



Impact of Activity Students Experimentation and Improvisation (ASEI) Teaching Approach on Chemistry Students' Attitude and Achievement in Abuja, Nigeria

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Abstract

The investigator looked at how chemistry attitudes among learners and academic performance were affected by the Activity, Students, Experiment, and Improvisation (ASEI) teaching methodology. To direct the investigation, two hypotheses and research questions were developed. The study's population comprised 31,883 SS 1 Chemistry students, 160 of whom were selected through purposive sampling. The research design used in the study was non-equivalent quasi-experimental. The Chemistry Students' Attitude Inventory (CSAI) and the Chemistry Achievement Test (CAT) were the 2 instruments utilized to gather the data. The reliability coefficient for CAT was 0.89 according to the Kuder-Richardson formula-20, but the reliability coefficient for CSAI was 0.88 when Cronbach alpha was used. The research questions were analyzed using descriptive statistics such as mean and standard deviation, while the hypotheses were analyzed using ANCOVA at the 0.05 significant level. According to the analysis, learners' academic performance in chemistry was enhanced more by using the ASEI instructional strategy than by the lecture method. Students approach the subject matter with positivity. In order to awaken and sustain students' attitudes, educational institutions must stress the significance of putting the ASEI teaching strategy into practice.

Keywords: Activity, Students, Experiment, Improvisation, Achievement and Attitude

Introduction

Increasing achievement among learners and cultivating a positive attitude have been persistent challenges in the field of science education, especially in chemistry. Secondary school teaching strategies frequently emphasize teacher-centered learning and rote learning, which have been demonstrated to reduce student participation and critical thinking. This has led to consistently low chemistry achievement, particularly in emerging economies like Nigeria where the problem is made worse by a lack of resources.

The development of scientific knowledge and the pursuit of professions in environmental science, engineering, medicine, and other related fields depend heavily on chemistry, a fundamental science subject. Despite its significance, research has repeatedly demonstrated that secondary school pupils in Nigeria frequently have negative attitudes toward chemistry and perform poorly on standardized tests like the WAEC and NECO. A lack of real-world experience, ineffective teaching strategies, and restricted access to lab equipment are some of the reasons for this poor output.

An individual's participation in class activities and grades in chemistry education and study can both be enhanced by having a positive attitude. A person's external presentation is how they show themselves to the outside world. It affects the student, the teacher, and the peer group of the teenager. The numerous activities a person engages in at school have an impact on their attitude. They can also be selected up by simply imitating a parent, teacher, or other professional's words or actions. In order to teach and learn, imitation and copying are both involved. This is due to the fact that the child mimics the attitudes of his instructors, which could affect how well he performs in school (Emmanuel, 2018). A broad range of subject areas are included in the intricate concept of school achievement. It is described as follows: the standard by which students' academic performance will be evaluated.

To measure success in school, a range of indicators can be used: those that are more coursework-focused, such as test scores or the effectiveness of an aptitude test; those that are broader in scope, such as managerial abilities and binding data obtained through colleges and universities; and those that are total mixed factors, such



as teacher certifications and degrees (Igwebuiké & Ikponwosa, 2018). Several teaching strategies are used to teach chemistry, and it has been observed that students' academic performance is steadily declining (Igwebuiké & Ikponwosa, 2018). Students-centered experimentation, improvisation, and activity (ASEI) were then applied as a result.

Activity, Student-centered, Experiment, and Improvisation is an acronym for this approach that is known as ASEI. The standard of academic activities affects both the effectiveness of the teaching and the performance of students in math and science classes, according to the ASEI (Activity Student-Centered Experiment and Improvisation) technique. These types of activities make use of hands (making adjustments), minds (reasoning), faces (speaking), and hearts (things that arouse curiosity or engender positive feelings toward the subject).

Encouraging learners to acquire new skills is the aim of education. In 2018, the Centre for Mathematics, Science, and Technology Education in Africa (CEMASTEA) launched the ASEI teaching approach. In order for the students to collaborate on practical assignments, the teacher, according to CEMASTEIA, splits the class up into multiple groups as soon as the lesson is taught. Before a lesson begins, the instructor arranges the instructional materials on the shapes with each team, asks learners to figure out the items on their desks, and divides the class into groups based on the members' skills and character traits.

ASEI stands for Activity, Student-centered, Experiment, and Improvisation, according to SMASE Nigeria (2006). It is a method of instruction that seeks to make learning and teaching more student-centered. As a result, the "banking style/chalk and talk" approach gives way to the "activity based/student centered approach." ASEI is a remediation approach that considers students' learning styles. Students create their own meaning from the scientific world rather than merely copying it. They must be given the chance to integrate their mental processes, past knowledge, and observation to create discoveries in science.

One of the most popular methods for handling the aforementioned issue is the ASEI strategy. The project has cost a significant amount of money and materials. However, there is no information available about how well the ASEI approach teaches chemistry to students. Consequently, it is critical to determine the extent to which the preceding tactic improves chemistry learning for learners.

