Effect of Tutorial Instructional Strategy on Students' Interest and Performance in Chemical Equilibrium in Abuja Municipal Area Council, Abuja, Nigeria

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ABSTRACT

This study investigated the effect of tutorial instructional strategy on students' interest and performance in chemical equilibrium in AMAC, Abuja, Nigeria. Two research questions guided the study and two null hypotheses were tested at 0.05 level of significance. The researcher adopted quasi-experimental design of pre-test, post-test control group. The population consisted of 723 senior secondary school two (SS II) students from 19 public secondary schools in AMAC. The sample comprised 102 (SS II) students of which 60 experimental group and 42 control group. A sample random sampling technique was used to select sample for the study. Chemical Equilibrium Interest Scale (CEIS) and Chemical Equilibrium Performance Test (CEPT) were used as instruments for data collection. The reliability of CEIS using Cronbach Alpha yielded 0.84 while that of CEPT yielded 0.88. Data were analyzed using mean and standard deviation to answer research questions and null hypotheses were tested using Analysis of Covariance (ANCOVA). Findings revealed a significant difference in the mean interest ratings of students in chemical equilibrium using tutorial instructional strategy and conventional method. Also, a significant difference existed in the mean academic performance scores in chemical equilibrium using tutorial instructional strategy and conventional method. The study recommended that teachers should use tutorial instructional strategy in chemical equilibrium lessons to boost student interest and performance, AMAC should organized seminars, workshop and conference for chemistry teachers on the use of tutorial instructional strategy among others.

INTRODUCTION

Chemistry is a core science subject in the secondary school curriculum and plays a vital role in the scientific and technological development of any nation. One of the key concepts in senior secondary school chemistry is chemical equilibrium, which provides learners with foundational knowledge necessary for understanding industrial processes, environmental chemistry, and advanced scientific studies. Oladejo, Okebukola, Olateju, Akinola, Ebisin and Dansu (2022), reported that chemical equilibrium concept is perceived as one of the most difficult concepts in chemistry as sampled from students in Nigeria and Ghana. The report from the above authors shows that beyond the WAEC Chief examiner's report, students' attest to the fact that the concept is difficult.

Aniodoh and Eze (2014), Eze and Okorie (2019), Akpan and Essien (2019), Gigina and Nweze (2014) observed that ineffective teaching methods adopted by teachers over the years as one of the factors responsible for the massive failure of students in chemistry. Literature is loaded with loud outcry against conventional methods that make students passive learners in

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chemistry classrooms This study aimed at giving educators guidance on the effect of tutorial instructional Strategy on students' interest, and performance on chemical equilibrium.

Tutorial instructional strategy is a learner-centered approach that emphasizes guided practice, small-group interaction, immediate feedback, and individualized support. This strategy allows students to actively participate in the learning process, ask questions freely and clarify misconceptions, thereby may enhance understanding of concepts and in turn enhance performance as well. When effectively implemented, tutorial instruction may have the potential to improve students' interest and performance in topics like chemical equilibrium. In science and technical subjects, tutorials have been particularly effective. For example, Akinyemi and Popoola (2022) demonstrated that tutorial-based interventions helped secondary school students better understand abstract concepts in chemistry by breaking down content into manageable, student-friendly sessions.

These sessions often include problem-solving, real-life applications, and formative assessments, all of which contribute to a more enriched learning experience. Digital transformation in education has also expanded the possibilities of tutorial teaching. With the integration of learning management systems, video conferencing, and interactive platforms, tutorials can now be delivered asynchronously or synchronously online. This enhances accessibility, especially in resource-limited contexts (Ibrahim & Yusuf, 2021).

STATEMENT OF PROBLEM

Students' academic performance is influenced by a complex interplay of internal and external factors. By identifying and addressing the root causes of these factors, significant achievement can be realized. Chemistry, being one of the basic requirements for admission to study medicine, pharmacy, agricultural science, chemical engineering among other lucrative courses requires excellent grades by students to produce high quality specialists in various fields. Chief examiners' reports from WAEC (2020-2024)

examinations indicates that students score low marks in chemical equilibrium questions thereby leading to poor grades in chemistry. Despite the perceived importance and role of chemistry in the world's science and technology development, students' performance in West African Senior School Certificate examinations in the past decades have persistently been low.

