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Boosting Students' Academic Performance in Chemistry: Examining The Roles of Enriched Lecture and Guided Discovery Methods

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ABSTRACT:
Chemistry remains a cornerstone of scientific advancement, yet students' academic performance in the subject continues to lag in Nigerian secondary schools. This study examined the effectiveness of enriched lecture and guided discovery methods in improving the academic performance of Senior Secondary 1 students in Kogi State. Guided by four research questions and five hypotheses, a quasi-experimental pretest-posttest non-equivalent control group design was employed. A total of 180 students were selected through a multi-stage sampling technique. Instructional treatments spanned four weeks, after which the Chemistry Performance Test (CPT) was administered with a reliability index of 0.88. Data were analyzed using means, standard deviation, and ANCOVA. Findings revealed that enriched lecture and guided discovery methods significantly enhanced students' academic performance compared to the conventional method, with enriched lecture outperforming guided discovery. However, both methods favored male students, revealing a gender gap in achievement. These findings suggest that chemistry teachers need to adopt enriched lectures while providing targeted support to female students to close the gender disparity. The study recommends that professional bodies such as the Science Teachers Association of Nigeria (STAN) promote training on enriched lectures and advocate for gender-responsive instructional strategies. The research contributes new insights into comparative pedagogical effectiveness and the critical need for inclusive education practices in science teaching.

Keywords: academic performance, boosting, enriched lecture, guided discovery, method

INTRODUCTION

Chemistry education is vital in understanding various aspects of life and is essential for fields such as technology, medicine, and engineering (Gongden & J., 2015). The significance of chemistry extends beyond academics, impacting daily life, health, quality of life, and nutrition. For instance, the development and manufacturing of medicine rely heavily on chemistry. It can be inferred that chemistry is a crucial science subject that deals with the forms, structure, and changes of substances around us. In Nigeria, senior secondary school students widely choose chemistry in the Senior School Certificate Examination (SSCE) and National Examination Council (NECO) due to its relevance and interest. However, despite the emphasis on innovative instructional strategies, students' academic performance in chemistry remains below average, as evident in the West African Senior School Certificate Examination (SSCE) conducted by the West African Examinations Council (WAEC) (Achimugu L., 2024; Council, 2022). This highlights the need for effective strategies to boost students' understanding and performance in chemistry.

Researchers in chemistry education have identified teacher-related factors as a significant contributor to students' low performance in chemistry, particularly after many years of the new chemistry curriculum. A significant factor identified is the teacher's reluctance or inability to adopt innovative instructional strategies, such as inquiry, cooperative learning, think-pair-share, guided discovery, concept mapping, mind mapping, computer-assisted instruction, game-based learning, problem-solving, and Google Classroom (Abraham, I. Victor, O Endurance, et al., 2023; Abraham, I. Victor, O., et al., 2023; Achimugu, 2016; Lamidi et al., 2015). In contrast, studies have shown that chemistry teachers predominantly use conventional strategies, with lectures being the most commonly used method (Achimugu, 2016). Although traditional lectures have been criticized, they can be improved by proper planning, encouraging students' participation through questioning and discussion, and combining them with other strategies. Hence, there is a need for an enriched lecture method.

The Enriched Lecture Method (ELS) combines lectures with other techniques, such as questioning and discussion, to promote active student participation. A good chemistry teacher ensures a two-way communication pattern and shared responsibility by asking questions and encouraging students to ask their own questions (Achimugu, 2018). This method aims to disseminate information and achieve educational objectives through learning. Studies have shown that ELS improves academic performance in chemistry and physics compared to traditional lecture methods (Bello, 2015; Matazu et al., 2023). Guided discovery learning is a widely recommended method in science education (Aldahmash et al., 2016). It involves students creating personal knowledge through questioning and investigation, guided by a teacher (Sola & and Ojo, 2017). This approach promotes active engagement, critical thinking, and collaboration, leading to a deeper understanding of concepts and the development of essential skills (Kuhlthau et al., 2015). Studies have shown that the guided discovery method is more effective than the

traditional method in improving student achievement in science subjects like Biology Abu & O. (2023) and Chemistry (Ogochukwu & and Stephen, 2022).

