

# INQUIRY-BASED TEACHING IN SECONDARY SCIENCE

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## Abstract

Inquiry-based science teaching shifts traditional classrooms by putting students in charge of their learning, promoting active exploration, critical thinking, and problem-solving. This approach deepens scientific understanding and cultivates a lifelong passion for science. Thus, this study aimed at establishing the status of the implementation of inquiry-based teaching in secondary science. Employing a descriptive research to 79 science teachers in the locale of this study, it is concluded that the respondents exhibit a commendable commitment to professional learning opportunities, with widespread availability and frequent utilization, underscoring a dedication to ongoing teacher development. Administrative support for inquiry-based learning is strong, characterized by a very high level of implementation, indicating active endorsement by school leadership. However, resources for inquiry instruction are moderately available, suggesting room for improvement in material accessibility and availability. Despite this supportive administrative environment and a classroom culture encouraging inquiry, teachers infrequently implement inquiry-based instruction, revealing a potential gap between administrative intent and classroom practice. In essence, while the study locale lays a robust foundation for promoting inquiry-based learning, bridging the disconnection between administrative support and teacher practice is essential for maximizing the impact of this innovative teaching approach in enhancing science education.

**Keywords:** Inquiry-based teaching, science teaching, secondary science.

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## 1. Introduction

The changing world has placed science at the forefront of our society, as it plays an indispensable role in our daily lives, enhancing comfort and enjoyment. Science education is a vital pillar, especially in the developing world, where nations recognize its global importance in fostering scientific knowledge and skills among their citizens. In the Philippines, science education is mandated by RA No. 10533, aiming to produce scientifically literate citizens who actively contribute to society.

However, despite these efforts, the Philippines faces significant challenges in science education, as evidenced by poor performance on international assessments like PISA and TIMSS (Bioco & Echaure, 2021; Lopez, 2021; PISA 2012; TIMSS, 2003).

The low qualities of instruction, inadequate resources, and limited access to instructional materials have contributed to this issue. There is an urgent need for a more focused approach to elevate the quality of science education in the Philippines.

One key factor influencing student science achievement is the quality of instruction. Effective teaching strategies, such as inquiry-based learning, can significantly enhance student learning outcomes. Research has shown that inquiry-based teaching methods lead to higher student engagement, critical thinking, and motivation. However, challenges, including teacher attitudes and the scarcity of inquiry-based materials, hinder its widespread adoption (Libao et al., 2016; Cairns, 2019).

Inquiry-based learning has been proven to be effective in enhancing students' scientific literacy and critical thinking skills. It aligns with the educational goals set by the K to 12 curriculum in the Philippines and helps students develop the skills required for scientific inquiry and problem-solving (Garcia & Paloma, 2018). Despite some conflicting research findings, many educational leaders and curriculum developers support the adoption of inquiry-based approaches for teaching science (Wale & Bishaw, 2020; Mulyeni, Jamaris, & Supriyati 2019).

Science process skills, such as critical thinking, are essential for understanding scientific concepts and solving real-life problems (Bagay et al., 2023; Vallerio et al., 2023; Discipulo & Bautista, 2022; Ligado et al., 2022). However, traditional teaching methods have often failed to develop these skills effectively (Legaspi et al., 2020). Inquiry-based teaching holds the promise of nurturing these skills by engaging students in hands-on, interactive learning experiences (Discipulo & Bautista, 2022; Ligado et al., 2022).

The crux is: science's central role in our changing world necessitates a strong focus on science education. The Philippines, like many other countries, faces challenges in improving the quality of science education, with inquiry-based learning emerging as a potential solution. Its adoption can enhance students' scientific literacy, critical thinking, and problem-solving skills, contributing to a more scientifically literate and capable population. However, overcoming the challenges associated with its implementation is crucial to realizing its potential benefits in science education.

## **2. Methodology**

This study employed a descriptive research method, aligning with the approach that emphasizes the current status of a phenomenon, describing prevailing conditions, and seeking accurate descriptions of activities, objects, persons, and processes. It focuses on answering questions related to "how," "what," "when," and "where" rather than "why." The goal is to describe, explain, or validate hypotheses or objectives concerning a specific group (McNeill, 2018).

The study's respondents included 79 public secondary school science teachers from different national high schools in the Division of Quirino during the 2022-2023 school year. The selection of teachers from national high schools is based on their typically higher levels of experience and exposure to training on inquiry-based teaching methods compared to newly hired teachers in remote areas. The sample size was determined using G\*power, aiming for a power of 95 and a margin of error of 5, and distributed through Stratified Random Sampling (SRS).

Data for the study were collected using a questionnaire adopted from Margolin, Brown, and Miller (2008). The researcher administered the questionnaire personally to the respondents, retrieving completed questionnaires immediately. Data were then processed and analyzed using the Statistical Package for Social Sciences (SPSS) Version 17.

