

Effect of 7E's Instructional Approach on Senior Secondary School Student's Achievement and Interest in Chemical Equilibrium in Delta State.

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Abstract

The present study investigated the effect of 7E's instructional approach on public senior secondary school student's achievement and interest in chemical equilibrium in Ika North East LGA of delta state. Using pre-test, post-test, non-equivalent control group involving quasi-experimental design was used. Specifically three objectives, three research questions and three null hypotheses guided the study. The study was conducted with 200 senior secondary II students drawn from 2 public senior secondary schools in the study area. In each school two intact chemistry classes were selected and randomly assigned experimental and control groups. The experimental group was taught chemical equilibrium using 7E's instructional approach, while the control group was taught using cooperative strategy. Chemical equilibrium chemistry achievement test and Chemistry interest inventory on chemical equilibrium were used for data collection. A reliability coefficient of 0.87 for CECAT and 0.82 for CIICE were established using Pearson's product moment correlation statistics. Mean and standard deviation were used to answer the three research questions while Analysis of Variance (ANOVA) was used to test the three null hypotheses at 0.05 level of significance. The result revealed among others that there was statistical significant improvement in student's achievement in chemical equilibrium after exposure to 7E's instructional approach in urban and rural area compare to cooperative strategy. Consequently, the study held that there was statistical significant difference in interest in chemical equilibrium between students exposed to 7E's instructional approach and cooperative strategy in urban and rural area, and that male students performed better than female students exposed to 7E's instructional approach in urban and rural areas. Based on the finding it was recommended among others that, the use of 7E's instructional approach in teaching and learning of chemistry should be encouraged, since it helps to stimulate students curiosity and that training should be organized for chemistry teachers to equip them with knowledge and skill in using 7E's instructional approach.

Keywords: *academic achievement, interest, 7E's instructional approach, cooperative strategy, gender, chemical equilibrium*

INTRODUCTION

Chemistry is one of the main branches of pure science; it deals with the composition, properties and uses of matter. It probes into the principles governing the changes that matter undergoes. In Nigeria, chemistry is one of the science subjects offered at the senior secondary level. In some schools, it is an essential subject for all the arms of SS1, while in other schools, it is offered only to the science students. Chemistry as a field of study covers a wide range of topics such as organic chemistry, inorganic chemistry, metals and non-metals, and applied chemistry. Chemistry is taught in most schools as an abstract subject without much stress on practical experiences (Ghassan, 2007). This approach of teaching the subject has resulted to student's low achievement of science processing skills. The shift from the teacher-centered method of teaching science to student-centered activity based method encourages and develops in the child the spirit of inquiry as opined by Akinbobola (2006). Thus, the best way to teach science is student-centered approach, which gives learner the opportunity to see thing in their own perception, thereby making them to assume the active role in a learning process.

The discovery learning approach that has been presented in the context of leading structuralisms theories such as Piaget, Bruner, and Vygotsky, emphasizes that students should be involved in creating and building their knowledge (Fitzpatrick, 2001). The cyclic learning models in different curricula with regular stages of 3E, 5E and 7E have been used. The 7E model was used in this study. Cyclic model of 7E's includes activities that attract students' attention and interest and arouses their curious and eager to assignments. These activities are generally related to daily events that happen to students. Lack of knowledge of students about the affairs through the use of activities of this cyclical model will be changed. There are many studies showing that the 7E model is more effective than other models and has many applications in teaching and learning. For example, researchers such as Akkar (2005), Wilder and Shatluth (2005) Kaynar, Tekkaya and Cakiroglu (2009), Brown and Sandra (2007), Ceylon and Gyban (2009) have carried out researches on this field and their findings suggest that the applying of this model and its superiority over the older versions. Edmund (2008) in his study explained that learning cycle as pedagogical approach or methodology is a best way to structure inquiry in science. The learning cycle model occurs in various planned and sequential manner.

7E learning cycle model is a useful recommended instructional approach in science curriculum and in today's science curriculum scenario the instructors or the teachers should be encouraged to incorporate this model into their teaching (Balta & Sarac, 2016). Arthur Eisenkraft (2003) also recommended that sometimes the existing learning models should be amended to maintain its value after new knowledge has been gathered.