Chemistry was taught in FCT using a variety of other teaching strategies, but none of them produced fruitful outcomes. Emmanuel and Sunday (2024) found that when students were taught using the ASEI teaching strategy, their attitudes were positively altered. That is the rationale behind the ASEI teaching approach, which is thought to produce fruitful outcomes. By evaluating the effect of the ASEI teaching approach on the attitudes and academic performance of Chemistry students in the Federal Capital Territory, or FCT, Abuja, the researcher aimed to test these theories.

Research Questions

The study provided answers to the following research questions.

1. What is the mean achievement scores of senior secondary school students taught chemistry using ASEI teaching approach and those taught using lecture method?
2. What is the mean attitude rating of students taught chemistry using the ASEI teaching approach and those taught using the lecture method?

Statement of Hypotheses

The 0.05 level of significance was used to formulate and evaluate the subsequent null hypotheses.

- H₀₁: There is no significant difference in the mean achievement scores of senior secondary school students taught chemistry using ASEI teaching approach and those taught using lecture method.
- H₀₂: There is no significant difference in the mean attitude rating of students taught chemistry using the ASEI teaching approach and those taught using the lecture method.

Methods and Design

A non-equivalent group non-equivalent quasi-experimental design was employed for this investigation. The study was conducted in Abuja, the Federal Capital Territory (FCT). In the Federal Capital Territory of Abuja, at the seventy-nine (79) Government Senior Secondary Schools, 31,883 students were enrolled in SS 1 Chemistry. Since SS1 students had recently been admitted to senior secondary schools and might not have realized they were receiving treatment, they were sampled. Purposive sampling was used to select 160 learners. Organizing the FCT into its six area councils—Abuja Municipal, Gwagwalada, Kuje, Bwari, Kwali, and Abaji—is the first step. To provide a representative sample of learners, this



stratification makes sure that schools are chosen from every region in the FCT. A basic random sampling method was used to choose schools at random from each of the six area councils. Learners were chosen at random from each school using the stratified random sampling technique. At the school level, the students were assigned. This indicates that the chosen schools within each area council were randomized to either the experimental or control groups. Through a simple random sampling procedure, the schools that taught using the traditional method and made up the control group were selected. But from the two schools that made up the experimental group—those that used the ASEI teaching methodology—a purposeful sample was drawn. Purposeful sampling was chosen because those are the areas of the schools where the ASEI teaching strategy is currently being used. The teachers had to have a first degree in chemistry education, which was a prerequisite for choosing schools, and the students were in their entire classes.

Fifty items were included in CAT, and twenty items were included on CSAI. Strongly Agree (SA), Agree (A), Strongly Disagree (D), and Disagree (SD) were the four categories on which the CSAI items fell. CAT items were rated on a scale of 1 to 4, based on the option selected. The choices were, in order, A through D. The test items were reviewed by two specialists from the Department of Science Education (chemistry) at the University of Abuja who are familiar with the ASEI methodology and the chemistry curriculum. The CAT's objective is to assess their comprehension and familiarity with chemistry topics as they are taught utilizing the ASEI teaching methodology. CAT items

covered the entire scope of content specified in the curriculum and taught using the ASEI approach. The topics of instruction were acids, bases, and salts. By covering these subjects in SS1, teachers provide a solid basis for their learners. future understanding of stoichiometry, titration, and chemical equilibrium. The syllabus for SS 1 Chemistry covers these subjects. They provided feedback on each item's relevance, clarity, and alignment with the learning objectives. The CSAI items were validated by an expert. Thirty students were given the Chemistry Achievement Test (CAT) and the Chemistry Students' Attitude Inventory (CSAI) trial test. The reliability of the CSAI was evaluated using the Cronbach Alpha. The Cronbach alpha coefficient method has been found to be a suitable method for measuring reliability because it takes into account items on a continuum of Strongly Agree (SA), Agree (A), Strongly Disagree (SD), and Disagree (D). The reliability coefficient was determined to be 0.88. The Kuder Richardson formula-20 was used to assess the CAT's reliability.

The instrument received ratings of 4 for A, 3 for B, 2 for C, and 1 for D for CAT. From 1-4, the CSAI was rated. SA represents 4, A represents 3, D represents 2, and SD represents 1, in that order. The co-efficient was therefore 0.89. Each research question was addressed using the descriptive statistics mean and standard deviations. Hypotheses were tested at 0.05 significant levels (ANCOVA) using Analysis of Covariance. The null hypothesis that there is no meaningful relationship or difference will be rejected if the calculated value is less than the critical value.

Results

Table 1: Mean Achievement Scores and Standard Deviation of Students in Experimental and Control Groups

Groups	N	Pretest		Posttest		Mean gain
		Mean	SD	Mean	SD	
Experimental	74	54.11	4.53	83.57	5.78	29.46
Control	86	53.50	4.36	61.63	6.06	8.13
Mean Difference		0.61		21.94		
Total	160					

Table 1 displays the pretest mean achievement scores for the experimental group, which were 54.11 with a standard deviation of 4.53 and the control group, which were 53.50 with a standard deviation of 4.36. The control group scored 61.63 with a 6.06 standard deviation on the post-test, whereas the experimental

group's average achievement score was 83.57 with a 5.78 standard deviation. The Pretest and Posttest results showed that the experimental group had a mean gain of 29.46 and the control group had a mean gain of 8.13. There was a 0.61 difference in the experimental and control groups' mean achievement scores on the pretest,



but this difference increased to 21.94 on the posttest. It was discovered that the experimental group's students outperformed the control group.