The questionnaire had two parts: Part I gathered information on teachers' profiles, including age, sex, marital status, academic rank, educational attainment, and years of teaching experience. Part II assessed the level of practice in professional learning community towards inquiry-based science teaching, administrator's support, and resources for inquiry instruction. Part III deals with the teachers' practice towards inquiry instruction and classroom culture. In the current study, the instrument has the following alphas: Part II - .88, .83, and .91, respectively for PLC, administrator's support, and resources for inquiry instruction; Part III - .97 and .89, respectively for inquiry instruction and classroom culture. Hence, a valid and reliable instrument. On the other hand, the gathered data are treated with mean.

### 3. Results and Discussion

**Table 1**

*Implementation of Professional Learning Community towards Inquiry-based Instruction in Science*

Professional learning community		Mean	Descriptive Equivalent
1	Science teachers regularly observe each other teaching classes in order to learn how to implement inquiry-based lessons	3.12	Moderately practiced
2	Teachers meet to examine student works to effectively study inquiry lessons	3.36	Highly practiced
3	Teachers receive in-school coaching and/or modelling to support inquiry-based instruction	3.36	Highly practiced
4	Teachers meet for professional development sessions on inquiry-based teaching and learning to discuss or plan implementation	3.36	Highly practiced
5	Teachers have time during the regular school week to work with each other on implementation of inquiry learning	3.12	Moderately practiced
6	Teachers discuss what they learned with other teachers in their school or department who did not attend a particular workshop	3.12	Moderately practiced
7	Teachers discuss or share what they learned at workshops on inquiry-based learning with their school heads (Principal, School Head, and Master Teachers)	3.29	Highly practiced
8	Teachers communicate with other teachers from other schools about inquiry learning	3.19	Moderately practiced
Grand Mean		3.24	Moderately practiced

Presented in Table 1 are the practices on the provision of a professional learning community (PLC) towards an inquiry-based teaching in science. In general, PLC is *practiced moderately* although four of the eight indicators are seen as *highly practiced*.

Indeed, PLCs in teaching science are collaborative groups of educators working together to improve science education. These communities foster the sharing of teaching strategies, resources, and expertise among science teachers. By promoting collaboration and continuous professional development, PLCs aim to enhance both teacher effectiveness and student learning outcomes in science education. These are evident in the vouched scores of the respondents as indicated in indicators 2, 3, 4, and 7.

**Table 2**

*Administrator’s Support towards Inquiry-based Instruction in Science*

Administrator’s support		Mean	Descriptive Equivalent
1	Administrators hold a total understanding on inquiry-based instruction	3.22	High extent
2	They communicate expectations about implementing inquiry learning	3.24	High extent
3	They encourage teacher collaboration to support inquiry learning, e.g. lesson planning, observing lessons, reviewing student works.	3.29	High extent
4	They monitor teacher implementation of inquiry learning	3.32	Very high extent
5	They accept the noise that comes with an active classroom	3.24	High extent
6	They encourage the implementation of current national standards in science education	3.32	Very high extent
7	They encourage innovative instructional practices	3.34	Very high extent
8	They encourage teachers to make connections across curriculum areas	3.46	Very high extent
9	They act as a buffer between teachers and external pressures	3.34	Very high extent
Grand Mean		3.31	Very high extent

Presented in Table 2 is the known administrative support towards an inquiry-based teaching in science. In general, the administrative support in the locale of this study is *very high extent* although four of the nine indicators are not in their optimum state.

Indeed, administrative support for inquiry-based instruction in science is crucial as it ensures alignment with educational goals, allocates necessary resources, and provides professional development opportunities for teachers. This support empowers educators to effectively implement inquiry-based methods, assess student progress, and enact policies that promote this approach. Ultimately, administrative backing enhances science education quality and fosters a culture of innovation in the teaching of science.

**Table 3**

*Resources towards Inquiry-based Instruction in Science*

Resources for inquiry instruction		Mean	Descriptive Equivalent
1	There is a sufficient planning and preparation time to create inquiry-based lessons	2.97	High extent
2	There is a sufficient access to computers for science instruction	2.90	High extent
3	There is a sufficient laboratory space to support inquiry learning	2.83	High extent
4	There are sufficient laboratory equipment to support inquiry learning	2.86	High extent
5	There are sufficient well-stocked science kits or boxes to support inquiry learning	2.80	High extent
6	There are sufficient laboratory supplies or consumables to support inquiry learning	2.76	High extent
7	There are instructional materials that align with inquiry learning	3.02	High extent
8	There are sufficient funds for equipment and supplies for science	2.80	High extent
Grand Mean		2.87	High extent

Presented in Table 3 are the known resources towards an inquiry-based teaching in science. In general, the resource for inquiry instruction in the locale of this study is in *high extent*.