Therefore, constructivist approach of teaching is student centered not teacher center, in sense that the students does most of the work in a learning process while the teacher is just there as a coach, guide and facilitator. The teacher is passive while the learners assume the active role in a learning process. Learning cycle model was originated from Piaget's mental functioning model. The first version of the model included three phases initially called preliminary exploration, invention and discovery, but they were revised to exploration, concept introduction and concept application to increase the expressiveness (Hanley, 1997). The developers of the model suggested that student's substantial knowledge impacts their learning and also they need to be allowed to explore the phenomena on their own previous knowledge to the introduction of new concept associated with the scientific concepts.

According to Bybee, Taylor, Gardner, (2006) educators and researches extended the phases of the model to increase the importance on some issues and different versions of the model were emerged as 3E, 4E, 5E and 7E. Among them, 7E's instructional approach is the broad one encompassing seven phases each starting with the same letter; Elicit, Engagement, Exploration, Explanation, Elaboration, Evaluation, and Extension. (Barcin, Leman, 2005) summarized the 7E's learning model as follows:

Elicit phase – This phase help to activates students existing knowledge, also to ascertain the level of knowledge a learner can contribute to the new concept to be taught.

Engagement phase – in this phase the students are given some exercise that will stimulate their curiosity on the new concept. The activities that are employed in these phase expose students' prior knowledge and make connections to present and future topics.

Exploration phase – this phase provides an opportunity for students to apply their knowledge to new domains, which may include asking new questions and making new hypothesis (Eisenkraft, 2003) in addition to re-examine their existing conceptions to be able to interpret the new phenomena. The cognitive conflict rose in students 'existing mental structures and new situation causes disequilibrium which the individual avoid to stay.

Explanation phase –this phase gives students the opportunity to expressed and demonstrate their understanding based on the data obtained from the exploratory activities. The teacher guides the student toward coherent and consistent generalization, helps the student with distinct scientific vocabulary and provides questions that help students use this vocabulary to explain the results of their exploration.

Elaboration phase – in this phase both assimilation and accommodation occur since the students organize, apply and relate the newly developed concept to prior concepts or daily life applications, in this stage there is bound to be equilibrium because the new information is anchorage to the existing knowledge, therefore learning become more meaningful.

Evaluation phase – this phase make students to realize the change in their knowledge and assess their own conceptions to make necessary arrangements.

Extension phase –this phase prepare students to connect the acquired knowledge to following new phenomena, and also find out the real-life situation the concept could be applied. Thus several studies have proven the effectiveness of 7E's instructional approach over other model or method of teaching science

Naade, Alamina, and Okwelle, (2018) investigated the effect of 7E constructivist approach on students' achievement in electromagnetic induction topic in senior secondary schools in Rivers State, Nigeria. The study employed a quasi-experimental design. Specifically, it was a pretest post-test non-equivalent control group design. Two schools were purposively selected from nine secondary schools in Gokana Local Government Area of Rivers State, Nigeria. Two intact classes were randomly selected from each school, making a total of four intact classes of 58 Senior Secondary Three (SS3) physics students. Results from the study showed that the mean score of the experimental group was higher than the mean score of the control group. The study also revealed that there was statistically significant difference between the mean scores of those exposed to 7E's's constructivist approach and those exposed to the traditional method. The result revealed that the constructivist approach enhance learning.

Abamba (2021) examine the effect of school location on student's academic achievement in senior secondary physics based on 5E learning cycle in delta state, Nigeria. The study was a non-randomized prët-test, post-test control group quasi-experimental design. The population of the study was 66,345. Two hundred and forty-three students were sampled from six schools. Four hypotheses were tested at 0.05 level of significant. The hypotheses state there is no significant difference in mean achievement scores in physics between urban and rural students taught using 5E's leaning cycle among others. The statistical tools used were mean, standard deviation and analysis of covariance (ANCOVA) were used in testing the hypotheses formulated. The result amongst others showed there is no significant difference between rural and urban students achievement taught using 5E learning cycle (fcal.(113)=fcrit (0.005),p>0,05).

