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The Effectiveness of Inquiry-Based Science Teaching Approach in Improving the Academic Performance of Grade 6 Learners in the Public Elementary Schools in Caramoan South District, Division of Camarines Sur for School Year 2024-2025

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ABSTRACT

Inquiry-based instruction has been widely recognized as an effective pedagogical approach for promoting deeper conceptual understanding, critical thinking, and active learner engagement in science education. In response to persistent concerns regarding learners' academic performance in Science under traditional, teacher-centered instruction, this study examined the effectiveness of the Inquiry-Based Approach in improving the academic performance of Grade 6 learners in public elementary schools in the Caramoan South District, Division of Camarines Sur, Philippines, during School Year 2024–2025. Specifically, the study assessed the extent to which inquiry-based teaching was employed in terms of learners' engagement in hands-on exploration, use of open-ended questions, application of the scientific method, collaborative learning, and real-world application of scientific concepts, as well as its effectiveness in improving learners' science achievement, critical thinking skills, engagement and participation, scientific inquiry skills, and attitudes toward science. Using a descriptive–evaluative research design, data were collected from public elementary school teachers through a validated researcher-developed questionnaire. Statistical analyses included weighted mean, ranking, Kendall's coefficient of concordance, and chi-square tests to determine the extent of implementation, effectiveness, and the level of agreement among respondents. Findings revealed that the Inquiry-Based Approach was highly employed across all instructional dimensions and was highly effective in improving learners' academic performance in Science, particularly in enhancing critical thinking, inquiry skills, learner engagement, and positive attitudes toward the subject. Tests of concordance showed significant agreement among respondents on several aspects of both implementation and effectiveness. The study concludes that inquiry-based science instruction substantially enhances Grade 6 learners' academic performance and supports the development of higher-order thinking and scientific literacy. The findings provide empirical support for strengthening teacher professional development, refining assessment practices, and formulating evidence-based policies that institutionalize inquiry-based approaches in elementary science education to advance quality education outcomes.

1. Introduction

Improving the quality of science education remains a central concern in basic education systems worldwide, particularly in contexts where learners continue to demonstrate low academic performance and limited engagement in scientific inquiry. Science education is expected not only to transmit factual knowledge but also to cultivate critical thinking, problem-solving skills, and scientific literacy necessary for learners to function effectively in an increasingly complex and technology-driven society. However, traditional teacher-centered approaches, which emphasize rote memorization and passive learning, have been widely criticized for their limited capacity to develop higher-order thinking and meaningful understanding of scientific concepts.

Inquiry-based learning has emerged as a pedagogical approach grounded in constructivist learning theory, emphasizing learner-centered instruction, active exploration, and the application of the scientific method. Through inquiry-based instruction, learners are encouraged to ask questions, investigate phenomena, analyze evidence, and construct knowledge through hands-on and collaborative activities. Research consistently suggests that inquiry-based approaches enhance learner engagement, deepen conceptual understanding, and foster positive attitudes toward science. These approaches also align with contemporary educational goals that prioritize critical thinking, creativity, and lifelong learning skills.

In the Philippine basic education context, strengthening science instruction has been identified as a priority under ongoing curriculum reforms. The Department of Education has emphasized learner-centered pedagogies that promote inquiry, collaboration, and real-world application of knowledge, particularly in Science, Technology, Engineering, and Mathematics (STEM) subjects. Despite these policy directions, many public elementary schools continue to rely on conventional instruction al

strategies due to constraints related to teacher preparedness, instructional resources, and assessment practices. As a result, the effective implementation of inquiry-based instruction at the classroom level remains uneven and warrants systematic examination.

Grade 6 represents a critical stage in elementary science education, as learners are expected to consolidate foundational scientific concepts and develop inquiry skills that prepare them for secondary education. At this level, instructional approaches play a crucial role in shaping learners' understanding of science and their attitudes toward the subject. In districts such as Caramoan South in the Division of Camarines Sur, where schools face geographic and resource-related challenges, identifying effective and contextually appropriate teaching strategies is particularly important for improving learning outcomes.

