



**EFFECTS OF GUIDED INQUIRY AND LECTURES METHOD ON IMPROVING
ACADEMIC PERFORMANCE OF SENIOR SECONDARY SCHOOL STUDENTS IN
CHEMISTRY IN MAIDUGURI, BORNO STATE, NIGERIA**

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ABSTRACT

The study compared the effectiveness of guided inquiry and lectures method on academic performance of male and female senior secondary 2 chemistry students in Maiduguri metropolis, Borno state, Nigeria. The population of the study was 2344 students. The study sample were selected through simple random sampling technique. Hypotheses formulated were tested using ANCOVA at 0.05 level of significance. The instrument for data collection was chemistry performance test (CPT). Students of both groups were given pre-test to find out the performance of students before application of treatment. During the treatment the same test was given to the same groups of students at school with a given interval of 4 weeks and thereafter a post-test was given to the same students after treatment to measure the performance and compare the effectiveness of guided inquiry and lecture methods. The findings of the study revealed that students taught using guided inquiry scored significantly higher in post-test than the pre-test. This is revealed in $(F(1, 11) = 7.404, p < .01, \eta^2 = .537) = 0.05$. Post-hoc tests revealed a substantial mean difference $(M = -34.090, SE = 0.281, p < .001) = 0.05$. The results revealed that there was no significant effect of gender. Therefore, it was recommended that chemistry teachers should use guided inquiry teaching in chemistry classrooms.

Keywords: Academic, Performance, Chemistry, Effects, Guided Inquiry, Lecture Method.



Introduction

Guided inquiry is a learning process that engages students by making real-world connections through exploration and high-level questioning. The guided inquiry method is driven by one's own curiosity, interest, or passion to understand an observation or to solve a problem. Guided inquiry-based learning gives students the ability to question and interact with their educational material and the process they go through as they discover facts and details through their own efforts helps to instill a love of learning and an excitement for new opportunities. According to Kocijancic (2014), this has an impact on the increase in the knowledge acquisition of technology, the development of problem-solving skills and the ability to make critical decisions.

Trianto (2007) stated that the guided inquiry method does not only develop intellectual abilities but including the emotional and skills development. Guided inquiry method has its root in the scientific ways of investigating issues in a structured arrangement. When it is related to learning, the strategy is a model for processing information that enables learners to discover relevance to give information following laid-down steps that enable them to conclude or reflect a newly attained set of knowledge. Effectiveness of guided inquiry method gives students the ability to question and interact with their educational material and the process they go through as they discover facts and details through their own efforts helps to instill a love of learning and an excitement for new opportunities.

Lecture method is a teaching method whereby the teacher delivers a pre-planned body of knowledge to his students verbally using approved students text books. According to Marhaeni and Artini, (2015) lecture method is strongly oriented towards quantity and depends solely on knowledge. It is considered unable to supply students with competencies that are necessary in life.



The lecture method saves time and energy because the teachers cover a large number of materials (syllabus) to a large class size in a very short period.

Chemistry is one of the subjects that is offered in the Nigerian secondary school curriculum, whose objectives is to provide students with basic knowledge in chemical concepts and principles, through efficient selection of content and sequencing. According to Ayuba (2014), the academic performance of chemistry students is progressively becoming unscientific in their thoughts and approaches to problem-solving. Among the reasons for these problems are teachers' inability to put chemistry ideas to students and the wrong perception of students that chemistry is complex and tough. Some of the problems include low enrolment and poor performance of secondary school students in West African Senior School Certificate Examinations. Chemistry, the branch of science that deals with the study of the composition and properties of matter, changes in matter, the laws and the principles that govern these changes has been characterized as the most utilitarian of all the experimental sciences and is one of the subjects that is offered in the Nigerian secondary school curriculum. All students believe that Chemistry is important for life after school and yet both boys and girls demonstrate some negativity towards the subject. They perceive the subject as difficult and uninteresting and thus are biased in the selections they make, often not considering the subject requirements needed for future careers.

West Africa Examination Council (WAEC, 2017-2021) chief examiners report, some of the problems include low enrollment and poor performance of secondary school students in Nigeria. Adamu (2022) stated that poor teaching method is the genesis of students' poor academic performance in science. Wait time of 3-5 seconds should be allowed for students to respond to a particular question or problem because it is a necessary skill required by teachers of science education in developing effective teaching and learning in classrooms.