Based on the pivotal role of chemistry in every sphere of life, it has been noted that the enrolment of students for the subject has been on the increase but performance of the students, persistently diminishes dramatically on yearly basis. Hence, students' high failure rate may be due to the fact that chemistry is a difficult subject. This failure is of great concern to stakeholders. Could this low performance be the outcome of teaching strategy? What will be the effect tutorial strategies on interest and performance of SS II students in chemical equilibrium concept in chemistry?

The search for a more efficient method of teaching chemical equilibrium concept in chemistry has necessitated the need for more interactive strategies for improved teaching and learning. An interactive strategy considered by this study for improvement is tutorial instructional strategy. Based on the above questions, the most prominent question is: What will be the effects of Tutorial Instructional Strategy on the interest and performance of students in chemical equilibrium in SS II chemistry? The findings of this study are expected to provide empirical evidence on the effectiveness of tutorial instructional strategy and offer useful insights for chemistry teachers, curriculum planners, and educational policy makers on improving the teaching and learning of chemistry at the secondary school level.

Objectives of the Study

This study main purpose is to investigating the effect of tutorial instructional strategy on students' interest and performance in chemical equilibrium in Abuja, Nigeria. While the specific objectives are:
1. To determine the effect of students' interest scale in chemical equilibrium

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when taught using Tutorial instructional strategy.

2. Investigate the students' performance scores in chemical equilibrium when taught using tutorial instructional strategy.

Research Questions

The following research questions were asked to guide this study:

1. What are the mean interest ratings of students taught chemical equilibrium using tutorial instructional strategy and conventional method?
2. What are the mean performance scores of students taught chemical equilibrium using tutorial and conventional strategies?

Statement of Hypotheses

The following null hypotheses were formulated and tested at 0.05 level of significance:

H_{01}. There is no significant difference in the mean interest ratings of students taught chemical equilibrium using tutorial strategy and those taught using conventional method.

H_{02}. There is no significance different in the mean performance scores of students taught chemical equilibrium using tutorial strategy and those taught using conventional method.

METHODOLOGY

The researcher employed a quasi-experimental design of pretest-posttest control group to investigate the effect of tutorial instructional strategy on students' interest and performance. The study consisted of two groups: an experimental group exposed to the tutorial instructional strategy and a control group taught using the conventional method.

The population comprised 723 SS II students in 19 public secondary schools in AMAC. A simple random sampling techniques was used to sampled out 102 SS II students for the study. Using a lucky dip, one school was designated the experimental group and the other, the control group. Out of the schools selected for the experimental and control groups, two intact classes will be chosen. One intact class will be designated as the experimental and control groups respectively. The chemistry teacher of each class will teach the class.

Chemical Equilibrium Interest Scale (CEIS) and Chemical Equilibrium Performance Test (CEPT) items were used for data collection. Chemical Equilibrium interest scale (CEIS) comprised of two sections (A & B). Section A was made up of bio-data of the respondents, such as class, gender and school name. Section B contains 20 items rated on a four-point scale: Strongly Agree (4), Agree (3), Disagree (2), and Strongly Disagree (1). Negatively worded items were reverse scored to ensure consistent interpretation.

Chemical Equilibrium Performance Test (CEPT) items contained 40 objectives questions with four distractive options (A-D) for each question. The items were adapted from West African Examination Council (WAEC) past questions. Students were instructed to select the option that best completed or answered the question. Each correct response was awarded one (1) mark. Each incorrect or unanswered item was scored zero (0). The maximum score of the CEPT items is 40 marks. The data collected was used for the analysis of students' interest and performance in chemical equilibrium. A Table of Specification (TOS) was developed to ensure content validity and balanced distribution of questions across the content areas and cognitive levels based on Bloom's taxonomy (2021).

Two instrument CEIS and CEPT were face validated by 2 experts in Science Education Department and One expert from Measurement and Evaluation department. The experts were required to validate the instrument with respect to clarity of the items and relevance. These experts ascertained face and content validity of the instruments. Based on the experts' comments, corrections and suggestions to correct the grammar and make some items specific, the instruments were modified. To ascertain the reliability of the instruments, 30 copies each of CEIS and CEPT instruments were trial tested on senior secondary school students offering Chemistry that were not part of the sample. The

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reliability of CEIS was determined using Cronbach Alpha, yielding a coefficient of 0.84. CEPT reliability was assessed using the Kuder-Richardson Formula 20 (KR-20), appropriate for dichotomously scored items, with a reliability coefficient of 0.88.