Aluko, (2004) investigated the effectiveness of cooperative and individualistic instructional strategies on problem solving abilities in secondary schools. He found that students in urban area taught cooperative performed better than students in rural area taught using the same approach. Thus, in cooperative learning the students are not afraid to ask their colleagues question in their area of misunderstanding, also students are freer in cooperative class room setting, because students can interact with one another by such learning become more effective.

Shaheen (2015) examined the effectiveness of instruction based on 7E Instructional Model and Traditional Instructional Model for the teaching of Biology on 9th grade students' achievement. Pretest posttest control group design was used in this study. A total number of 122 ninth grade students (62 boys and 60 girls) from four classes of a biology course of two schools were purposively selected. The result showed that constructivist teaching approach is more effective than the traditional method of teaching and also there was a significant difference on the mean score of male and female students.

Several studies in the chemistry education (Jack, 2005; Obomanu, 2012; Njoku & Nzewi, 2015; Uchegbu et al., 2016) dealt with the learning difficulties of basic concepts of chemistry at schools and some reasons given included poor teaching methodologies. Concepts formed when the ideas or thoughts are developed based on common properties of objects or events by the process of abstraction. Consequently, there is a great need to help improve chemistry students' perceived learning difficulties of chemical concepts not just for them to sail through SSCE/GCE examinations, but also for them to be aware and be appreciative of the contributions they can make to the country's development. Available evidence from West African Examination Council and some science educationist (WAEC, 2014, 2015; Jack, 2005; Oyedokun, 2002) indicates student's poor academic achievement in chemistry. Thus, there is a need for teaching and learning strategies that provide us with a wide range and higher educational potential that will help our students to enrich their information, expand their mental abilities, acquire science process skills and train them to be innovative.

Therefore, the methodology or pedagogy used by a teacher will determine how effective and interesting the learning will be, since the type of instructional materials and teaching method have been a factor contributing to students poor academic achievement in chemistry. Therefore this study aimed to investigate the effects of 7E's instructional approach on public senior secondary school student's achievement and interest in chemical equilibrium in Ika North East Local Government Area of Delta State.

Statement of the Problem

Adesoji and Olatunbosun (2008) stated that in spite of the attempts made by researchers to improve on the teaching and learning of chemistry, the achievement of students in the subject remains low in Nigeria and discouraging. Researchers have shown that some causes of students' anxiety leading to the perception of chemistry as a difficult subject include: broad coverage of the syllabus, students' family background problems, students' lack of interest in and poor attitude towards chemistry, low awareness of career opportunities, lack of teaching aids/laboratory, the abstract nature of science concepts, the teacher, traditional teaching strategies, and teacher-centered applications (Jegade, 2007; Kolomuc, Ozmen, Metin, & Acisli, 2012; Nbina & Vico, 2010). According to Caliskan (2004) methodology is the dominant factor in science teaching to achieve the goals of science education. Thus, the type of method one uses in the presentation of a new concept will determine how effective learning will take place, or how interesting the topic will be to the students'.

Also, the poor performance of students in Chemistry could be as a result of teachers' approach or pedagogy in the presentation of new concepts. Hence it is against the above stated problem the researcher deemed it fit to investigate the study effect of 7E's instructional approach on public senior secondary school student's achievement and interest in chemical equilibrium in Ika North East Local Government Area of Delta State in comparative with cooperative strategy.

Purpose of the Study

The purpose of this study is to investigate the effect 7E's instructional approach on senior secondary school students achievement and interest in chemical equilibrium in Ika North East Delta State in comparative with cooperative strategy. Specifically, the study intends to:

- 1 Find out if there is any difference in the academic achievement of students taught chemistry using 7E's instructional approach and those taught using cooperative strategy in Ika North East LGA.
- 2 Determine whether there is difference in interest of students taught chemical equilibrium using 7E's instructional approach and those taught using cooperative strategy in Ika North East LGA.
- 3 Investigate the effect of gender on the mean score of students in chemical equilibrium taught using 7E's instructional approach in Ika North East LGA.

Research Question

As a guide to the study, the following research questions were posed

1. What is the difference in the academic achievement of students taught chemical equilibrium using 7E's instructional approach and students taught using cooperative strategy in Ika North East LGA?
2. What is the difference in interest of students taught chemical equilibrium using 7E's instructional approach and those taught using cooperative strategy in Ika North East LGA.
3. What is the effect of gender on the mean score of students taught chemical equilibrium using 7E's instructional approach in Ika North East LGA?

