

Effect of Socratic Seminar Strategy on Academic Performance of Basic Science Students in Makurdi Metropolis

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Abstract

The study investigated the Effect of Socratic seminar strategy on academic performance of Basic Science students in Makurdi metropolis. The study raised and answered two research questions and two hypotheses formulated and tested at 0.05 α -level. A pre-test, post-test non-equivalent quasi-experimental research design was adopted. The population comprised 1,613 Basic 8 students across 25 government-approved secondary schools, from which a sample of 60 students. The instrument for data collection was the Basic Science Performance Test (BSPT), and was validated by two experts the reliability coefficient of the instrument was determined using the Kuder-Richardson Formula 21 (KR-21), which yielded a coefficient of 0.94, indicating high internal consistency. Data were analyzed using mean, standard deviation, to answer research questions, Analysis of Covariance (ANCOVA) was used to test the null hypotheses at a 0.05 level of significance. Findings revealed that students taught using the Socratic Seminar strategy achieved significantly higher academic performance than those taught using the lecture method, with a mean gain of 9.97 compared to 1.90 for the lecture group. ANCOVA results showed a statistically significant difference in favour of the Socratic Seminar strategy, $F(1,57) = 194.522$, $p < .05$, with a large effect size (partial $\eta^2 = .773$). The study also found no significant difference in academic performance between male and female students taught using the Socratic Seminar strategy, $F(1,27) = 2.044$, $p > .05$, indicating that gender had minimal influence. Based on the findings it was concluded that the Socratic Seminar strategy is highly effective in improving students' academic performance in Basic Science and is gender-inclusive in its impact. Therefore Socratic Seminar strategy was recommended to enhance students' academic performance.

Keywords: Socratic Seminar, Academic Performance, Basic Science, Student-Centered Learning Gender Differences

Introduction

Education is universally recognized as a fundamental human right and a critical driver of socio-economic development, serving as a foundation for individual advancement, societal progress, and national growth. It equips learners with essential knowledge, skills, and competencies necessary for meaningful participation in society and for improving overall quality of life (Ololube, 2020). In Nigeria, education is regarded as a strategic investment in human capital and an indispensable tool for achieving sustainable development.

Science education, as a central component of the educational system, holds a vital role in developing scientific literacy, critical thinking, and problem-solving skills. It encompasses disciplines such as Basic Science, Biology, Chemistry, Physics, and Mathematics, all of which contribute to understanding natural phenomena and technological advancement. Basic Science, in particular, provides foundational knowledge that prepares students for further studies in science-related fields (Ode & Eriba, 2019; Gallagher, et al, 2008). In line with this, the Nigerian Educational Research and Development Council (NERDC, 2012) introduced the Basic Science and Technology (BST) curriculum under the Universal Basic Education (UBE) programme. This integrated curriculum combines Basic Science, Basic Technology, Physical and Health Education, and Information and Communication Technology (ICT), emphasizing student-centered learning, practical activities, and innovative teaching approaches to enhance engagement, creativity, and critical thinking.

Despite its significance, students' academic performance in Basic Science has remained persistently low and inconsistent. Examination data from the Basic Education Certificate Examination (BECE) indicate a progressive increase in failure rates from 3.52% in 2018 to 11.15% in 2020 though a slight improvement was observed at 8.72% in 2021 (Benue State Examination Board, 2022). This trend suggests ongoing challenges in the teaching and learning of Basic Science. Several factors have been identified as contributors to this poor performance, including inadequate teacher mastery of subject content, heavy reliance on traditional lecture-based teaching methods, and students' difficulty in understanding and applying scientific concepts (Niswah & Qohar, 2020; Obafemi, 2022). The conventional lecture method often positions students as passive recipients of knowledge, limiting opportunities for interaction, critical questioning, and deeper engagement. Consequently, students tend to rely on rote memorization rather than meaningful understanding, resulting in low retention and weak problem-solving abilities (Okwara, et al, 2017).

To address these challenges, there has been growing advocacy for the adoption of student-centered instructional strategies. One such approach is the Socratic Seminar, an inquiry-based and dialogic teaching method grounded in structured questioning and collaborative discussion. In this approach, the teacher acts as a facilitator, guiding learners to critically examine ideas, analyze evidence, and construct knowledge through dialogue. The strategy promotes higher-order thinking skills such as analysis, synthesis, and evaluation (Paul & Elder, 2016). Empirical evidence supports the effectiveness of the Socratic Seminar in enhancing academic achievement and engagement. Studies have shown that structured classroom discussions improve students' comprehension, reasoning abilities, and retention of knowledge (Murphy, et al, 2021). In science education, inquiry-based dialogue has been found to facilitate conceptual understanding and correct misconceptions through peer interaction (Osborne, 2021). Additionally, dialogic teaching approaches foster collaborative learning environments that enhance communication skills,

confidence, and intellectual independence among learners (Reznitskaya & Gregory, 2022).