A two-day training session was organized by the researcher for the regular Chemistry teachers assigned to the experimental and control groups. During the training, the teacher for the experimental group was trained on how to use the tutorial instructional strategy to teach chemical equilibrium, while the control group teacher was guided on using the conventional method based on the validated lesson plan. The regular Chemistry teachers subsequently implemented the lessons and administered the research instruments. The

Chemical Equilibrium Interest Scale (CEIS) and the Chemical Equilibrium Achievement Test (CEAT) pre-tests were administered to both groups one week prior to the commencement of the teaching. At the end of the instructional period, post-tests were administered to determine the effect of the treatment. Mean and standard deviation were used to answer research questions while Analysis of Covariance (ANCOVA) was used to test the null hypotheses at 0.05 level of significance.

RESULTS AND FINDINGS

Research Questions:
What are the mean interest ratings of students taught chemical equilibrium using tutorial instructional strategy and conventional method?

Table 1: Mean and Standard Deviation on Mean Interest Scale of Students Taught Chemical Equilibrium Using Tutorial Instructional Strategy and Conventional Method

Groups	N	Mean	Std. Dev.
Experimental	60	67.67	8.87
Control	42	33.43	7.02

Table 1 revealed the mean and standard deviation on mean interest ratings of students taught chemical equilibrium using tutorial instructional strategy and conventional method. Experimental group are (N = 60, M = 67.67, SD = 8.87) and control group are (N = 42, M = 33.43, SD = 7.02) respectively. This implies that students

in experimental group have higher positive interest than the control group.

Research Question Two:
What are the mean performance scores of students taught chemical equilibrium using tutorial and conventional strategies?

Table 2: Mean and Standard Deviation on Mean Performance Scores of Students Taught Chemical Equilibrium Using Tutorial Instructional Strategy and Conventional Method

Groups	N	Mean	Std. Dev.
Experimental	60	35.85	1.77
Control	42	15.33	4.32

Table 2 revealed the mean and standard deviation on mean performance scores of students taught chemical equilibrium using tutorial instructional strategy and conventional method. Experimental group are (N = 60, M = 35.85, SD = 1.77) and control group are (N = 42, M = 15.33, SD = 4.32) respectively. This implies that students in experimental group performed higher than the control group.

Null Hypothesis One:
There is no significant difference in the mean interest ratings of students taught chemical equilibrium using tutorial strategy and those taught using the conventional method.

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Table 3: ANCOVA Results on Students Interest Scale when Taught Chemical Equilibrium Using Tutorial Instructional Strategy and Conventional Method

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	28961.401[a]	1	28961.401	434.750	0.000	0.813
Intercept	252500.224	1	252500.224	3790.373	0.000	0.974
GROUP	28961.401	1	28961.401	434.750	0.000	0.813
Error	6661.619	100	66.616			
Total	328322.000	102				
Corrected Total	35623.020	101				

a. R Squared = 0.813 (Adjusted R Squared = 0.811)
b. Computed using alpha = 0.05

Table 3 reveals that; there is a significant difference in the mean interest scale of students exposed to Tutorial Instructional Strategy and Conventional Method. The value of $F_{(1, 100)} = 434.750$ is obtained with associated exact probability value of 0.000. Since the associated probability value was 0.000 is less than 0.05 level of significance, the null hypothesis one is rejected. The results implied that, the Tutorial Instructional strategy produce a significant effect on the post-test interest scores of students when covariate effect (pre-test) is controlled. Hence, there is a significance difference among the two groups.

Null Hypothesis Two:
There is no significance different in the mean performance scores of students taught chemical equilibrium using tutorial strategy and those taught using the conventional method.

