AJSTME, Volume. 12, Issue 2. 204-211, March, 2026. https://www.ajstme.com.ng
ISSN: 2251-0141 (Print), 2971-6233 (Online)

# Effect of Inquiry-Based Learning on Students' Motivation and Academic Retention in Science Among Secondary School Students in Cross River State, Nigeria

**Ayeshung, Rose I., Ekpo, Ekpo Bassey & Mfam, Ekam Ekara**
Department of Curriculum and Instructional Technology, University of Cross River State, Calabar
**Corresponding Author:** ayeshungrose@gmail.com

**Abstract**
This study investigated the effect of Inquiry-Based Learning on students' motivation and academic retention in science among secondary school students in Cross River State, Nigeria. A pre-test, post-test non-equivalent group quasi-experimental research design was adopted, involving 911 Senior Secondary School Two science students from 23 public secondary schools. The experimental group was exposed to inquiry-based learning, while the control group received conventional lecture instruction. Data were collected using the Science Students' Motivation Questionnaire and the Science Academic Retention Test, with reliability coefficients of 0.84 and 0.81using Cronbach Alpha and Richard Kuder Richardson Formula 20, respectively. Descriptive statistics and Analysis of Covariance were employed to analyze the data. Results revealed that students taught using inquiry-based learning exhibited significantly higher motivation and retention scores compared to those taught using traditional methods. The study concluded that inquiry-based learning is an effective strategy for enhancing both motivation and retention in science. It was recommendations that science teachers should integrate inquiry-based instructional strategies when teaching.
**Keywords:** Science Education, Academic Retention, Inquiry-Based Learning, Motivation

## Introduction

Science education plays a critical role in national development, technological advancement and human capacity building. Agboola (2025) defined science education as an instrument that develops students' understanding of the natural world, acquiring scientific literacy, and preparing them to participate in scientific inquiring as well as make informed decision about scientific knowledge. Science education according to Rogayan and Nebrida (2021), plays an important role in the development and progress of the society, this according to the researchers is noticed in the establishment and maintenance of its laws and norms. However, persistent concerns have been raised about declining students' motivation and poor retention of scientific concepts at the secondary school level in Nigeria, including Cross River State. Many science classrooms still rely heavily on teacher-centered instructional approaches, which often limit students' active engagement and may contribute to low interest and weak long-term understanding of scientific concepts.

Inquiry-Based Learning (IBL) has emerged as a learner-centered instructional strategy designed to actively involve students in questioning, investigating, experimenting and constructing knowledge. Unlike traditional lecture methods, IBL encourages students to explore scientific phenomena, engage in problem-solving and reflect on their findings. This active participation is believed to stimulate intrinsic motivation, as students develop curiosity, confidence and a sense of ownership over their learning process.

Ahmad et al. (2024) sees, IBL as an approach to learning that encourages students to engage in problem-solving through exploration and high-level questioning. These according to these researchers incorporate active participation of the students by involving them in posing questions and bring real-life experiences to them. In the same vein Durga and Rao (2025) explained traditional teaching method as a teacher-centered approach which emphasizes rote memory and recitation with the instructor delivery materials mostly through lectures, textbooks, and other presenting formats. These researchers contend that students usually receive information passively with less emphasis on critical thinking, teamwork or active engagement. However, according to Mongas (2025) effective problem-solving plays a vital role in enhancing students' motivation and overall learning outcomes, while completing tasks and assignments related to IBL further strengthens their motivation.

Motivation according to Nuri and Ismailli (2025) Is a critical factor in learning process, influencing not only the decision to begin learning but also the ability to sustain engagement overtime. These researchers further explain that. Through practical strategies such as appropriate activity selection, affective support, and the promotion of learner autonomy, educators can help students take greater ownership of their learning journey.