According to Baba (2022), Wait-time is when a teacher waits after a question is asked before calling on a student to rephrase a question or supply the answer. It is the length of pause



preceding any teacher's utterance. This accordingly provides the teacher with direct control over relevant pause(s) within the course of the lesson, it is a variable which could be used to determine the quality and quantity of learners' discourse that occur in a science lesson. Even when the teacher has mastered the skills of controlling the pauses and is teaching a highly receptive class, the teacher's lesson may result in little or no learning if he or she fails to use wait-time properly.

According to Khan, (2011) the uniqueness of chemistry and the central role that it stands to play in the development of any nation, when considered are however not evident in the performance of students. Hightower (2011) stated that teachers are expected to device ways of motivating their students to develop positive attitudes towards science and science related disciplines and in order to facilitate the process of knowledge transmission, teachers are expected to apply appropriate teaching methods that best suit specific objectives and level exit outcome.

Selecting appropriate methods of teaching has become one of the shortcomings affecting learning and higher achievement in chemistry. Many students find chemistry to be a hindrance in attaining their aims and objectives. It is therefore necessary to properly groom the students right from the secondary school level to enable them improve their academic achievement in chemistry. Poor performance of students in science subjects, particularly chemistry, has assumed a serious dimension as reported by some parents. Guided Inquiry method of teaching allows students questions to influence the curriculum. Instead of teachers framing the questions themselves, it will encourage the students to pose questions that arose in their minds. Listening to the students' questions will have uncovered countless points of confusion that otherwise would have gone completely unrecognized.

The guided inquiry method is driven by one's own curiosity, interest, or passion to understand an observation or to solve a problem. Guided inquiry-based learning gives students the ability to question and interact with their educational material and the process they go through as they discover facts and details through their own efforts helps to instill a love of learning and an



excitement for new opportunities. According to Kocijancic (2014), this has an impact on the increase in the knowledge acquisition of technology, the development of problem-solving skills and the ability to make critical decisions. Kuhlthau (2012) stated that due to the freedom and independent approach used in Guided Inquiry, students may also choose to do their projects in a different way. Hence, the type of education that is wanted now is education that takes part contextually. A lecture approach to teaching focuses on delivering information to students, yet constructivism argues that you cannot directly impart this information. Only an experienced teacher can facilitate students to construct their own knowledge. The Lecture Method of exposition has this advantage. It saves time and energy in that the teacher cover a large number of materials (syllabus) to a large class size in a very short period.

According to Jensen (2015), this method of teaching implies that lectures are given in class and the lecture is often the first-time students are exposed to material. Students are given practice problems or activities to help reinforce concepts taught by the instructor and are eventually tested on their knowledge. This method places the responsibility of learning on the teacher and his or her ability to deliver the material and keep students motivated. We need to understand when a traditional method works best and when it's right to try new and innovative approaches”.

Gender refers to social and cultural construction and representative of being ‘male’ and ‘female’, but attitude related factors such as low self-esteem, poor self-concept, fear of success, and lack of confidence are seen on girls’ achievement in chemistry.

Therefore, gender effect on chemistry achievement could be attributed to psychological, social and cultural factors. Despite spirited gender awareness efforts, gender disparity in students’ performance in chemistry persists. Orodho, (1996) stated that lack of adequate instructional resources and equipment, poor teacher preparation and remuneration, uninspired curricula and a negative attitude by stakeholders in education are factors affecting teaching. Even after many



attempts have been made to counter these factors, including spirited gender awareness efforts by governments, this problem seems to persist.

Guided inquiry, as it relates to science education, should mirror as closely as possible the enterprise of doing real science. The guided inquiry begins when the learner notices something that intrigues, surprises, or stimulates a question something that is new, or something that may not make sense in relationship to the learner's previous experience or current understanding. In supporting this view, Saage (2009) stated that several factors have been advanced to affect students 'poor performance, such factors include the student factor, teacher factor, societal factor, the governmental infrastructural problem, language problem examination body related variables, curriculum related variables, test related variables, textbook related variables and home related variables. Many students have a negative impression of chemistry and think that it pulls down their grade point averages. Therefore, teachers must find the most suitable methods to teach the students in order to determine best practices for classroom delivery and minimize achievement loss, using resources available to them.