Researchers have recommended that teachers adopt guided discovery methods to improve teaching and learning in science and boost student performance (Ogochukwu & Stephen, 2022). Additionally, studies have found no significant difference in academic achievement between genders when using the guided discovery method, with no significant interaction between gender and method (Ogochukwu & Stephen, 2022). Overall, guided discovery learning is a powerful approach to science education that promotes active learning, critical thinking, and collaboration, leading to improved student outcomes (Ekwueme, 2024). For these reasons, guided discovery was recommended to implement the senior secondary school chemistry curriculum in Nigeria effectively. However, research outcomes and findings obtained from studies conducted by many science educators and researchers in Nigeria have shown that many chemistry teachers do not utilize guided discovery or any other innovative method recommended in the national curriculum. Indeed, many teachers are reluctant to give up their old practices of conventional lecture methods (Ochu & Haruna P.F., 2014). To create changes and innovations in science teaching, science educators have devised the idea of enriching the lecture method, which may be easier for science teachers to accept and adopt for their classroom interaction pattern. Therefore, this study aims to examine the role of enriched lecture methods and guided discovery methods in improving academic performance in chemistry.

On a general note, the study aimed to examine the role of enriched lecture and guided discovery methods in improving students' academic performance in chemistry at Kogi State. Specifically, the study sought to determine: the mean performance scores of students taught chemistry through enriched lecture and guided discovery methods, the mean performance scores of students taught chemistry through enriched lecture and conventional lecture methods, the mean performance scores of students taught chemistry through guided discovery and conventional lecture methods and the mean performance scores of male and female students taught chemistry through enriched lecture and guided discovery methods. The following research questions guided the study: what are the mean performance scores of students taught chemistry through enriched lecture and guided discovery methods; what are the mean performance scores of students taught chemistry through enriched lecture and conventional methods; what are the mean performance scores of students taught chemistry through guided discovery and conventional methods, and what are the mean performance scores of male and female students taught chemistry through enriched lecture and guided discovery methods?. The following hypotheses were formulated to guide the study and were tested at a 0.05 level of significance: there is no significant difference in the mean performance scores of students taught chemistry through enriched lecture and guided discovery methods, there is no significant difference in the mean performance scores of students taught chemistry through enriched lecture and conventional lecture methods, there is no significant difference in the mean

performance scores of students taught chemistry through guided discovery and conventional methods, and there is no significant difference in the mean performance scores of male and female students taught chemistry through enriched lecture and guided discovery methods.

The novelty of this study lies in its comparative analysis of *enriched lecture* and *guided discovery* methods specifically within the context of senior secondary school chemistry in Kogi State, Nigeria—something that has received limited attention in previous literature. While prior research (Bello, 2015; Matazu et al., 2023) established the individual effectiveness of enriched lecture or guided discovery methods over conventional teaching, this study uniquely evaluates both methods against each other using a robust quasi-experimental design. Furthermore, it highlights a significant gender disparity in student performance, favoring males across both methods, contradicting some earlier findings (Musa et al., 2021; Ogochukwu & and Stephen, 2022), and thus introduces a critical gender dimension to the discourse on pedagogical effectiveness in chemistry education. This dual focus on instructional method comparison and gender responsiveness underscores the need for a gender-sensitive pedagogical framework, particularly within the Nigerian science education context.