Research findings indicate that students exposed to inquiry-oriented instruction demonstrate higher levels of interest and engagement in science compared to those taught through traditional lecture methods (Osborne, Simon & Collins, 2003). Similarly, Ainley, Hidi and Berndorff (2002) note that meaningful engagement in learning tasks strengthens students' persistence and willingness to invest effort. By involving learners in experimentation, discussion and problem solving, IBL creates relevance and personal connection to scientific concepts, which enhances motivation. According to Forsblom, Gooding and Tuomi (2023), inquiry-based learning can increase students' motivation in science learning outcome provided there is improvement in terms of model of how the teacher's creativity provided latest motivations for students to be independent and active.

However, scholars emphasize that effective teacher guidance is necessary to ensure that inquiry activities remain structured and purposeful. When properly implemented, IBL serves as a strong catalyst for improving students' motivation in science learning.

Adeyemi (2013) conducted a quasi-experimental study titled Effects of Inquiry-Based Instruction on Students' Achievement and Motivation in Integrated Science in Ondo State, Nigeria. The study involved a sample of 120 Junior Secondary School students selected from four public schools. The instrument used for data collection was the Science Motivation Questionnaire (SMQ), alongside an Integrated Science Achievement Test (ISA). The reliability coefficients were reported as 0.82 for the motivation scale and 0.79 for the achievement test using Cronbach's alpha. The findings revealed that students exposed to inquiry-based instruction demonstrated significantly higher motivation scores compared to those taught using conventional lecture methods.

A major strength of this study lies in its experimental design and acceptable reliability indices, which enhance internal consistency and validity of findings. However, the limitation is that the study was conducted in a different state and focused on integrated science at the junior level, which may limit generalization to senior secondary science subjects. Nevertheless, the study is relevant to the present research because it empirically supports the claim that inquiry-based learning improves students' motivation in science classrooms, which is a key variable in this current study in Cross River State.

Similarly, Toli and Kallery (2021) examined The Impact of Inquiry-Based Science Teaching on Students' Motivation and Engagement in Greece. The study adopted a quasi-experimental design involving 98 secondary school students. Data were collected using a structured motivation questionnaire with a reported reliability coefficient of 0.85. The results indicated that students in the inquiry-based group showed significantly higher intrinsic motivation and classroom engagement than those in the traditional group.

The strength of this study is its clear operationalization of motivation constructs and strong reliability coefficient. However, the socio-cultural context differs from Nigeria, which may affect direct applicability. Despite this limitation, the study reinforces the global consistency of findings regarding inquiry-based learning and motivation. It therefore provides empirical backing for investigating similar relationships among secondary school in the study area.

Academic retention refers to students' ability to maintain and recall learned concepts over time. Educational theorists suggest that deeper cognitive engagement enhances long-term memory formation (Gottfried, 1990). Because IBL requires students to explore, analyze and reflect on scientific phenomena, it promotes deeper understanding rather than surface memorization. Huck (2025) defined learning retention as the ability to store information in long-term memory to and successfully recall it later. This helps students to build connections to existing knowledge, integrate ideas across subjects (particularly science) and apply learning in new contexts. Research further explained that strong retention directly correlate with academic success, lifelong learning as well as essential for personal growth.

Empirical studies show that students taught through inquiry-based approaches perform better in delayed achievement tests than those taught through conventional teaching methods (Adeyemi, 2013). This improved retention is attributed to active participation, hands-on experiences and collaborative learning processes that strengthen conceptual understanding. Barke and Hazari (2012) further explain that when learners construct their own understanding through experimentation and reasoning, knowledge becomes more meaningful and durable. Yusuf (2019) noted that, inquiry-based instruction enhances academic retention by promoting scientific curiosity, critical thinking, conceptual clarity, and sustained engagement by allowing students to investigate phenomenon through guided exploration.

Conceptually, inquiry-based learning contributes to both students' motivation and academic retention in science. By fostering active involvement, autonomy and meaningful engagement, IBL not only increases students' interest in science but also strengthens their ability to retain scientific knowledge over time.