Statement of the Problem

Chemistry is one of the subjects that is offered in the Nigerian secondary schools' curriculum, whose objectives is to provide students with basic knowledge in chemical concepts and principles, through efficient selection of content and sequencing. As a student of education and teacher, the researcher observed that student's academic performance in schools especially internal and external examinations is very low. These made parents to worry and express their concern on low performance of students in schools. Parents also put the blame on teachers and schools' administrators, on why students are not performing better and having low academic performance in schools. The researcher therefore set to find out, whether the teachers are selecting appropriate teaching methods for effective teaching and learning activities. Many students in Maiduguri



metropolis have a negative impression of chemistry and think that it pulls down their grade point averages. Therefore, teachers must find the most suitable methods to teach the students in order to determine best practices for classroom delivery and minimize achievement loss, using resources available. The study therefore determines the comparative effectiveness of guided inquiry and lecture methods on academic performance of male and female senior secondary 2 Chemistry students in Maiduguri Metropolis, Borno State, Nigeria.

Objectives of the Study

The objectives of the study were to determine;
Effects of guided inquiry and lectures method on academic performance of male and female senior secondary 2 chemistry students in Maiduguri metropolis, Borno state, Nigeria.

Research Questions

The following research questions were answered:

1. What is the effect of guided inquiry on academic performance of senior secondary 2 chemistry students?
2. What is the effect of lecture method on academic performance of senior secondary 2 chemistry students?



Hypotheses

H₀₁: There is no significant difference in the academic performance of senior secondary school chemistry male and female students taught using guided inquiry and those taught using lecture methods.

Research Methodology

The study determined the comparative effectiveness of guided inquiry and lecture method on male and female academic performance of senior secondary 2 Chemistry students in Maiduguri Metropolis, Borno State, Nigeria. The study used quasi-experimental design, specifically, utilizing pre-test and post-test to assess the performance of students instructed in Chemistry. The population for study was 14,525 of 2022/2023 academic session Chemistry students from 13 public Senior Secondary Schools in Maiduguri Metropolis, Borno State, Nigeria. Two (2) intact classes were used in each of the three (3) schools. The number of experimental and control groups were selected from the three (3) sampled schools using simple random sampling technique. Classes were randomly selected and assigned to experimental and control groups. Class A was assigned as experimental group in each sampled school while second group B was assigned as control group in each of the three (3) sampled schools. The instrument used for data collection was developed by the researcher Chemistry performance test (CPT) in Maiduguri Metropolis in Borno state. According to Bland (2018) a performance assessment should allow students to demonstrate knowledge and skills, including the process by which they solve problems. The instrument consisted of two (2) sections, A and B. Section, A consist of demographic data of the respondents while section B contains data required for the study, which consist of 25 items of multiple-choice.



Method of Data Analysis Results

The data collected were analyzed using descriptive statistics, such as mean and standard deviation to address research questions 1 and 2. Additionally, inferential statistics, specifically the ANCOVA was used to test hypotheses 1 and 2 at 0.05 significance level.

What is the Effect of guided inquiry on Academic performance of senior secondary two Chemistry students?

Table1: Summary of mean and standard deviation of Effect of Guided Inquiry Method of Teaching on Academic Performance of Senior Secondary School Chemistry Students

Guided Inquiry Method	<i>N</i>	Mean	Standard Deviation
Pre-test	160	46.21	9.31
Post-test	160	73.05	11.13

Table1: presents a summary of the mean and standard deviation of the effect of the Guided Inquiry Method of teaching on the academic performance of senior secondary school chemistry students. The pre-test results, based on a sample size of 160 students, indicated a mean score of 46.21 (SD = 9.31). After the intervention of the Guided Inquiry Method, the post-test mean score based on 160 students increased to 73.05 (SD = 11.13) for the same sample. The higher post-test mean suggests a positive effect of the Guided Inquiry Method on the academic performance of the students.

What is the effect of lecture method on academic performance of senior secondary 2 chemistry students?



Table 2 Summary of mean and standard deviation on Effect of Lecture Method of Teaching on Academic Performance of Male and Female Senior Secondary School Chemistry Students

Lecture Method	N	Mean	Standard Deviation
Pre-test	160	23.75	4.53
Post-test	160	62.15	9.72

Source: Field data

Table 2 answers research 2 question on the effect of the lecture method on the academic performance of senior secondary school chemistry students. To evaluate this, the researcher conducted both a pretest and a post-test and recorded the mean scores and standard deviations (SD) for each test. The data presented in Table 2 is a summary of these statistics.

The mean scores on the pre-test for the students is 23.75. This represents the average academic performance of the senior secondary 2 chemistry students before they were exposed to the lecture method. It represents the baseline performance of the students before they were exposed to the lecture method. It's important to note that this score is significantly lower than the post-test mean, which suggests that, on average, the students' performance improved after the lecture method was employed. The standard deviation is 4.53. This measures the spread or variability of scores around the mean.