RESEARCH METHODS

This study utilized a quasi-experimental design, specifically the pretest-posttest non-equivalent control group design, as Achimugu et al. proposed (2024). The research design involved administering a pretest to assess the subjects' initial ability levels. Subsequently, the students received instruction through either the Enriched Lecture Method (Gp1) or the Guided Discovery Method (Gp2), while the control group (Gp3) followed the conventional lecture method. A posttest was then administered to evaluate the effectiveness of the instructional strategies. Although intact classes were randomly selected, they were non-randomly assigned to the experimental or control groups, as is characteristic of quasi-experimental designs (Achimugu et al., 2024). The design can be illustrated as follows:

Gp1 (Experimental Group One): Pt1 → X1 → Pt2

Gp2 (Experimental Group Two): Pt1 → X2 → Pt2

Gp3 (Control Group): Pt1 → C → Pt2

Where:

Pt1 = Pretest for all groups

Pt2 = Posttest for all groups

X1 = Treatment with Enriched lecture method

X2 = Treatment with the guided discovery method

C = Control group (no treatment).

The study population consisted of the entire senior secondary school class one (SS I) students offering chemistry in two hundred and fifty-four (254) government secondary schools

in Kogi State, Nigeria. These two hundred and fifty-four (254) schools had a population of eleven thousand, three hundred and ninety-one (11,391) students, 6,082 males and 5,309 females. (Source: Kogi State Science Technical Education and Teaching Service Commission (STETSCOM press, 2024). The sample for the study was 180 (107 males and 73 females) of SSI chemistry students. A multi-stage sampling technique was used to select schools from the target population. Initially, 10 schools with well-equipped chemistry laboratories, qualified chemistry teachers, and co-educational chemistry classes were purposively selected. Then, three schools were randomly selected from these 10 schools using a simple random sampling technique.

The sample for the study was 180 (107 males and 73 females) of SSI chemistry students. A multi-stage sampling technique was used to select schools from the target population. Firstly, a simple random sampling technique by balloting was used to select two Local Government Areas (LGAs) from each of Kogi state's three senatorial zones, comprising six (6) LGAs. Secondly, the purposive sampling technique was used to select four (4) schools from each LGA, giving twenty-four (24) schools with well-equipped chemistry laboratories, qualified chemistry teachers, and one arm of a co-educational chemistry class. The 24 schools that met the above criteria were subjected to the third stage of sampling, which involved using a simple random sampling technique by balloting to select two schools from each of the senatorial zones, giving a total of six schools. Fourthly, simple random sampling by throwing a coin was used to assign two schools with their intact classes to each group (two experimental and one control), giving a total of six schools used for the study.

The instrument for this study was the Chemistry Performance Test (CPT). The Chemistry Performance Test (CPT) assessed students' understanding of acids, bases, and salts. The CPT consisted of 25 objective questions with four response options. Four lesson plans were prepared for each method, and experts validated the instrument's face and content validity. The reliability of the CPT was determined through a pilot test, which yielded a reliability index of 0.88 using the Kuder-Richardson formula (KR-20). For the experimental procedure, six regular chemistry teachers (research assistants) were trained for two hours daily for four days. The training manual included lesson plans and questions to elicit student participation. The topics: acids, bases, and salts, were taught four times using the three strategies. The treatment involved administering a pre-test and then a post-test after four weeks. Extraneous variables were controlled by administering pre-tests and post-tests, using ANCOVA to test hypotheses, and minimizing teacher and experimental bias. Data analysis used mean and standard deviation to answer research questions and ANCOVA to test hypotheses at a 0.05 significance level.

RESULTS AND DISCUSSION

The results were presented according to the research questions and hypotheses that guided the study.

A. **Question 1.** What is the difference between the mean performance score of students taught chemistry using guided discovery and those taught using enriched lecture methods?

Table 1. **Pretest/Posttest of the Mean Performance score of Students taught Chemistry using Guided Discovery and those taught using Enriched Lecture Method.**

Group	Sample (n)	Pre-test	Post-test	Mean gain		
		Mean	SD	Mean	SD	
Guided Discovery	63	29.83	7.840	64.76	5.833	34.93
Enriched lecture	58	29.95	7.407	65.88	5.557	35.93
Mean Difference		0.120		1.120		1.000
Total	121					

Results in Table 1 showed the pre-test and post-test mean academic performance scores of students taught chemistry using guided discovery and enriched lecture methods. The results showed that the enriched lecture method's higher mean gain difference (1.000) improved students' academic performance more than guided discovery. It implies that enriched lecture methods positively affected students' mean academic performance scores in chemistry.