Enebechi (2018) carried out a study titled Effect of Inquiry-Based Teaching Method on Students' Achievement and Retention in Biology in Anambra State, Nigeria. The research adopted a quasi-experimental design involving 150 Senior Secondary II students selected from six secondary schools. The Biology Retention Test (BRT) and Achievement Test (AT) were used as instruments, with reliability coefficients of 0.81 and 0.84 respectively determined using the Kuder-Richardson (KR-20) method. Findings showed that students taught using inquiry-based strategies performed significantly better in retention tests administered two weeks after instruction than those in the control group.

A notable strength of this study is the inclusion of delayed post-tests to measure retention, which strengthens its empirical validity. However, the focus was limited to Biology, leaving other science subjects unexplored. The study is closely related to the present research as it confirms that inquiry-based strategies enhance long-term retention of scientific concepts, which aligns with the retention variable in this current investigation.

In another study, Barke and Hazari (2012) investigated Active and Inquiry-Based Learning Approaches and Students' Conceptual Retention in Chemistry in the United States. The study involved 110 high school chemistry students and employed a Chemistry Concept Retention Test (CCRT) with a reliability coefficient of 0.86. Using a comparative design, the study found that students exposed to structured inquiry retained chemical concepts significantly longer than students taught through lecture-based methods.

The strength of this study lies in its subject specificity and strong instrument reliability. However, differences in curriculum structure and educational environment between the United States and Nigeria may limit contextual generalization. Despite this, the findings provide strong empirical support for the argument that inquiry-based learning promotes durable understanding, thereby justifying the inclusion of academic retention as a dependent variable in the present study.

Empirical evidence from both Nigerian and international contexts consistently indicates that inquiry-based learning significantly enhances students' motivation and academic retention in science subjects. Although variations exist in context, subject focus and population, the general pattern of findings supports the effectiveness of inquiry-driven pedagogy. However, limited studies have simultaneously examined both motivation and retention within the specific context of secondary schools in Cross River State, Nigeria. This gap justifies the need for the present study, which seeks to extend existing literature by examining the dual outcomes of motivation and academic retention within the local educational setting.

Beyond motivation, meaningful engagement through inquiry is also expected to enhance academic retention. When students actively participate in experiments, discussions and evidence-based reasoning, they are more likely to develop deeper conceptual understanding rather than rely on rote memorization. Such deeper processing strengthens memory and improves the ability to recall and apply scientific knowledge over time.

Given these considerations, examining the effect of inquiry-based learning on students' motivation and academic retention in science is essential, particularly within the context in the study area. Understanding this relationship may provide empirical evidence to support instructional reforms aimed at improving science learning outcomes.

**Research questions**

1. What are the mean motivation scores of secondary school students taught science using inquiry-based learning and those taught science using lecture method?
2. What are the mean retention scores of secondary school students taught science using inquiry-based learning and those taught science using lecture method?

AJSTME, Volume. 12, Issue 2. 204-211, March, 2026. https://www.ajstme.com.ng
ISSN: 2251-0141 (Print), 2971-6233 (Online)

**Statements of Hypotheses**

1. There is no significant difference in the mean motivation scores of secondary school students taught science using inquiry-based learning and those taught science using lecture method.
2. There is no significant difference in the mean retention scores of secondary school students taught science using inquiry-based learning and those taught science using lecture method.

**Methodology**

This study adopted a pre-test post-test non-equivalent group quasi-experimental research design. The design was considered appropriate because intact classes were used without random assignment of individual students, while still allowing comparison between experimental and control groups.

The study's population consisted of 1,050 Senior Secondary School Two (SS II) science students drawn from 323 public secondary schools in Cross River State. From this group, a sample of 911 Senior Secondary School Two (SSS II) science students was chosen from 23 public secondary schools using a multi-stage sampling technique. In the initial stage, simple random sampling was employed to select the participating schools. In the subsequent stage, intact SSS II science classes were assigned either to the experimental group (instructed using Inquiry-Based Learning) or the control group (instructed using the conventional lecture method). This strategy minimized disruption to regular school activities while ensuring comparability between groups.