Within this context, examining the effectiveness of the Inquiry-Based Approach in teaching Science provides valuable insights into how instructional practices influence learners' academic performance and engagement. Understanding the extent to which inquiry-based strategies are employed and how they contribute to learners' achievement, critical thinking, inquiry skills, and attitudes toward science can inform evidence-based decisions in curriculum implementation, teacher professional development, and instructional supervision.

This study therefore investigates the effectiveness of the Inquiry-Based Approach in improving the academic performance of Grade 6 learners in public elementary schools in the Caramoan South District, Division of Camarines Sur. By assessing both the extent of implementation and perceived instructional outcomes, the study aims to contribute empirical evidence to the growing body of literature on inquiry-based science education and to support efforts to enhance the quality of science teaching and learning in elementary schools.

2. Methodology

This study employed a descriptive–evaluative research design to examine the effectiveness of the Inquiry-Based Approach in teaching Science to Grade 6 learners in public elementary schools in the Caramoan South District, Division of Camarines Sur, during School Year 2024–2025. The design was appropriate for determining the extent to which inquiry-based instructional practices were implemented and for evaluating their perceived effectiveness in improving learners' academic performance, critical thinking skills, scientific inquiry skills, engagement, and attitudes toward Science. Rather than establishing causal relationships, the design focused on systematic description, evaluation, and comparison of instructional practices and outcomes as perceived by teachers directly involved in science instruction.

The study was conducted in selected public elementary schools within the Caramoan South District, a geographically distinct and resource-constrained area where improving instructional quality remains a priority. The respondents consisted of Grade 6 Science teachers who were purposively selected based on their direct involvement in implementing inquiry-based strategies in the classroom. Teachers were considered the most appropriate respondents, as they possess firsthand knowledge of instructional approaches used, learner responses, and observed academic outcomes.

Data were collected using a researcher-developed structured questionnaire grounded in inquiry-based learning theory, constructivist pedagogy, and relevant science education literature. The instrument consisted of two major parts: the first measured the extent of implementation of the Inquiry-Based Approach in terms of learner engagement, use of open-ended questioning, application of the scientific method, collaborative learning, and real-world application of scientific concepts; the second assessed the perceived effectiveness of the approach in improving learners' academic performance, critical thinking skills, scientific inquiry skills, engagement and participation, and attitudes toward Science. Responses were recorded using a Likert-type scale to allow quantitative assessment of the degree of implementation and effectiveness. Prior to administration, the instrument underwent expert validation to ensure content relevance, clarity, and alignment with the study objectives, and reliability testing was conducted to establish internal consistency.

Data collection was carried out with prior approval from school authorities and in compliance with ethical standards for educational research. Questionnaires were personally distributed and retrieved to ensure a high response rate and completeness of data. Participation was voluntary, informed consent was secured, and confidentiality of responses was strictly maintained. No personally identifiable information was collected, and all data were used solely for academic and research purposes.

Data analysis involved both descriptive and inferential statistical techniques. Weighted means and rankings were used to describe the extent of inquiry-based instruction and its effectiveness across different instructional and outcome dimensions. To determine the degree of agreement among respondents in ranking the dimensions of implementation and effectiveness, Kendall's coefficient of concordance (W) was employed. The statistical significance of the observed agreement was tested using the chi-square (χ^2) test at the 0.05 level of significance. These analytical procedures enabled a robust and systematic evaluation of instructional practices and outcomes, as well as an assessment of the consistency of teachers' perceptions regarding the effectiveness of inquiry-based science instruction.

3. Results and Discussions

3.1 Extent of Implementation of the Inquiry-Based Approach in Science Instruction

Table 1 presents the extent to which inquiry-based instructional practices were implemented by Grade 6 Science teachers.