B. **Question 2.** What is the difference between the mean performance score of students taught chemistry using enriched lecture and those taught using conventional methods?

Table 2. Pretest/Posttest Mean Performance Score of Students Taught Chemistry using Enriched Lecture and those taught using the Conventional Method.

Group	Sample (n)	Pre-test	Post-test	Mean gain		
		Mean	SD	Mean	SD	
Enriched Lecture Method	58	29.95	7.407	65.88	5.557	35.93
Conventional Lecture Method	59	31.64	7.165	42.12	7.821	10.48
Mean Difference		1.690		23.76		25.45
Total	117					

Table 2 shows the mean performance score of students taught chemistry using enriched lectures and those taught using conventional methods. The results show that the enriched lecture method's higher mean gain difference (25.45) improved students' academic performance more than the conventional method. This indicates that the enriched lecture method positively affected students' mean academic performance scores in chemistry.

C. **Question 3.** What is the difference between the mean performance score of students taught chemistry using guided discovery and those taught using enriched lecture methods.

Table 3. Pretest/Posttest Mean Academic Performance Score of Students Taught Chemistry

Using Guided Discovery and Those Taught Using Conventional Lecture Teaching Method.

Group	Sample (n)	Pre-te st	Post-test	Mean gain		Mean gain
		Mean	SD	Mean	SD	
Guided Discovery	63	29.83	7.840	64.76	5.833	34.93
Conventional Lecture Method	59	31.64	7.165	42.12	7.821	10.48
Mean Difference		1.810		22.64		24.45
Total	122					

Results in Table 3 showed the pre-test and post-test mean academic performance scores of students taught Chemistry using guided discovery and conventional lecture teaching methods. We can deduce from the table that the higher mean gain difference (24.45) of guided discovery improved students' academic performance more than the conventional method. It implies the positive effect of guided discovery on the mean academic performance scores of students in chemistry. This further implies that the treatment was effective. The closeness of SD varies in the two groups, indicating that the respondents were homogenous in their responses to academic performance items.

D. Question 4: What are the mean performance scores of male and female students taught chemistry using enriched lecture and guided discovery methods?

Table 4. Mean performance scores of male and female students taught chemistry using Enriched lecture, guided discovery, and conventional lecture methods.

Group	Gender	N	Pre-test Mean	Pre-test SD	Post-test Mean	Post-test SD	Mean Gain	Mean Difference
Enriched Lecture	Male	27	26.55	6.506	67.81	2.182	41.26	
	Female	31	27.85	4.456	67.45	3.870	39.60	**1.960**
Guided Discovery	Male	29	27.38	6.831	67.71	2.303	40.33	
	Female	34	28.93	5.324	67.21	3.609	38.28	**2.050**
	Total	121						

Results in Table 4 showed the influence of gender on mean academic performance scores of students taught chemistry using the enriched lecture method and those taught using the guided discovery method. The result indicated that the male students performed higher than their female counterparts, with a mean gain of 40.33, while the female students had a mean gain of 33.28, thus with a mean difference of 2.050 in favour of the male counterpart.

Ho1: There is no significant difference in the mean performance scores of students taught

chemistry using enriched lecture and guided discovery methods.