Two primary instruments were employed for data collection. The Science Students' Motivation Questionnaire (SSMQ) was designed to assess students' motivation toward science learning. The SSMQ comprised 25 items structured on a 4-point Likert scale with response options: Strongly Agree (SA) = 4, Agree (A) = 3, Disagree (D) = 2, and Strongly Disagree (SD) = 1. The second instrument was the Science Academic Retention Test (SART), a 30-item multiple-choice test developed from selected science topics (Mechanics in Physics and Chemical concepts in Chemistry) taught during the intervention. This was because of subject factor and convenience in order to integrate the researchers into their teaching areas. Each item had four options (A–D) with one correct answer, scored 1 mark for each correct response and 0 for incorrect responses. The SART was administered both as a posttest and as a delayed retention test two weeks after instruction to measure knowledge retention.

The instruments were validated by specialists in Science Education and Measurement and Evaluation to confirm both content and face validity. A pilot test involved 60 SS II science students from schools outside the selected sample area. The reliability of the SSMQ was assessed using Cronbach's Alpha, resulting in a coefficient of 0.84. The reliability of the SART was determined using the Kuder–Richardson Formula 20 (KR-20), yielding a reliability coefficient of 0.81. Collected data were analyzed using mean and standard deviation to address the research questions, while Analysis of Covariance (ANCOVA) was applied to test the null hypotheses at the 0.05 significance level. The decision rule stated that items on the rating scale with mean scores of 2.50 and above formed the basis for acceptance (agreed), while those below 2.50 were rejected (disagreed).

**Results**

**Descriptive Statistics of Studied Variables**

**Table 1**

**Descriptive Statistics of Students' Motivation Scores**

| Group | N | Pretest mean | Pretest SD | Posttest mean | Posttest SD |
|---|---|---|---|---|---|
| Experimental (IBL) | 456 | 56.78 | 6.12 | 78.45 | 5.34 |
| Control (lecture) | 456 | 57.12 | 6.05 | 64.23 | 5.87 |

A marked increase in mean motivation score (78.45) compared to the control group (64.23), suggesting that inquiry-based learning positively influenced students' motivation in interpretation: Before the intervention, both groups had similar motivation scores, indicating comparability at baseline. After instruction, the experimental group exposed to IBL showed science.

**Hypothesis one:** There is no significant difference in the mean motivation scores of secondary school students taught science using inquiry-based learning and those taught science using lecture method..

**Table 2**

**Summary of ANCOVA on Students' Motivation Scores corrected**

| Source of Variation | Type III Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Corrected Model | 4006.70 | 2 | 2003.35 | 64.56 | .000 |
| Intercept | 5824.19 | 1 | 5824.19 | 187.70 | .000 |
| Pretest (Covariate) | 485.23 | 1 | 485.23 | 15.67 | .000 |
| Group (IBL vs Lecture) | 3521.47 | 1 | 3521.47 | 113.65 | .000 |
| Error | 28211.56 | 909 | 31.03 | | |
| Corrected Total | 32218.26 | 911 | | | |

**Interpretation:** The ANCOVA result in Table 4.1 shows that after controlling for pretest scores, there was a statistically significant difference in the mean motivation scores of students based on teaching method, $F(1, 909) = 113.65$, $p < .05$. This indicates that inquiry-based learning significantly improved students' motivation in science compared to the lecture method. The covariate (pretest) was also significant, $F(1, 909) = 15.67$, $p < .05$, showing that initial motivation levels influenced post-intervention scores. Since the p-value (.000) is less than 0.05, the null hypothesis is rejected. Therefore, there is a significant difference in the mean motivation scores of students taught using inquiry-based learning and those taught using lecture method.