. The mean score on the post-test for the students is 62.15. This represents the average academic performance of the senior secondary 2 chemistry students after they were exposed to the lecture method. It indicates the academic performance of the students after being taught using the lecture



method. This is significantly higher than the pretest means, indicating that the lecture method had a positive impact on the students' academic performance

The standard deviation is 9.72. It measures the variability of scores, and in this case, it represents the spread of scores on the post-test. The standard deviation for both the pretest and posttest indicates the degree of variability in the scores. The higher standard deviation in the post-test suggests that there is more variability in student performance after the lecture method was employed, which could mean that some students benefited more than others from this teaching method. **Hypothesis 1 (H₀₁):** There is no significant difference in the academic performance of male and female senior secondary school chemistry students taught using guided inquiry and those taught using lecture methods.

Table 3: Summary Result on test between Subject Effect

Source	Type III Sum			F	Sig.	Partial Eta Squared
	of Squares	Df	Mean Square			
Corrected Model	218.628a	4	54.657	0.589	0.672	0.041
Intercept	40579.27	1	40579.27	437.45	0.000	0.888
Pretest	16.961	1	16.961	0.183	0.671	0.003
Gender	19.063	1	19.063	0.205	0.652	0.004
Teaching Method	54.649	1	54.649	0.589	0.446	0.011
Gender *						
Teaching Method	127.611	1	127.611	1.376	0.246	0.024
Error	5101.972	55	92.763			
Total	256486	280				
Corrected Total	5320.6	279				

a R Squared = .041 (Adjusted R Squared = -.029)



Table 3. shows that after adjusting for the covariance, (pre-test score), the treatment effect on students' academic performance in Chemistry was not significant statistically ($F_{(2,55)} = 0.589$, $p = 0.671$). As a result, the null hypothesis was retained. Adjusted R Squared value of .029 indicated that treatment produced 2.9% of the variations observed in the scores of students in Chemistry. Additionally, the table displayed the results of Partial Eta Square (η^2) obtained to be .011, indicating the observed effect size of the intervention on students' performance in Chemistry was 0.11%. With the result of Partial Eta Square, the effect size was considered to be too small to conclude that the variances amongst pre-test and post-test scores of the students in Chemistry were as a result of treatment.

Discussion

The findings of this study on the compared effectiveness of guided inquiry and lectures method on academic performance of male and female senior secondary 2 chemistry students, revealed that there was no significant difference in the academic performance of senior secondary school chemistry male and female students taught using guided inquiry and those taught using lecture methods. The result aligns with a study conducted by Putra, Widodo, and Jatmiko (2016) who reported that gender was not a significant factor on students' academic achievement in chemistry when taught using mend mapping teaching strategies (MMTS). Furthermore, the results revealed that there was no significant interaction effect of gender and treatment on student's retention. This study recommends that Chemistry teachers should adopt mend mapping as a teaching strategy in chemistry classrooms and laboratories, and the teacher training institutions should include the use of mend mapping teaching strategies (MMTS) in their chemistry method course content to ensure the training of the pre-service chemistry teachers. Also, that author of chemistry



text-books should include mind mapping teaching strategies (MMTS) in their texts for easy access for students and teacher.

Conclusion

Based on the findings, it was concluded that there were positive and effective impact observed with the guided inquiry method in teaching senior secondary 2 chemistry students underscore its potential as a valuable instructional approach for enhancing academic performance in this educational context. Acknowledging the positive effect of the lecture method on the female academic performance of senior secondary school chemistry students highlights its relevance and efficacy as a teaching strategy, contributing to favorable learning outcomes. The significant effectiveness demonstrated by both guided inquiry and lecture methods in improving the academic performance of Male and Female senior secondary school chemistry students emphasizes the importance of employing a diversified instructional approach to cater to various learning styles and preferences. The absence of a significant difference in academic performance between male and female senior secondary school chemistry students taught using guided inquiry and lecture methods implies that both instructional approaches can be employed equitably, fostering an inclusive learning environment that addresses the diverse needs of students irrespective of gender.

Recommendations

Based on the finding of the study:

1. It is recommended that, curriculum planners to emphasize gender-neutral pedagogical practices by continuing to employ guided inquiry method, as the study found significant difference in academic performance between male and female senior secondary school chemistry students, ensuring an inclusive and equitable learning environment.



2. . Educators should consider a blended approach. Combine the strengths of both methods by incorporating guided inquiry sessions into the curriculum alongside lecture method.



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