Table 5. Analysis of Covariance (ANCOVA) of the Difference in the Mean Performance Score of Students Taught Chemistry Using Guided Discovery and Those Taught Using Enriched Lecture Method.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	276.256[a]	2	138.128	6.274	.003	.096
Intercept	34408.694	1	34408.694	1562.783	.000	.930
Pretest	49.854	1	49.854	2.264	.135	.019
MethodEandG	228.113	1	228.113	10.360	.002	.081
Error	2598.074	118	22.018			
Total	531139.000	121				
Corrected Total	2874.331	120				

a. R Squared = .096 (Adjusted R Squared = .081)

The result in Table 5 showed the ANCOVA of the difference in the mean academic performance scores of students in chemistry when exposed to guided discovery and enriched lecture methods. The result was statistically significant at (F) =10.360, p= 0.002, η2p = 0.081). The null hypothesis was rejected since the associated probability value of 0.002 is less than 0.05, set as the significance level. Thus, the inference drawn is that there was a statistically significant difference in the mean academic performance of students taught chemistry when exposed to enriched lectures and guided discovery in favour of enriched lectures, with a high mean. The result further showed the effect size (η2p = 0.081), which indicates that an 8.1% variance in the mean academic performance of students in Chemistry when exposed to enriched lectures can be accounted for by the teaching method used.

Ho2: There is no significant difference in the mean performance scores of students taught chemistry through enriched and conventional lectures.

Table 6. Analysis of Covariance (ANCOVA) of Difference in the Mean Performance Score of Students Taught Chemistry Using Enriched Lecture and Those Taught Using Conventional Lecture Teaching Method.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	18933.764[a]	2	9466.882	270.160	.000	.826
Intercept	20941.406	1	20941.406	597.612	.000	.840
PretestEand C	91.904	1	91.904	2.623	.108	.022
MethodEandC	18282.298	1	18282.298	521.728	.000	.821
Error	3994.766	114	35.042			

Total	373014.000	117
Corrected Total	22928.530	116

a. R Squared = .826 (Adjusted R Squared = .823)

The result in Table 6 showed the ANCOVA of the difference in the mean academic performance scores of students in Chemistry when exposed to enriched lecture and conventional lecture teaching methods. The result was statistically significant at (F) =521.728, p= 0.00, η2p = 0.821). The null hypothesis was rejected since the associated probability value of 0.00 is less than 0.05, set as the significance level. Thus, the inference drawn is that there was a statistically significant difference in the mean academic performance of students taught Chemistry when exposed to enriched lectures and conventional lecture teaching methods in favour of enriched lectures, with a high mean. The result further showed the effect size (η2p = 0.821), which indicates that 82.1% of the variance in the mean academic performance of students in Chemistry when exposed to enriched lectures can be attributed to the teaching method used.

Ho3: There is no significant difference in the mean performance score of students taught chemistry using guided discovery and those taught using conventional teaching methods.

Table 7. Analysis of Covariance (ANCOVA) of the Difference in the Mean Performance Score of Students Taught Chemistry Using Guided Discovery and Those Taught Using the Conventional Teaching Method.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	15787.244[a]	2	7893.622	171.056	.000	.742
Intercept	23025.779	1	23025.779	498.973	.000	.807
PretestGandC	166.178	1	166.178	3.601	.060	.029
MethodGandC	15008.145	1	15008.145	325.229	.000	.732
Error	5491.420	119	46.146			
Total	374551.000	122				
Corrected Total	21278.664	121				

a. R Squared = .742 (Adjusted R Squared = .738)

The result in Table 7 showed the ANCOVA of the difference in the mean academic performance scores of students in chemistry when exposed to guided discovery and conventional lecture teaching methods. The result was statistically significant at (F) =325.229, p= 0.00, η2p = (0. 732). The null hypothesis was rejected since the associated probability value of 0.00 is less than 0.05, set as the significance level. Thus, the inference drawn is that there was a statistically significant difference in the mean academic performance of students in chemistry when exposed to guided discovery and conventional methods in favour of guided discovery, with a high mean. The result further showed the effect size (η2p = 0.732), which indicates that a 73.2% variance in

the mean academic performance of students in chemistry when exposed to guided discovery can be attributed to the teaching method used.

Ho4: There is no significant difference in the mean performance score of male and female students taught chemistry using enriched lectures and guided discovery methods.