Research Hypothesis

The following null hypotheses were formulated to guide the study.

1. There is no significant difference between the mean score of students taught chemical equilibrium using 7E's instructional approach and those taught using cooperative strategy in Ika North East LGA.
2. There is no significance difference in interest in chemical equilibrium between students taught using 7E's instructional approach and those taught using cooperative strategy in Ika North East LGA.
3. There is no significance difference on the mean score of male and female student's taught chemical equilibrium using 7E's instructional approach in Ika North East LGA.

Methodology

A pretest, posttest, quasi-experimental control groups design using intact classes with non randomization and non-equivalent design was employed for this study. Two groups of students were used for data collection i.e the Experimental and Control groups. A pretest was administered to the two groups in order to determine the equivalence of the groups in ability before the commencement of the treatment. The experimental group was exposed to 7E's instructional approach while control group was exposed to cooperative strategy. The population for the study comprised of all chemistry students in all public senior secondary schools in Ika North East Local Government Area of Delta State, totaling 2777 (Source: School Enrolment List, Post primary education board zonal office Agbor Delta State 2021). Out of the number that met the criteria simple random sampling techniques was used to select one school each, from schools in the urban and rural areas. In each school selected, students in SS2 were purposively selected for the study as they have successfully studied chemistry for at least one year. SS3 classes were not considered as they may be preparing for their external examination. In each school, two arms (A&B) of chemistry classes were selected and randomly assigned experimental and control groups respectively. In

all 200 students participated in the study. The experimental group was treated using 7E's instructional approach while the control groups were taught using cooperative strategy.

Two instruments was developed by the researcher in the course of the study; the first instrument is measuring student's academic achievement (CECAT) which was designed by drawing 40 multiple choice questions from four topics in chemical equilibrium and include, chemical equilibrium, property of system in equilibrium, Le-Chateliers principle and factors affecting the position of equilibrium. Each question attracted one mark for each correct answer. A total of 40 marks were allocated to the instrument. The second instrument adopted in this study was chemistry interest inventory on chemical equilibrium (CIICE) which was designed to evaluate the interest level of the students in chemical equilibrium concept in chemistry, taught using 7E's instructional strategy and those taught using cooperative strategy. It was structured on likert 4-point rating scales of Strongly Agree (SA) = 4 points, Agree (A) = 3 points, Disagree (D) = 2 points and Strongly Disagree (SD) = 1 point with 20 measurable items. Average score were calculated for each item for male and female students. Criterion mean of 2.50 was used for decision rule. Questionnaire items with ratings below 2.50 denoted disagree while 2.50 and above signified, agree. The data generated from these instruments were used to answer the research questions and analyze the hypotheses for the study.

The instrument was validated by my supervisor and two lecturers in the Department of Science Education, Rivers State University. The researcher ensured that the items reflected the specific concept (Chemical equilibrium). A reliability coefficient of 0.87 for CECAT and 0.82 for CIICE were obtained using Pearson's product moment correlation statistics. A letter of request for permission was taken to the Principals of the schools to be involved in the study. After obtaining the permission from the Principals, the researchers interacted with the chemistry teachers. The pretest was administered to determine the students' level of understanding of the selected topics before teaching them.

The chemical equilibrium chemistry achievement test (CEQCAT) and chemistry interest inventory on chemical equilibrium (CIICE) were administered as pre-test to both the experimental and control groups. A week after the pretest, the researcher introduced the 7E's instructional approach, which include Elicit, Engagement, Exploration, Explanation, Elaboration, Evaluation, and Extension, each of this step was use to plan lesson on chemical equilibrium concepts that is used to teach the SS2 students in Urban and Rural Area public school in Ika North East Local Government of Delta State.

The research questions were analyzed with the use of mean and standard deviation while the hypotheses were tested using analysis of variance, t-test and ANOVA at 0.05 level of significance.

Results

Research question 1: What is the difference in the academic achievement of students taught chemical equilibrium using 7E's instructional approach and those taught using cooperative strategy?