Indeed, resources for inquiry-based instruction in science are essential in providing students with hands-on learning opportunities, access to information, and the tools needed to explore and investigate concepts independently. Adequate funding, materials, and technology support teachers in creating engaging and effective inquiry-based learning experiences, fostering critical thinking and student-driven exploration.

**Table 4**

*Teachers' Practices towards Inquiry-based Instruction in Science*

Inquiry instruction	Mean	Descriptive Equivalent
1 Generating their own ideas, questions, and/or propositions	3.22	Much implemented
2 Sharing ideas or solving problems with each other in small groups	3.25	Highly implemented
3 Asking scientifically oriented questions about phenomena they observe	3.27	Highly implemented
4 Examining critically the scientific activities or investigations	3.20	Much implemented
5 Doing hands-on/laboratory science activities or investigations	3.17	Much implemented
6 Explaining their findings and conclusions to other students	3.29	Highly implemented
7 Following specific instructions in an activity or investigation	3.31	Highly implemented
8 Planning investigations to answer scientific questions	3.17	Much implemented
9 Participating in field works and field studies	3.15	Much implemented
10 Writing reflections in a notebook or journal	3.17	Much implemented
11 Preparing written science reports	3.24	Much implemented
12 Recording, presenting, and/or analyzing data	3.31	Highly implemented
13 Supporting their explanations with scientific knowledge	3.22	Much implemented
14 Using data to support an explanation	3.32	Highly implemented
15 Working on models or simulations	3.12	Much implemented
16 Working on extended science investigations or projects	2.98	Much implemented
17 Making formal presentations to class	3.20	Much implemented
Grand Mean	3.21	Much implemented

Presented in Table 4 are the known instruction practices towards an inquiry-based teaching in science. In general, the inquiry instruction in the locale of this study is much implemented although six of the 17 indicators are *highly implemented*.

The current state of inquiry instruction in science in the locale of the study shows a gap that needs to be addressed with an immediate action. The state of inquiry instruction is justified due to its effectiveness in promoting active learning and critical thinking, aligning with curriculum standards, and fostering long-term knowledge retention. It engages students, motivates curiosity, and equips them with problem-solving skills that have broader applications beyond science. Additionally, inquiry-based instruction promotes diversity and inclusion, making science education more accessible to a wider range of learners. In an ever-changing world, it prepares students for future

challenges and contributes to global competitiveness by nurturing innovation and technological advancement. However, its successful implementation requires sufficient resources, teacher training, and support from educational institutions and policymakers.

**Table 5***Classroom Culture towards Inquiry-based Instruction in Science*

Classroom culture		Mean	Descriptive Equivalent
1	Arranging seating to facilitate student discussion	3.39	Always
2	Assigning students to work in groups or projects	3.42	Always
3	Providing opportunities for student-to-student interaction	3.51	Always
4	Engaging the whole class in class discussions	3.58	Always
5	Engaging students in small group or one-on-one discussion	3.32	Always
6	Letting the questions and comments of students guide the focus of the lesson	3.32	Always
7	Providing differentiated background readings according to student ability and readiness	3.32	Always
8	Providing students with a choice of different assignments	3.37	Always
9	Sharing ideas or solving problems with each other in small groups	3.42	Always
Grand Mean		3.41	Always

Presented in Table 5 is the known classroom culture towards an inquiry-based teaching in science. In general, the classroom culture in the locale of this study is observed and implemented all the time.

Indeed, the classroom culture of inquiry-based teaching in science is characterized by several key elements that foster active learning, critical thinking, and student engagement. In an inquiry-based teaching environment in science, students are encouraged to ask questions, collaborate with peers, and actively engage with hands-on experiments. The teacher acts as a facilitator, guiding students through the inquiry process, fostering problem-solving skills, and promoting a growth mindset. Assessment focuses on understanding and application rather than memorization, and students are encouraged to learn from their mistakes. This inclusive and student-centered culture values curiosity, critical thinking, and the joy of scientific discovery, aiming to inspire lifelong learners who are well-equipped to tackle complex challenges in the field of science.

#### **4. Conclusion**

Based on the findings of the study, the following are concluded:

1. Professional Learning Opportunities: In the locale of the study, professional learning opportunities are widely available and frequently practiced. This indicates a commitment to ongoing teacher development and improvement.

2. Administrative Support for Inquiry-Based Learning: There is strong administrative support for inquiry-based learning, with a very high level of implementation. This suggests that school leadership is actively promoting and encouraging inquiry-based teaching methods.

3. Resources for Inquiry Instruction: Resources for inquiry instruction are available to a moderate extent. While there are resources, it may be beneficial to increase the availability and accessibility of materials to better support teachers in implementing inquiry-based instruction effectively.