Table 4: ANCOVA Results on Students Performance Scores when Taught Chemical Equilibrium Using Tutorial Instructional Strategy and Conventional Method

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	10399.536[a]	1	10399.536	1093.556	0.000	0.916
Intercept	64722.830	1	64722.830	6805.885	0.000	0.986
GROUP	10399.536	1	10399.536	1093.556	0.000	0.916
Error	950.983	100	9.510			
Total	87939.000	102				
Corrected Total	11350.520	101				

a. R Squared = 0.916 (Adjusted R Squared =0.915)
b. Computed using alpha = 0.05

Table 4 reveals that; there is a significant difference in the mean performance scores of students exposed to Tutorial Instructional Strategy and Conventional Method. The value of $F_{(1, 100)} = 1093.556$ is obtained with associated exact probability value of 0.000. Since the associated probability value was 0.000 is less than 0.05 level of significance, the null hypothesis two is rejected. The results implied that; the Tutorial Instructional strategy produce a significant effect on the post-test performance scores of students when covariate effect (pre-test) is

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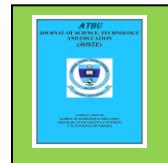
controlled. Hence, there is a significance difference among the two groups.

DISCUSSION OF FINDINGS

The findings of the study revealed that, there is significant difference among the mean interest ratings of students in chemical equilibrium using tutorial instructional strategy and conventional method. The significant difference in students' interest ratings could be justified by the interactive and engaging nature of tutorial instructional strategy, which makes abstract concepts like chemical equilibrium more understandable and visually appealing. Unlike conventional method, tutorial instructional strategy provides dynamic multiple repetition, immediate feedback, and opportunities for active exploration, all of which help to capture students' attention and sustain their interest.

This finding supports that of Samuel (2018) which states that, significant differences in the interest of students exposed to tutorial instructional strategy compared to conventional method. The finding is similar to that of Asedillas and Quimbo (2019) which observed that tutorial strategy increased students' performance and interest in Chemistry. The finding also coincides with that of Olugbuyi (2021) which found significant difference in the post-test mean interest of students' exposed to tutorial instructional strategy and conventional method. It also aligns with Aliyu, Isah & Dikko, (2025) which found that the interest ratings of students taught using tutorial instructional strategy increased more than the control group. This finding however, in disagreement with the earlier finding by Salisu (2016) which reported that improving students' interest does not depend on utilization of tutorial instructional strategy.

Furthermore, it was found that there is significant difference among the mean academic performance scores of students in chemical equilibrium using tutorial instructional strategy and conventional method. The significant difference in academic performance may be justified by the interactive nature of tutorial, which help students better understand and apply complex concepts through visualization, manipulation, and immediate feedback. This active learning approach enhances retention and corrects misconceptions more effectively than conventional methods, leading to improved performance in chemical equilibrium. This finding agrees with that of Okwuduba, Offiah, & Madichie, (2018) who found that tutorial teaching strategy was more effective in enhancing students' performance in chemistry than conventional method.

The finding also agrees with the finding of Jack and Gamnjoh (2020) who found significant difference in the mean performance scores of students taught chemical equilibrium using Tutorial Instructional strategy than the Conventional method. This finding is similar to Okebanama, Ugwu, & Elenwoke (2021) which states that, students who were taught with tutorial achieved better than those taught with conventional method. Similarly, Batamuliza, Habinshuti & Nkurunziza (2024) revealed that, tutorial enhance students' performance in chemical equilibrium. This finding is similar to Gongden (2025) who found significant difference in students' achievement in favor of those taught using tutorial classroom approach.

CONCLUSION

The findings of this study have supplied empirical proof that employing tutorial instructional strategy is an effective way to enhance students' interest and academic performance in chemical equilibrium. Therefore, integrating tutorial into Chemistry instruction can serve as a transformational strategy for teaching, making learning complex scientific concepts like chemical equilibrium, engaging, and comprehensible for learners with improved interest and academic performance.

RECOMMENDATIONS

The following recommendations are made based on the findings of the study:
1. Chemistry teacher should be encouraged to adopt Tutorial instructional strategy in teaching Chemical Equilibrium concepts in Chemistry.

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2. Chemistry teachers should be trained on how to adopt or adapt the use of Tutorial instructional strategy to teach Chemical Equilibrium and other chemistry concepts in general.

3. Chemistry teachers should discourage in utilizing Conventional Method alone, as they promote rote learning.

4. Chemistry teachers should use student-cantered approach like Tutorial Instructional Strategy in Teaching and learning and be practical as recommended by the curriculum to improve their creative thinking skills in learning Chemical Equilibrium.

5. Seminars, Conferences, and workshops be organized for chemistry teachers to update their knowledge on the use Tutorial instructional strategy by AMAC, Abuja.

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