Table 8: Analysis of Covariance (ANCOVA) of the Difference in the Mean Performance Score of Male and Female Students Taught Chemistry Using Enriched Lecture and Guided Discovery Methods

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	8.222[a]	2	4.111	.426	.655	.065
Intercept	11556.180	1	11556.180	1198.598	.000	.656
PretestEandG	1.969	1	1.969	.204	.253	.004
Gender2	23.176	1	23.176	26.261	.004	.451
Error	530.278	118	9.641			
Total	264801.000	121				
Corrected Total	538.500	120				

a. R Squared = .656 (Adjusted R Squared = .626)

The result in Table 8 also showed the ANCOVA of the difference between the mean academic performance of male and female students taught chemistry using enriched lectures and guided discovery methods. The result was statistically significant at (F) = 26.261, p= 0.004, η2p = 0.451). The null hypothesis was rejected since the associated probability value of 0.004 is less than 0.05, set as the significance level. Thus, the inference drawn is that there was a significant difference between the mean academic performance of male and female students taught chemistry using enriched lectures and those taught with guided discovery teaching methods in favour of males, with higher mean scores. The result further showed the effect size (η2p = 0.451), which indicates that a 45.1% variance in the mean academic performance of male and female students taught chemistry using enriched lecture and guided discovery teaching methods can be accounted for by gender.

Discussion

In Tables 1& 5, the results on the academic performance score of students, when taught chemistry using guided discovery and enriched lecture method, showed that there was a statistically significant difference in the mean academic performance of students in chemistry when exposed to enriched lecture and guided discovery in favour of enriched lecture with high mean. The effectiveness of enriched lectures can be attributed to their incorporation of activities that promote active learning, critical thinking, and problem-solving. Additionally, using enriched

lecture methods in conjunction with other methods, such as questioning and discussion skills, boosts active student participation in classroom interactions. Enriched lecture is an instructional method that boosts conventional lectures with multimedia, interactive elements, and learner-centered activities to improve student learning outcomes and motivation. In this method, students actively develop their skills and abilities in a flexible and conducive classroom environment. The role of the teacher is to create a problematic situation, provide resources, and guide students in identifying issues, testing hypotheses, and drawing conclusions. As noted by Achimugu (2018), chemistry teachers using this method should facilitate two-way communication, share responsibility, and encourage students to ask questions. In contrast, the guided discovery method, which is often recommended as a best practice in science education, was less effective than the enriched lecture method in this study. This may be because the guided discovery method requires students to take more responsibility for their learning, which can be challenging for some students (Jeong & Hmelo-Silver, 2016). Additionally, the guided discovery method may not provide enough structure and guidance for students, leading to confusion and frustration (Endo et al., 2023). The findings of this study are unique and interesting, as a thorough review of the literature revealed limited research in science education, particularly chemistry, that compares the relative effectiveness of enriched lecture and guided discovery methods in improving students' performance. This study provides valuable insights for teachers who traditionally rely on conventional teaching methods, suggesting that incorporating innovative approaches, such as enriched lectures, can make instruction more student-centred and improve chemistry students' performance.

The study's finding is also supported by hypothesis one, which found a statistically significant difference in the mean academic performance of students in chemistry when exposed to enriched lecture and conventional lecture methods in favour of the enriched lecture method. This implies that conventional lecture methods can explain 82% of the variance in the mean academic performance of students in chemistry when exposed to enriched lecture methods. The higher academic performance of students in the enriched lecture group could be because conventional methods, typically characterized by lecture-based instruction and individual work, often fail to engage students actively. In contrast, Enriched lecture engages students in active participation by ensuring a two-way communication pattern and shared responsibility by asking questions and encouraging students to ask questions, having them think about a problem, discuss it with a partner, and then share their insights with the larger group. This process fosters critical thinking and more profound understanding and boosts academic performance. The finding agrees with Achimugu (2018) who examined the effectiveness of enriched demonstration and lecture instructional strategies on senior secondary school students' achievement in chemistry in Idah Local Government Area of Kogi State and found that there is a significant difference between the performance of students exposed to two enriched instructional strategies and those exposed to conventional lecture method in favour of enriched lecture method. The finding is also

consistent with Muhammed et al., who investigated the impact of enriched lecture method on the academic performance of secondary school students in physics in Kano Metropolis Nigeria and found that there was a difference in academic performance between students taught using multimedia-enriched lecture method and those taught using conventional lecture method in favour of enriched lecture method. The finding further concurs with Baba et al. (2022) who found a significant difference in the mean scores of students taught using the enriched lecture method compared to those taught using the conventional approach.