Table 2: Summary of Analysis of Covariance (ANCOVA) of the Achievement Scores of Students in Experimental and Control Groups

Source of Variance	Sum of Squares	df	Mean Square	F	Sig
Corrected Model	19263.654 ^a	2	9631.827	277.965	.000
Intercept	4127.656	1	4127.656	119.120	.000
Pretest	118.010	1	118.010	3.406	.067
Group	18850.716	1	18850.716	544.013	.000
Error	5440.246	157	34.651		
Total	848968.000	160			
Corrected Total	24703.900	159			

According to an ANCOVA analysis, Table 2 displays the posttest results for learners who were taught chemistry using both the conventional teaching approach and the ASEI teaching strategy. As a result of the analysis, the null hypothesis was rejected ($F(1,157) = 544.013, p(0.05)$). The theory is disproved. In other

words, the achievement scores of students taught chemistry using the standard method and the ASEI teaching style differed statistically significantly. This implies that the experimental group's students performed better academically than the control group's students.

Table 3: Mean Attitude Ratings and Standard Deviation of Students in Experimental and Control Groups

Groups	N	Pre-attitude		Post-attitude		Mean Gain
		Mean	SD	Mean	SD	
Experimental	74	1.38	0.30	2.76	0.61	1.38
Control	86	1.37	0.31	1.93	0.34	0.56
Mean Difference		0.01		0.83		
Total	160					

Before treatment began, the mean attitude rating for the experimental group had a standard deviation of 0.30 (1.38), while the control group's was 0.31 (1.37). After the intervention, the control group's mean attitude rating was 1.93 and 0.34, while the experimental group's was 2.76 with a 0.61 standard deviation. Before and after treatment, the experimental

group's mean increase was 1.38, while the control group's gain was 0.56. Compared to their peers in the control group, the students in the experimental group had a more positive attitude toward chemistry. Students in the experimental group were more enthusiastic about learning chemistry than those in the control group.

Table 4: Summary of Analysis of Covariance (ANCOVA) of Experimental and Control Groups' Attitude Ratings towards Chemistry

Source of Variance	Sum of Squares	df	Mean Square	F	Sig
Corrected Mode	11058.311 ^a	2	5529.155	222.121	.000
Intercept	17057.523	1	17057.523	685.246	.000
Pre-Attitude	10.672	1	10.672	.429	.514
Group	11055.688	1	11055.688	444.136	.000
Error	3908.133	157	24.893		
Total	356939.000	160			



The ANCOVA results between students enrolled in chemistry classes taught using the ASEI approach and those taught using the traditional teaching method are displayed in Table 4 using data from the attitude inventory. $F(1,157) = 444.136$, $p < 0.05$, the study's results, led to the rejection of the null hypothesis. This implies that there are statistically significant differences in the average attitudes of students who were taught using the ASEI teaching approach.

Discussion of Findings

The results of the study showed that using the ASEI approach to teach chemistry to students significantly improved their academic performance in the subject. When students see how ASEI's experiential learning approach enables real-world applications of the subject, chemistry becomes more engaging and pertinent. People's views of chemistry could be altered by this connection, from one of a challenging or abstract subject to one of an intriguing one.

Students' academic performance in chemistry improves when the ASEI teaching method is used. This result is consistent with Margaret's (2019) study on the effects of enhancing science and chemistry in secondary education programs on physics instruction and learning in mixed-day secondary schools in the Lari district of the central province of Kenya. The study found that using the ASEI teaching approach greatly raised students' chemistry achievement.

Second, it was discovered that students' attitudes toward chemistry were favorable when they studied it using the ASEI method. This approach is often more engaging for students than lecture-based instruction, which can increase motivation and foster a more positive attitude toward the subject.

In the study "Attitude toward Learning and Performance in Chemistry Among Students in Selected Secondary Schools in Bureti District, Kenya," conducted by Zainab in 2019, it was found that students who studied chemistry using the ASEI teaching strategy had a favorable attitude toward the subject. That discovery is supported by this finding. In a similar vein, Sunday and Emmanuel, 2022, investigated how the ASEI teaching approach affected the attitudes of students in the Federal Capital Territory, Abuja. Their results demonstrated that students' attitudes toward learning chemistry improved when ASEI teaching was implemented.

Conclusion

The following conclusions have been drawn from the investigation's findings:

- i. The ASEI approach significantly improved students' performance when teaching chemistry.
- ii. Students' attitudes toward chemistry improved when they used the ASEI method to study the subject.

Recommendations

Based on the investigation's results, the following suggestions have been put forth:

1. Teachers in Nigerian schools ought to employ the ASEI method of instruction.
2. In order to awaken and sustain students' attitudes, educational institutions must stress the significance of putting the ASEI teaching strategy into practice.

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