Table 1. Extent of Implementation of the Inquiry-Based Approach

Inquiry-Based Instruction Dimension	Weighted Mean	Interpretation
Learner Engagement in Hands-on Activities	4.52	Highly Implemented
Use of Open-Ended Questions	4.48	Highly Implemented
Application of the Scientific Method	4.46	Highly Implemented
Collaborative Learning	4.43	Highly Implemented
Real-World Application of Concepts	4.39	Highly Implemented

The results indicate that the Inquiry-Based Approach is highly implemented across all instructional dimensions. The highest rating for learner engagement in hands-on activities suggests that teachers frequently provide opportunities for learners to explore scientific concepts through experiments, observations, and guided investigations. This aligns with constructivist principles, which emphasize active knowledge construction rather than passive reception of information.

The extensive use of open-ended questioning reflects teachers' efforts to promote critical thinking and conceptual understanding by encouraging learners to explain, predict, and justify scientific phenomena. Similarly, high ratings in the application of the scientific method indicate that learners are regularly exposed to processes such as hypothesizing, data gathering, and drawing conclusions—skills essential to scientific literacy.

Collaborative learning and real-world application, while slightly lower in ranking, remained highly implemented. This suggests that teachers recognize the value of peer interaction and contextualized learning in deepening understanding. The findings collectively demonstrate a strong alignment between classroom practices and inquiry-based pedagogy, even within a geographically and resource-constrained district.

3.2 Agreement on the Rank Order of Inquiry-Based Instruction Dimensions

To assess consistency in teachers' perceptions, Kendall's coefficient of concordance (W) was applied.

Table 2. Test of Agreement on Inquiry-Based Instruction Dimensions

Kendall's W	χ^2	p-value	Interpretation
0.71	18.64	< 0.05	Significant

The significant level of agreement indicates that teachers share a common understanding of the relative importance of inquiry-based instructional components. This consensus suggests institutional coherence in instructional priorities and reflects shared professional norms regarding effective science teaching practices.

3.3 Effectiveness of the Inquiry-Based Approach on Learners' Academic Performance

Table 3 summarizes the perceived effectiveness of the Inquiry-Based Approach on learners' academic and cognitive outcomes in Science.

Table 3. Effectiveness of the Inquiry-Based Approach

Outcome Dimension	Weighted Mean	Interpretation
Academic Performance in Science	4.49	Highly Effective
Critical Thinking Skills	4.55	Highly Effective
Scientific Inquiry Skills	4.53	Highly Effective
Learner Engagement and Participation	4.51	Highly Effective
Attitude Toward Science	4.47	Highly Effective

The findings show that the Inquiry-Based Approach is highly effective across all measured outcomes. The highest ratings were observed in critical thinking and scientific inquiry skills, indicating that inquiry-based instruction effectively cultivates higher-order thinking competencies. Learners are not only acquiring content knowledge but are also developing the ability to analyze, reason, and apply scientific concepts.

High effectiveness in learner engagement and participation supports the view that inquiry-based environments foster motivation and active involvement. When learners are encouraged to ask questions and investigate phenomena, they become more invested in the learning process. Positive attitudes toward Science further suggest that inquiry-based instruction helps reduce anxiety and increase interest in the subject, which is critical for sustained academic engagement.

The strong rating for academic performance implies that inquiry-based strategies do not compromise content mastery; rather, they enhance understanding by situating learning within meaningful contexts. These findings reinforce empirical evidence that inquiry-based instruction improves both cognitive and affective learning outcomes.

3.4 Agreement on the Rank Order of Effectiveness Dimensions

Table 4. Test of Agreement on Effectiveness Dimensions

Kendall's W	χ^2	p-value	Interpretation
0.68	16.92	< 0.05	Significant

The significant agreement among teachers regarding effectiveness dimensions indicates consistent perceptions of the benefits of inquiry-based instruction. This consistency strengthens the validity of the findings and suggests that observed outcomes are not isolated experiences but shared instructional realities across schools.

3.5 Discussion and Analysis of Findings

The results clearly demonstrate that inquiry-based instruction is both well implemented and highly effective in improving Grade 6 Science learning outcomes. Teachers' strong adherence to inquiry-based practices reflects successful alignment between pedagogical theory and classroom implementation, even within a rural and geographically challenged context.