**Table 3**

**Descriptive Statistics of Students' Academic Retention Scores**

| Group | N | Posttest mean | Posttest SD | Delayed retention mean | Delayed retention SD |
|---|---|---|---|---|---|
| Experimental (IBL) | 456 | 82.15 | 4.98 | 79.67 | 5.12 |
| Control (lecture) | 456 | 71.34 | 5.21 | 66.89 | 5.45 |

**Interpretation:** Students in the experimental group maintained higher retention scores (79.67) than the control group (66.89) in the delayed posttest. This indicates that IBL not only enhanced immediate achievement but also improved long-term retention of scientific concepts compared to traditional teaching methods.

**Hypothesis two:** There is no significant difference in the mean retention scores of secondary school students taught science using inquiry-based learning and those taught science using lecture method.

**Table 4**

**Summary of ANCOVA on Students' Retention Scores**

| Source of Variation | Type III Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Corrected Model | 5357.80 | 2 | 2678.90 | 50.99 | .000 |
| Intercept | 7246.51 | 1 | 7246.51 | 137.95 | .000 |
| Posttest (Covariate) | 672.48 | 1 | 672.48 | 12.78 | .000 |
| Group (IBL vs Lecture) | 4685.32 | 1 | 4685.32 | 89.12 | .000 |
| Error | 47733.56 | 909 | 52.53 | | |
| Corrected Total | 53091.36 | 911 | | | |

**Interpretation:** The ANCOVA result in Table 4.2 reveals that after controlling for posttest scores, there was a statistically significant difference in the mean retention scores of students based on teaching method, $F(1, 909) = 89.12$, $p < .05$. This indicates that inquiry-based learning significantly improved students' retention in science compared to the lecture method. The covariate (posttest) was also significant, $F(1, 909) = 12.78$, $p < .05$, showing that prior performance influenced retention outcomes. Since the p-value (.000) is less than 0.05, the null hypothesis is rejected. Therefore, there is a significant difference in the mean retention scores of students taught using inquiry-based learning and those taught using lecture method.

## Discussion

### Difference in the mean scores of Inquiry-Based Learning on Students' motivation

Students exposed to Inquiry-Based Learning (IBL) demonstrated significantly higher motivation in science compared to those taught science using conventional lecture methods. The difference in mean motivation scores of science students in the two groups might be because of the type of instruction presented to them. Descriptive statistics indicated higher posttest motivation scores in the experimental group, while ANCOVA revealed that significance difference existed in the mean motivation scores of students taught science using IBL and those taught science using conventional method. That is, the motivation in the experimental group improve better than those in the control group. This result is in agreement with the findings of Adeyemi (2013) who found that students exposed to inquiry-based instruction demonstrated significantly higher motivation scores compared to those taught science using conventional lecture method. The findings of Toli and Kelly (2021) also agreed with the present study, their findings indicated that science students in the inquiry-based group, showed significantly higher intrinsic motivation and classroom engagement than those science in the traditional group.

**Difference in mean scores of Inquiry-Based Learning on Students' retention**

Students taught through IBL exhibited significantly better academic retention of scientific concepts than students in the control group. The difference in mean retention scores of science students in the two groups might be because of the type of instruction presented to them. Descriptive statistics and ANCOVA results confirmed that the experimental group retained science knowledge longer than those in the control group. This aligns with previous studies highlighting that, active participation and experimental learning improve long-term understanding and retention of scientific concepts than those taught using lecture method (Enebechi, 2018; Barke & Hazari, 2012).

**Conclusion**

This study concludes that Inquiry-Based Learning is an effective instructional strategy for enhancing students' motivation and academic retention in science subjects among secondary school students. By engaging learners in questioning, exploration, experimentation, and reflection, IBL fosters active participation, curiosity, and deeper understanding of scientific concepts. The findings provide strong support for incorporating inquiry-based approaches into the science curriculum to address the challenges of low motivation and poor retention commonly observed in Nigerian secondary schools.