Table 4.1: Mean Scores and Standard Deviation of Experimental and Control Groups of Students in the Pre-test and Post-test Achievement on Chemical Equilibrium in Ika North East Local Government of Delta State.

Location	N	Pre-test Mean	S.D	Post-test Mean	S.D	Gain
Experiment	110	24.33	8.82	37.21	9.13	12.88
Control	90	21.03	7.09	30.57	8.61	9.54

Field Survey Data, 2022

Table4.1 shows the mean and standard deviation score of students. The mean posttest score and standard deviation for the 7E's instructional approach were 37.21 and 9.13 while those for the control group were 30.57 and 8.61 respectively. As shown in the table above students taught using 7E's instructional approach performed better than students taught cooperative strategy in Ika North East Local Government of Delta State. This implies that 7E's group appears to be more effective than cooperative approach in Ika North East Local Government of Delta State. While the mean posttest score and standard deviation for the 7E's instructional approach in Ika North East Local Government of Delta State 37.21 and 9.13 while those for the control group were 30.57 and 8.61 respectively. As shown in the table above students taught using 7E's instructional approach performed better than students taught cooperative strategy.

Research question 2: What is the difference in interest in chemical equilibrium between students taught using 7E's instructional approach and those taught using cooperative strategy in Ika North East Local Government of Delta State?

Table4.2: Mean Scores and Standard Deviation of Experimental and Control Group and Students Interest in Chemical Equilibrium in Ika North East Local Government of Delta State

ITEM	EXPERIMENTAL (N=110)			CONTROL (N=90)			
	X	SD	RK	X	SD	RK	
1	Chemical equilibrium concepts is a topic a enjoy most	3.16	0.73	A	3.33	0.69	A
2	Learning chemical equilibrium is very interesting to me	3.11	0.75	A	3.28	0.60	A
3	I like read book about Chemical equilibrium Concept	2.84	1.03	A	3.09	0.67	A
4	I do not like chemical Equilibrium and it scare me	1.99	0.90	D	1.93	0.88	D
5	When I hear the word chemical equilibrium, I have a feeling of dislike	1.99	0.91	D	1.77	0.72	D
6	Reading any aspect of chemical equilibrium concept make me feel uncomfortable, restless and Impatient.	2.06	0.95	D	1.75	0.79	D
7	I am happier studying Chemical equilibrium concepts than any other topic in chemistry	2.68	1.05	A	2.63	0.95	A
8	I answering question during lessons in chemical equilibrium	2.79	0.92	A	2.72	0.82	A
9	I spend my time talking and chatting when lesson on chemical equilibrium is going on	2.31	1.03	D	2.09	1.07	D
10	my mind goes blank unable to think clearly when studying chemical equilibrium	2.15	1.01	D	2.57	0.90	A
11	I enjoy participating in lesson on chemical Equilibrium	2.63	1.03	A	2.78	0.82	A
12	during examination I attempt question on chemical equilibrium	2.61	1.02	A	2.51	0.99	A
13	chemical equilibrium concepts are topics I hate more in chemistry	2.41	1.13	D	2.31	1.00	D
14	I do not like failing question in chemical equilibrium	2.50	1.02	A	2.66	1.02	A
15	I do not like answering question on chemical equilibrium concepts during examination and test	2.52	1.20	A	1.68	1.65	D
16	I spend my time reacting and learning chemical equilibrium concept	2.62	0.98	A	2.54	0.96	A
17	I sleep during lesson when topics in chemical equilibrium concepts are taught	2.25	1.15	D	2.44	0.87	D
18	I encourage others from studying chemical equilibrium Concepts	2.21	1.07	D	2.40	0.93	D
19	I discourage others from studying chemical equilibrium Concepts	1.81	0.92	D	1.69	0.75	D
20	chemical equilibrium makes me to dislike chemistry	1.36	0.68	D	1.66	0.95	D

Grand Mean 2.40 0.43 D 2.391 0.52 D

Field Survey Data, 2022

Table 4.2 shows the interest of students in treatment group, the items 1, 2, 3, 7, 8, 11, 12, 1 and 16 were rated as agreed by the respondents, while they rated items 4, 5, 6, 9, 10, 13, 14, 16, 17, 19 and 20 as disagreed. While the control group, the items 1, 2, 3, 7, 8, 10, 11, 13, 14, 16 and 17 were rated as agreed by the respondents, while they rated items 4, 5, 6, 7, 9, 12, 15, 18, 19 and 20 as disagreed. The grand mean score for treatment group and control groups are 2.40 and 2.391. Therefore, there was no different in the interest of students on chemical equilibrium expose to 7E's instructional approach and cooperative strategy in Ika North East Local Government of Delta State.