Academic performance, defined as the measurable outcomes of learners' educational activities, reflects students' understanding, application of knowledge, and problem-solving abilities (Abaidoo, 2018). In Basic Science, it indicates how effectively students can grasp scientific concepts and apply them to real-life situations. However, poor academic performance is often associated with teacher-centered practices and limited student engagement, which discourage active learning and critical thinking. Another important variable influencing academic performance is gender. Gender differences in science achievement have generated significant debate due to the influence of socio-cultural factors, including stereotypes and societal expectations, on students' participation and confidence (Ugwu & Nwagbo, 2019; Ozturk, et al, 2020). Empirical findings on gender disparities, however, remain inconclusive. While some studies report differences in performance between male and female students (Tofi, et al, 2021; Alamri, 2018), others find no significant differences (Timayi, 2016; Kingdom-Aaron, et al, 2019). These mixed results indicate that the influence of gender on academic achievement is complex and context-dependent. Given these inconsistencies, there is a need for inclusive instructional strategies that promote equitable learning outcomes. The Socratic Seminar, with its emphasis on dialogue, inquiry, and collaborative learning, offers a promising approach to address both performance challenges and potential gender disparities. By engaging students in meaningful discussions linked to real-life experiences, it creates an inclusive environment that supports active participation for all learners.

The theoretical anchorage of this study is on Experiential Learning Theory (ELT), put forward by David A. Kolb in 1984. Kolb's theory emphasizes that learning is a continuous process grounded in experience and reflection, rather than a static acquisition of facts. ELT maintains that optimal adult learning occurs best when the learner goes through a complete cycle of learning that encompasses four different ways of learning. Concrete Experience, Reflective Observation, Abstract Conceptualization, and Active Experimentation. Empirically, previous studies have shown that Socratic-based instructional strategies significantly improve students' academic achievement compared to conventional teaching methods. Abdullahi (2021), Onaolapo et al. (2024), and Agbowuro et al. (2019) all reported superior performance among students taught using Socratic approaches. However, these studies were conducted in different locations, educational levels, and subject areas, leaving limited evidence on the effectiveness of the Socratic Seminar strategy in Basic Science within Makurdi Metropolis.

Accordingly, this study examines the effect of the Socratic Seminar strategy on the academic performance of Basic Science students in Makurdi Metropolis, with particular attention to gender as a moderating variable. The study seeks to provide empirical evidence to inform effective teaching practices, enhance student engagement, and promote equitable academic achievement.

Statement of the Problem

The Upper Basic level continues to experience significant challenges, including poor academic performance, low student engagement, and inadequate use of learner-centered instructional strategies. Despite ongoing curriculum reforms and teacher professional development initiatives, many students in Basic Eight still encounter difficulties in understanding and applying fundamental scientific concepts. These persistent challenges raise concerns about the effectiveness of current teaching approaches in achieving the objectives of Basic Science education. One major factor contributing to this problem, as observed by the researcher, is the predominant use of conventional lecture-based teaching methods. In many classrooms, instruction is teacher-centered, with limited opportunities for students to actively participate, ask questions, or relate scientific concepts to their cultural experiences and everyday realities. Such approaches often fail to accommodate learners' diverse backgrounds and varying learning styles.

Consequently, students may memorize scientific facts without developing deep conceptual understanding or critical thinking skills. In view of the foregoing, the problem of this study is posed in question form as; what is the effect of the Socratic Seminar strategy on the academic performance of Basic Eight students in Basic Science in Makurdi Metropolis?

Purpose of the Study

The purpose of this study was to investigate the effect of Socratic seminar strategy on academic performance of Basic 8 Science students in Makurdi metropolis. The study sought to:

1. Find out if there is a difference in the academic performance of basic (8) science students taught using Socratic seminar strategy and lecture method.
2. Compare the academic performance of male and female students in Basic Science when taught using Socratic seminar strategy.

Research Questions

The following research questions guided the study:

1. What is the difference in mean academic performance scores of basic (8) science students in Basic Science taught using Socratic seminar strategy and those taught using lecture method?
2. How do male and female students differ in mean academic performance in Basic Science when taught using Socratic seminar strategy?