The prominence of learner engagement, critical thinking, and inquiry skills underscores the capacity of inquiry-based instruction to address longstanding concerns in science education—namely, superficial understanding and learner disengagement. By positioning learners as active investigators, inquiry-based teaching shifts the focus from memorization to meaning-making, thereby fostering deeper conceptual understanding.

The significant agreement among teachers across instructional and outcome dimensions suggests institutional readiness and professional consensus. This coherence is particularly important for sustaining instructional reforms, as shared beliefs and practices increase the likelihood of long-term adoption.

However, slightly lower ratings for real-world application and collaborative learning indicate areas for enhancement. While these dimensions remain highly implemented, strengthening community-based investigations, interdisciplinary projects, and authentic problem-solving activities may further enrich inquiry-based instruction and improve contextual relevance.

Overall, the findings affirm that inquiry-based pedagogy is not only theoretically sound but also practically viable and impactful in public elementary school settings. The results provide strong empirical support for expanding inquiry-based approaches through teacher professional development, instructional supervision, and curriculum planning to further enhance science education outcomes.

4. Conclusions and Implications

4.1 Conclusions

This study examined the extent of implementation and effectiveness of the Inquiry-Based Approach in teaching Science to Grade 6 learners in public elementary schools in the Caramoan South District, Division of Camarines Sur. The findings provide strong evidence that inquiry-based instructional practices are highly implemented across key dimensions, including learner engagement, open-ended questioning, application of the scientific method, collaborative learning, and real-world application of scientific concepts. These practices reflect teachers' consistent use of learner-centered strategies that align with constructivist principles and contemporary science education goals.

The results further demonstrate that the Inquiry-Based Approach is highly effective in improving learners' academic performance in Science. In particular, the approach significantly enhances critical thinking skills, scientific inquiry skills, learner engagement, and positive attitudes toward the subject. These outcomes suggest that inquiry-based instruction not only supports content mastery but also fosters higher-order cognitive and affective competencies essential for scientific literacy. The significant agreement among teachers in ranking both implementation and effectiveness dimensions indicates a shared understanding of the value and impact of inquiry-based pedagogy within the district.

Overall, the study concludes that inquiry-based science instruction is a viable and effective pedagogical approach for elementary education, even in geographically and resource-constrained settings. Its successful implementation underscores the capacity of teachers to adopt innovative instructional strategies that promote meaningful learning and sustained learner engagement.

4.2 Implications for Policy, Practice, and Research

From a policy perspective, the findings support the institutionalization of inquiry-based instruction as a core strategy in elementary science education. Education authorities may consider strengthening curriculum guidelines and instructional standards that explicitly promote inquiry-based practices, ensuring alignment between policy directives, classroom implementation, and assessment systems. Providing sustained support for inquiry-based pedagogy through teacher development programs and instructional supervision can further enhance the quality of science education.

In terms of educational practice, the results highlight the importance of continuous professional development for teachers. Targeted training programs that focus on designing inquiry-based lessons, facilitating collaborative learning, and integrating real-world scientific problems can help deepen instructional effectiveness. Schools may also encourage peer collaboration and sharing of best practices to sustain the consistent implementation of inquiry-based strategies across classrooms.

For school leadership and governance, the study emphasizes the role of administrators in creating enabling environments for inquiry-based learning. Adequate provision of instructional resources, supportive scheduling, and encouragement of innovative teaching practices are essential for sustaining inquiry-based instruction. Strengthening community and local partnerships may also enhance opportunities for contextualized and experiential science learning.

With regard to future research, further studies may employ experimental or longitudinal designs to examine the long-term impact of inquiry-based instruction on learners' academic achievement and scientific literacy. Research that incorporates learners' perspectives, classroom observations, and objective achievement data would provide a more comprehensive understanding of the mechanisms through which inquiry-based approaches influence learning outcomes. Comparative studies across districts or grade levels may also yield insights into contextual factors affecting implementation and effectiveness.

In conclusion, the study affirms that inquiry-based instruction is a powerful approach to improving science education outcomes. Strengthening its institutional support and refining its implementation can contribute significantly to developing scientifically literate learners equipped with the skills necessary to thrive in an increasingly complex and knowledge-driven world.

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