Also, the result showed that students taught chemistry using guided discovery had higher mean academic performance scores than those taught conventional lecture teaching methods. This implied that guided discovery significantly affected chemistry students more than the conventional lecture teaching method. The study's finding is also supported by the test of hypothesis two, which found a statistically significant difference in the mean academic performance of students in chemistry when exposed to guided discovery. This implied that conventional instructional methods can explain a 73% variance in the mean academic performance scores of students in chemistry when exposed to guided discovery. Guided discovery has several features that contribute to its superiority over conventional lecture teaching methods. This finding could be because one of the key advantages of guided discovery is that it fosters the philosophy of learning by doing and problem-solving through guided experimentation, which boosts students' participation, creativity, and academic performance. This finding agrees with Egbes et al. (2023) who investigated the effects of guided discovery and problem-solving instructional strategies on the achievement of biology students in Delta Central senatorial district, Nigeria whose results showed that there was a significant difference in the mean performance scores in biology among students in guided discovery, problem-solving instructional strategies and lecture method with students in the guided discovery group scoring the highest mark followed by students in problem-solving and lecture method respectively. The finding is consistent with Bamiro & O. (2015) who found that students taught with guided discovery and think-pair-share strategies obtained significantly higher post-test mean performance scores than those in the lecture method. The findings of the study are in agreement with Maake (2019) whose study findings revealed that the guided discovery instructional method improved learners' performance in science than the conventional lecture method. The agreement of the findings could result from the guided discovery method's ability to encourage students to take a more active role in their learning process by answering a series of questions or solving problems to help them understand concepts.

Regarding gender, the study showed that male students had higher mean academic performance than their female counterparts in chemistry when taught with enriched lectures and guided discovery. This is in line with the test of hypothesis four, which found a statistically significant difference between the mean academic performance of male and female students

taught chemistry using enriched lecture and guided discovery teaching methods in favour of the male. This could be because in the use of enriched lecture and guided discovery teaching methods, female students, in particular, may face challenges in using enriched lecture and guided discovery methods due to societal and cultural factors that may influence their confidence and self-efficacy in science, technology, engineering, and mathematics (STEM) subjects. This calls for special attention to female students when a chemistry teacher uses the above two methods in teaching chemistry. The finding disagrees with Musa et al. (2021) who found no significant difference in the mean performance scores between male and female students using the simulation method. The finding of the study was not consistent with Ozioko (2015) who researched the effect of the guided discovery method on academic performance and interest of senior secondary school students in foods and nutrition in the Nsukka Education zone of Enugu State and found that there is no significant difference in the performance between male and female students. Similarly, the finding was not similar to those of Musa (2015), whose findings revealed no significant difference between the mean academic performance scores of male and female students taught the wave concept of physics using computer-aided instruction. This disagreement could be due to teachers' variables, geographical location, and experimental bias.

CONCLUSION

The study revealed that enriched lecture and guided discovery methods improved students' academic performance in chemistry, with enriched lecture proving significantly more effective. However, both methods favored male students, highlighting a gender disparity in academic performance. As a result, it is recommended that chemistry teachers prioritize the enriched lecture method while also providing targeted support to female students when using either approach to help close the gender gap. Additionally, professional bodies like the Science Teachers Association of Nigeria (STAN) should organize training on the use of enriched lecture methods. Based on these findings, future research should focus on developing gender-responsive adaptations of these teaching methods to enhance female students' performance, assess the impact of such adaptations on gender disparities, and explore students' perceptions of the modified instructional strategies.

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