Hypotheses

1. There is no significant difference between the mean performance score of students who are exposed to Socratic Seminar strategy and lecture method.
2. There is no significant difference in mean performance scores of male and female students in Basic Science who are taught using Socratic Seminar strategy

Methodology

This study adopted a pre-test, post-test non-equivalent quasi-experimental design involving intact classroom groups to preserve the natural school setting. Conducted in Makurdi Local Government Area of Benue State, the study targeted a population of 1,613 Basic 8 students from 25 public secondary schools, from which a sample of 60 students was selected using multistage sampling techniques (purposive, stratified, and random). Two comparable schools were chosen and assigned to experimental and control groups, with the former taught using the Socratic Seminar strategy and the latter using the traditional lecture method, while both male and female students participated. Data were collected using a researcher-developed Basic Science Performance Test (BSPT), a 30-item multiple-choice instrument covering selected science topics, which was validated by experts and yielded a high reliability coefficient ($KR-21 = 0.94$). The instrument was administered as both pre-test and post-test over a two-week period. Collected data were analyzed using mean, standard deviation, and mean gain to answer research questions, while Analysis of Covariance (ANCOVA) was employed to test hypotheses at the 0.05 level of significance.

Results

The result of this study is presented in table 1- 4 in the order of the research questions and the null hypotheses as follows:

Research Question One: What is the difference in mean academic performance scores of basic (8) science students in Basic Science taught using Socratic seminar strategy and those taught using lecture

method?

Table 1: Mean and Standard Deviation of Academic Performance Scores of Basic (8) Science Students in Basic Science taught using Socratic Seminar Strategy and those taught using Lecture Method.

Method		Pre-test	Post-test	Mean Gain
Socratic Seminar Strategy	Mean	18.13	28.10	9.97
	N	30	30	
	Std. Deviation	2.50	2.09	0.41
Lecture Method	Mean	10.40	12.30	1.9
	N	30	30	
	Std. Deviation	1.92	1.78	0.14
Mean Difference				8.07

The results indicate a clear difference in academic performance between students taught using the Socratic Seminar strategy and those taught through the lecture method. Although both groups showed some improvement after instruction, students exposed to the Socratic Seminar achieved a substantially higher increase in scores, with a mean gain of 9.97 compared to only 1.90 for the lecture group. This suggests that the Socratic Seminar was significantly more effective in enhancing students’ understanding of Basic Science concepts. Additionally, the lower variation in post-test scores among the Socratic Seminar group reflects more consistent learning outcomes, implying that the strategy not only improved overall performance but also ensured more uniform achievement among students.

Research Question Two: How do male and female students differ in mean academic performance in Basic Science when taught using Socratic seminar strategy?

Table 2: Mean and Standard Deviation of Academic Performance Scores of Male and Female Students taught Basic Science using Socratic seminar strategy

GenderSSS		Pre-test	Post-test	Mean Gain
Male	Mean	18.17	27.67	9.5
	N	18	18	
	Std. Deviation	1.86	2.17	0.31
Female	Mean	18.08	28.75	10.67
	N	12	12	
	Std. Deviation	3.34	1.87	1.47
Mean Difference				1.17

Table 2 reveals that both male and female students benefited greatly from the Socratic Seminar strategy, as reflected in their improved performance scores. Male students’ mean score increased from 18.17 (SD = 1.86) in the pre-test to 27.67 (SD = 2.17) in the post-test, resulting in a mean gain of 9.50. Similarly, female students improved from a pre-test mean of 18.08 (SD = 3.34) to a higher post-test mean of 28.75 (SD = 1.87), with a greater mean gain of 10.67. Although both groups showed substantial progress,

females performed slightly better, with a mean difference of 1.17 in their favour. Overall, the results suggest that the Socratic Seminar strategy effectively enhanced academic performance for both genders, with a slight advantage observed among female students.

Hypothesis One: There is no significant difference between the mean performance score of students who are exposed to Socratic Seminar strategy and lecture method.