Research question 3: What is the effect of gender on the mean score of students taught chemical equilibrium using 7E's instructional approach in Ika North East Local Government of Delta State?

Table 4.3: Mean Scores And Standard Deviation Of Experimental Groups Of Students On The Pre-Test And Post-Test Achievement On Chemical Equilibrium

Gender	N	Pretest Mean	S.D	Post-test Mean	S.D	Gain
Male	50	23.98	9.27	39.35	7.53	15.37
Female	60	24.65	8.80	35.50	9.99	10.85

Field Survey Data, 2022

Table 3 shows the mean and standard deviation scores of male and female students. The mean posttest and standard deviation for male Students in treatment group are 39.35 and 7.53 while those for control group were 35.50 and 9.99 respectively. As shown in the table above, the post-test mean score of male students in treatment group are higher than the female student's in the control group. This proves the effectiveness of 7E's instructional approach on student's academic achievement in chemical equilibrium over the cooperative strategy.

Hypotheses

Hypotheses 1: There is no significant difference between the mean score of students taught chemical equilibrium using 7E's instructional approach and those taught using cooperative strategy in Ika North East Local Government of Delta State.

Table 4.4: ANOVA Analysis Difference between the Mean Score of Students Taught Chemical Equilibrium Using 7E's Instructional Approach and Those Taught Using Cooperative Strategy in Ika North East Local Government of Delta State

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	433.500	1	433.500	21.313	.000
Within Groups	1993.250	98	20.339		Rejected
Total	2426.750	99			
Between Groups	106.090	1	106.090	6.140	.015
Within Groups	1693.220	98	17.278		
Total	1799.310	99			

Field Survey Data, 2022

Table 4 shows ANOVAs analysis on the score of students taught using 7E's instructional approach and students taught using cooperative strategy, from the result on the table above the null hypothesis that stated there is no significant difference between the mean score of students taught chemical equilibrium using 7E's instructional approach and those taught using cooperative strategy is rejected, which shows that there is significant difference on the mean score of students that is exposed to 7E's instructional approach and cooperative strategy.

Hypothesis 2: There is no significance difference in interest in chemical equilibrium between students taught using 7E's instructional approach and those taught using cooperative strategy in Ika North East Local Government of Delta State.

Table 4.5 ANOVA Analysis of Difference in Interest in Chemical Equilibrium between Students Taught Using 7E's Instructional Approach And those Taught Using Cooperative Strategy In Ika North East Local Government of Delta State.

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	.014	1	.014	.183	.670
Within Groups	7.528	98	.077		
Total	7.542	99			
Between Groups	.111	1	.111	1.776	.186
Within Groups	6.125	98	.062		
Total	6.236	99			

Field Survey Data, 2022

Table 5 shows ANOVAs analysis of students interest in chemical equilibrium in the treatment and control group, from the result on the table above, the null hypothesis that stated there is no significant difference in interest in chemical equilibrium between students taught using 7E's instructional approach and those taught using cooperative strategy is therefore rejected, which shows that there is a significant difference on the interest of students in chemical equilibrium taught using 7E's instructional approach and those taught using cooperative strategy.

Hypothesis 3: There is no significance difference on the mean score of male and female student's taught chemical equilibrium using 7E's instructional approach in Ika North East Local Government of Delta State.

Table 4.6 ANOVA Analysis of Difference on the Mean Score Of Male And Female Student's Taught Chemical Equilibrium Using 7E's Instructional Approach In Ika North East Local Government of Delta State.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	50.700	1	50.700	2.152	.148
Within Groups	1366.150	58	23.554		
Total	1416.850	59			Rejected
Between Groups	43.320	1	43.320	2.771	.102
Within Groups	750.300	48	15.631		
Total	793.620	49			

Field Survey Data, 2022

Table 6 shows that there is significant difference between the performance of male and female in treatment group. Therefore the hypothesis is rejected, which shows that the male students in the treatment group performed better than the female students in the treatment group.

