Scores as Covariate

Source	Type III Sum of Squares	Df	Mean Square	F	P-cal	Decision
Corrected Model	2.942a	2	1.471	.088	.916	*
Intercept	979.685	1	979.685	58.781	.000	*
Pretest	.448	1	.448	.027	.870	*
Gender	2.343	1	2.343	.141	.709	NS
Error	1183.342	41	16.667			
Total	12649.000	44				
Corrected Total	1186.284	43				

a. R squared = .002 (Adjusted R squared = .026) *Not Significant at .05 Alpha level

Table 6 shows that the calculated p-value of .709 is greater than the alpha level of .05. Therefore, null hypothesis three is retained. This implies that there is no significant difference in the achievement scores of male and female chemistry students taught greenhouse gas emission using virtual online classroom instructional strategies.

Research Question Four

What is the interaction effects of flip charts, virtual online classrooms and gender on chemistry students' academic achievement on the concept of Green-house gas emission?

This research question was answered using results on Table 7 used for testing Hypothesis 4.

Hypothesis Four: There is no significant interaction effects of flip charts, virtual online classrooms and gender on chemistry students' academic achievement on the concept of Green-house gas emission.

Table 7: Summary of Analysis of Covariance (ANCOVA) of male and female students' post-test scores classified by treatment groups and gender with pre-test scores as covariate

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Decision at .05 alpha level
Corrected Model	20987.590a	4	5246.897	225.735	.000	S
Intercept	4874.476	1	4874.476	209.713	.000	S
Covariate (Pretest)	12.960	1	12.960	.558	.456	NS
Treatment	20943.309	1	20943.309	901.037	.000	S
Gender	137.658	1	137.658	5.922	.316	NS
Treatment * Gender	27.853	1	27.853	1.198	.276	NS
Error	3300.587	127	23.244	-	-	-
Total	148554.000	130	-	-	-	-
Corrected Total	24288.177	129	-	-	-	-

a. R Squared = .864 (Adjusted R Squared = .860), S = Significant at .05 alpha level, NS = Not significant at .05 alpha level

Discussion of Findings

The findings with regard to the relative effect of visual online and flip charts teaching/learning strategies on students achievement on the concept of green house gas emission, showed that there was a significant difference in student academic achievement when taught the chemistry concept using flip charts classrooms and when taught the concept using online virtual classrooms which in line with the observation of Mohammed (2020) which opined that its enhances students academic achievement in the concept.

CONCLUSION

Based on the findings of this study, it was concluded that the use of flip chart in the teaching and learning of the concept of green house gas emission enhances and facilitates chemistry students' academic achievement more than virtual online classrooms teaching method. Flip chart and virtual online classroom methods are not gender sensitive while flip charts enhances student academic achievement in green house gas emission.

RECOMMENDATIONS

Based on the findings and the conclusion reached, the following recommendations were made:

1. Flip charts should be adopted and use by chemistry teachers and students in the teaching and learning of the concept of green house gas emission in public secondary school.
2. Seminars, workshops and conferences should be organized more frequently for chemistry teachers and other science teachers to update their knowledge on the need to adopt students centered teaching methods such as flip charts and virtual online classrooms to enhance students' academic achievement in the learning of difficult concept in chemistry.
3. Government at all levels should ensure that the use of flip charts and online visual classroom should be incorporated into curriculum for the teaching of difficult concepts in chemistry in public secondary schools.

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