Table 3: ANCOVA of Mean Academic Performance Scores of Students Exposed to Socratic Seminar Strategy and Lecture Method

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	3777.870 ^a	2	1888.935	579.709	.000	.953
Intercept	326.734	1	326.734	100.274	.000	.638
PRETEST	33.270	1	33.270	10.211	.002	.152
METHOD	633.834	1	633.834	194.522	.000	.773
Error	185.730	57	3.258			
Total	28446.000	60				
Corrected Total	3963.600	59				

a. R Squared = .953 (Adjusted R Squared = .951)

Table 3 presents the ANCOVA results comparing the mean academic performance scores of students taught Basic Science using the Socratic Seminar strategy and those taught using the lecture method, with pre-test scores controlled. The results show that the instructional method had a statistically significant effect on students' academic performance, $F(1, 57) = 194.522, p = .000 < .05$. Since the probability value is less than the 0.05 level of significance, the null hypothesis is rejected. This finding indicates that there is a significant difference in the mean academic performance scores of students taught using the Socratic Seminar strategy and those taught using the lecture method. Students exposed to the Socratic Seminar strategy performed significantly better than their counterparts taught using the conventional lecture method.

Hypothesis Two: There is no significant difference in mean performance scores of male and female students in Basic Science who are taught using Socratic Seminar strategy

Table 4: ANCOVA of Mean Academic Performance Scores of Male and Female Students taught Basic Science using Socratic Seminar Strategy

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	12.543 ^a	2	6.272	1.483	.245	.099
Intercept	351.941	1	351.941	83.240	.000	.755
PRETEST	4.093	1	4.093	.968	.334	.035
GENDER	8.644	1	8.644	2.044	.164	.070
Error	114.157	27	4.228			

Total	23815.000	30
Corrected Total	126.700	29

a. R Squared = .099 (Adjusted R Squared = .032)

Table 4 presents the ANCOVA results comparing the mean academic performance scores of male and female students taught Basic Science using the Socratic Seminar strategy, with pre-test scores used as a covariate. The analysis reveals that gender did not have a statistically significant effect on students' academic performance, $F(1, 27) = 2.044$, $p = .164 > .05$. Since the probability value is greater than the 0.05 level of significance, the null hypothesis is retained. This result indicates that there is no significant difference in the mean academic performance scores of male and female students taught Basic Science using the Socratic Seminar strategy. Although slight differences were observed in the mean scores of male and female students, these differences were not statistically meaningful.

Discussion of Findings

The study found that students taught Basic Science using the Socratic Seminar strategy performed significantly better academically than those taught using the conventional lecture method. This improved performance is attributed to the learner-centred and interactive nature of the Socratic Seminar, which encourages active participation, critical thinking, questioning, collaboration, and deeper understanding of scientific concepts. Through structured discussions, students construct knowledge, exchange ideas, and develop higher-order thinking skills, leading to better retention and achievement. These findings agree with previous studies by Agbowuro et al. (2019), Onaolapo et al. (2024), which also reported that the Socratic Seminar or Socratic Method was more effective than the lecture method in improving students' academic performance. Overall, the findings confirm that the Socratic Seminar is an effective instructional strategy for enhancing students' achievement in Basic Science.

The study found no statistically significant difference in the academic performance of male and female students taught Basic Science using the Socratic Seminar strategy, despite female students recording slightly higher mean scores. This suggests that the strategy is equally effective for both genders. The finding is attributed to the inclusive, learner-centred nature of the Socratic Seminar, which promotes equal participation, collaborative learning, critical thinking, and open dialogue. By providing all students with equal opportunities to contribute and construct knowledge, the strategy minimizes gender-related disparities in learning outcomes. These findings are consistent with those of Abdullahi (2021) and Onaolapo et al. (2024), who also reported no significant gender differences in students' academic performance when taught using the Socratic Seminar strategy. Overall, the results indicate that the Socratic Seminar is a gender-neutral instructional approach that supports equitable academic achievement in Basic Science.

Conclusion

Based on the findings of this study, the following conclusions were drawn: The Socratic Seminar instructional strategy is more effective than the conventional lecture method in enhancing students' academic performance in Basic Science. This is because the strategy actively engages students in questioning, discussion, reasoning, and critical thinking, thereby promoting deeper understanding of scientific concepts. The study also concludes that both male and female students benefit equally from the use of the Socratic Seminar strategy in Basic Science. Although slight differences in mean scores were observed, gender did not significantly influence students' academic performance when exposed to the strategy.

Recommendations

Based on the findings and conclusions of the study, the following recommendations were made:

1. Basic Science teachers should adopt the Socratic Seminar strategy as an alternative or complement to the traditional lecture method to enhance students' academic performance.
2. Teachers should be trained on how to plan effective Socratic questions, moderate classroom discussions, and encourage equal participation among students. Emphasis should be placed on creating a supportive classroom atmosphere where students feel confident to express ideas and engage in meaningful dialogue.
3. School administrators should encourage the use of learner-centred instructional strategies by providing support and motivation for teachers.

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