4. Teacher Practice: Despite a supportive administrative environment and the presence of a classroom culture that encourages inquiry, inquiry-based instruction is seldomly implemented by teachers. This indicates a potential gap between the administrative intent and the actual teaching practices in the classroom.

In summary, the locale of the study appears to have a strong foundation for promoting inquiry-based learning, with ample professional learning opportunities and administrative support. However, there is a need to bridge the gap between administrative support and actual teacher practice.

#### **References**

- Bagay, MC., Ursua, RRR., Abellera, MAA., Baldovino, RJG., Concepcion, RAP., Galapon, VS., & Bautista, RG. (2023). Problem-based learning in teaching science. *Journal of Innovations in Teaching and Learning*, 3(1), <https://doi.org/10.12691/jitl-3-1-2>
- Bioco, M. & Echaure, J. (2021). Inquiry-Based Teaching Practices, Attitudes, and Difficulties of Secondary Science Teachers in Masinloc District Division of Zambales for S.Y. 2020-2021. *International Journal of Multidisciplinary: Applied Business and Education Research*, 2(11). 1074-1084.  
<https://doi.org/10.11594/10.11594/ijmaber.02.11.08>
- Cairns, Dean (2019). Investigating the relationship between instructional practices and science achievement in an inquiry-based learning environment, *International Journal of Science Education*, 41:15, 2113-2135  
<https://doi.org/10.1080/09500693.2019.1660927>
- Garcia, C. & Paloma, D. R. (2018). Inquiry-based learning: an innovative proposal for early childhood education. *Journal of Learning Styles*, 11(22), 50-76.
- Discipulo, LG. & Bautista, RG. (2022). Students' cognitive and metacognitive learning strategies towards hands-on science. *International Journal of Evaluation and Research in Education*, 11(2), 658-664.  
<https://doi.org/10.11591/ijere.v11i2.22018>

- Legaspi, JME., Perhilia, CO., Camayang, JG., Garingan, EG., Velasco, MKGT., Ursua, JC., & Bautista, RG. (2020). Scientific Learning Motivations as Predictors of Pre-service Elementary Grade Teachers' Authentic Assessment Practices in Science. *American Journal of Educational Research*, 8(3), 150-154.  
<https://doi.org/10.12691/education-8-3-4>
- Libao, NJP., Sagun, JJB., Tamangan, EA., Pattalitan, AP., Dupa, MED., & Bautista, RG. (2016). Science Learning Motivation as Correlate of Students' Academic Performances. *Journal of Technology and Science Education*, 6(3), 209-218.  
<http://dx.doi.org/10.3926/jotse.231>
- Ligado, FN., Guray, ND., & Bautista, RG. (2022). Pedagogical beliefs, techniques, and practices towards elementary hands-on science. *American Journal of Educational Research*, 10(10), 584-591. <https://doi.org/10.12691/education-10-10-1>
- Lopez, MJD. (2021). Inquiry-Based Teaching and Learning in Science: It's Extent of Implementation, Challenges Encountered and Learning Outcomes among the Secondary Schools in the Division of Aklan, Philippines. *International Journal of Trend in Scientific Research and Development*, 5(2), 1048-1051.
- Margolin, J., Brown, M., & Miller, S. (2008). Inquiry-based Instruction in Iowa: A Report on the Implementation of Every Learner Inquires in Year 2. Retrieved from [www.learningpt.org](http://www.learningpt.org).
- McNeill, K.L. (2018). Transitioning to the Next Generation Science Standards: Shifting classrooms to support students in science practices. Keynote address at the Rhode Island Science Teachers Association Annual meeting, East Greenwich, RI.
- Mulyeni, T., Jamaris, M. & Supriyati, Y. (2019). Improving Basic Science Process Skills Through Inquiry-Based Approach in Learning Science for Early Elementary Students. *Journal of Turkish Science Education*, 16(2):187-201.
- PISA 2012. Results in Focus-What is 15 year -old know and what they can do with they know OECD, 2014.  
<http://www.oecd.org/pisa/keyfindings/PISA-2012-results-US.pdf>
- Trends in International Mathematics and Science Study (TIMSS). (2003).  
<http://timss.bc.edu>
- Vallerio, ZV., Tobias, JCZ., Tillay, JN., Dumangeng, AP., Pumihic, VT., & Bautista, RG. (2023). Science teaching and learning conceptions towards teachers' sense of efficacy. *American Journal of Educational Research*, 11(2), 79-83.  
<https://doi.org/10.12691/education-11-2-6>
- Wale, B.D., & Bishaw, K.S. (2020). Effects of using inquiry-based learning on EFL students' critical thinking skills. *Asian-Pacific Journal of Second and Foreign Language Education*, 5(9). <https://doi.org/10.1186/s40862-020-00090-2>