DISCUSSION OF FINDINGS

The result in table 4.1 shows the mean score of students expose 7E's instructional approach were 37.21% while those expose to control group 30.57%. As shown in the table above students taught using 7E's instructional approach performed better than students taught cooperative strategy. This implies that 7E's instructional approach is more effective than cooperative approach. The null hypothesis was rejected due to the result of the hypothesis 1 (Table 4) which states that there is a significant difference in the mean scores of students taught chemical equilibrium using 7E's instructional approach and cooperative strategy, since the calculated F-ratio at $P < 0.55$ is greater than the critical value ($20.915 > .000$) at degree of freedom, df 198. The 7E's class performed better than cooperative strategy. This is in agreement with the finding of Naade, Alamina, and Okwelle, (2018) Results from the study showed that the mean score of the treatment group was higher than the mean score of the control group. The study also revealed that there was statistically significant difference between the mean scores of those exposed to 7E's instructional approach and those exposed to traditional method. The result is also in variance with the result of Abamba (2021) who examine the effect of school location on student's academic achievement in senior secondary physics based on 5E learning cycle in Delta State, Nigeria. In his result there was no difference on the

academic achievement of students in urban and rural area. There is no literature in collaboration with the finding of this work because there is no literature that has ever compare 7E's approach and cooperative strategy.

The result in table 4.2 show a grand mean score for experimental group and control groups 2.40 and 2.391. There was a difference in interest in chemical equilibrium in experimental and control group. Students expose to treatment have more interest in chemical equilibrium than their counterpart in control groups. The null hypothesis was rejected due to the result of the hypothesis 2 (Table 5) which states that there is no significance difference in interest in chemical equilibrium between students taught using 7E's instructional approach and those taught using cooperative strategy, is therefore rejected since the calculated F-ratio at $P < 0.55$ for urban is $1.83 < 670$ and rural $1.775 > .186$ at degree of freedom, df 98, from the result there was a difference in interest of students exposed to 7E's instructional approach and cooperative strategy. The finding of this study is in agreement with the result of Nwokeke (2016) investigated the effect of constructivist approach on students achievement and interest in basic ecological concepts, in their result there was a significant difference on the interest of students expose to constructivist approach in learning ecological concepts. .

The result in table 6 shows the mean scores of male and female students. The mean posttest for male in the treatment group was 39.35 while the mean score of female students exposed to 7E's, was 35.50 respectively. As shown in the table above, the post-test mean score of male is higher than the post-test mean score female students. The null hypothesis stated that there is no significance difference on the mean score of male and female student's taught chemical equilibrium using 7E's instructional approach was rejected. Since the calculated F-ratio at $P < 0.55$ is greater than the critical value ($2.152 > .148$ and $2.771 > .102$) at degree of freedom, of 58 and 48. The strategy provided no equal opportunity to both male and female student base academic achievement, this show that 7E's instructional approach is responsive to genders. The finding of this study is in agreement with the studies of Shaheen and Kayani (2015), conducted a study on improving student's achievement in biology using 7E's instructional model. In their result there was a significant difference in the academic achievement of male and female students exposed to 7E's instructional model.

Conclusion

Based on the findings of this study, it was concluded that students exposed to 7E's instructional Approach performed significantly better than students exposed to chemical equilibrium through cooperative strategy. In addition, male students exposed to 7E's instructional Approach performed better than the female students exposed to the same method. Furthermore, students exposed to chemical equilibrium using 7E's instruction approach had more interest in chemical equilibrium than students exposed to cooperative strategy.

Recommendation

1. The use of 7E's instructional approach should be encouraged as it enables students to learn from their past experience or prior knowledge.
2. Training should be organized for chemistry teachers to equip them with the knowledge and skill of 7E's instructional approach.
3. Science Teacher Association of Nigeria (STAN) should organize a seminar or workshop and a conference to update their members with the use of 7E's instructional approach for effective teaching and learning.

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