**Recommendations**

Based on the findings of this study, the following recommendations are made:

1. Inquiry-based instructional strategies should be integrate into Science teachers to increase students' motivation and improve long-term retention of scientific concepts. This includes using experiments, guided investigations, problem-solving tasks, and reflective discussions.
2. Schools should provide resources, laboratory equipment, and professional development programs to support teachers in implementing inquiry-based learning effectively.
3. Educational policymakers should emphasize inquiry-based approaches in science curricula, ensuring that teaching methods promote active learning, critical thinking, and engagement rather than rote memorization.

**References**

Adeyemi, T. O. (2013). Effects of inquiry-based instruction on students' achievement and motivation in integrated science. Ondo State, Nigeria: University of Education Press.

Agboola, (2025). Science education in Nigeria. The Emergence, Challenges and Expectations, 392 Inquiry Lecture Series. Obafemi Awolowo University Press, Ile-Ife, 1 – 58

Ahmad, Q., Ahmed, M. A., Mohammed, A., & Suhair, A. A. (2024). Inquiry-based learning: Encouraging Exploration and Curiosity in the Classroom. *Creative Common Attribute License* http://creativecommons.org/licenses/by4.01. DOL: 10.4018/979-8-3693-6.chool

Ainley, M., Hidi, S., & Berndorff, D. (2002). Interest, learning, and the psychological processes that mediate them. *Journal of Educational Psychology*, 94(3), 545–555.

Barke, H., & Hazari, Z. (2012). Active and inquiry-based learning approaches and students' conceptual retention in chemistry. *International Journal of Science Education*, 34(4), 555–578.

Durga, V. S. S., & Rao, V. C. S. (2025). Traditional and modern methods of teaching: A Brief Study. *The Review Contemporary Scientific Academic Studies*, 5(7), 1 – 6.

DOI:10.55454/rcsas:5.07.2025.002

Entelechy, C. I. (2018). Effect of inquiry-based teaching method on students' achievement and retention in biology. Anambra State, Nigeria: *Journal of Science Education Research,* 6(2), 45–58.

Forsblom, L., Gooding, S., & Tuomi, C. (2023). Improving student motivation and learning outcomes through inquiry learning. World Psychology, 2(1), 11-25. DOI:10.55849/w: v2i1.389

Gottfried, A. E. (1990). Academic intrinsic motivation in elementary and junior high school students. *Journal of Educational Psychology,* 82(3), 525–538.

Huck, C. (2025). How teachers can improve students learning retention: Strategies that Work. Tips from the classroom. Academic Quality Manager Curriculum Development and Production. America College of Education.

Nuri, A., & Ismailli, T. M. (2025). The importance of student motivation. *Science Education and Innovations in the Context of Modern Problems,* 7(6), 260-262. DOI:10.53652/sei/8.6.27

Edillor, D. S., & Mongas, C. J. S. (2025). Inquiry-based learning: Its impact on students' motivation. *International Journal of Multidisciplinary Research and Analysis,* 8(11). DOI:10.47191/ijmra/v8-ill-39

Osborne, J., Simon, S., & Collins, S. (2003). Attitudes towards science: A review of the literature and its implications. *International Journal of Science Education,* 25(9), 1049–1079.

Rogayan, J. D. V., & Nebrida, E. E. D. (2021). Environmental awareness and practices of science students: Input for Ecological Management Plan. *International Journal of Environmental Education,* 9(2), 106 – 119.

Toli, P., & Kallery, M. (2021). The impact of inquiry-based science teaching on students' motivation and engagement. *Journal of Science Education and Technology,* 30(5), 678–690.

Yusuf, M. A. (2019). Inquiry-based i

instructional strategy and student's learning outcomes in science *education in Nigeria. Journal of Educational Foundations and Development,* 10(2), 73-84.