MËTILËDTËD: *International Multidisciplinary Journal in Language, Education, and Culture*

Engaging Minds: Inquiry-Based Pedagogical Strategies and Grade 12 Students Attitudes Towards Physical Science

Authors:
[1]Diana Mae A. Dalugdug, LPT, MIB
Upper Katungal National High School

[2]Josevic F. Hurtada, PhD
DepEd Division of Sultan Kudarat

Publication History:
Date Submitted: April 17, 2026
Date Accepted: April 18, 2026
Date Reviewed: April 19, 2026
Date Revised: May 22, 2026
Date Published: May 29, 2026

How to cite this work:

Dalugdug, D. M., & Hurtada, J. (2026). Engaging Minds: Inquiry-Based Pedagogical Strategies and Grade 12 Students Attitudes Towards Physical Science. *METILEDTED: International Multidisciplinary Journal in Language, Education, and Culture,* 2(13), 490-506. https://metiledtedjournal.com/

ABSTRACT

Inquiry-based strategies are widely recognized as effective approaches for promoting student engagement, critical thinking, and meaningful learning in science education. However, their consistent application in Senior High School Physical Science classrooms remains a challenge, which may influence learners' attitudes toward the subject. This quantitative study examined the relationship between teachers' use of inquiry-based strategies and the attitudes of Grade 12 students toward Physical Science in selected secondary schools in the Division of Tacurong City, Sultan Kudarat, during School Year 2025-2026. The study employed a descriptive-correlational research design to determine both the extent of teachers' application of inquiry-based strategies and the level of students' attitudes toward the subject. Seven Physical Science teachers were selected through total enumeration, while fifty Grade 12 students were chosen using simple random sampling to ensure fair representation. Data were gathered through a validated survey questionnaire designed to measure teachers' instructional practices and students' attitudes in terms of positive, negative, and neutral responses. The collected data were analyzed using weighted mean to determine the level of application and attitudes, and Pearson's r correlation to identify relationships between variables. Findings revealed a high level of inquiry-based strategy use and predominantly positive student attitudes, with low negative and minimal neutral responses. A positive, statistically significant relationship was observed between teachers' practices and students' attitudes, indicating that inquiry-based strategies contribute to student engagement and positive learning experiences. The study emphasizes the importance of ongoing professional development, strengthened inquiry-driven instruction, and teacher support to improve student attitudes and learning outcomes in Physical Science.

Keywords: Inquiry-based strategies, student engagement, student attitudes, teacher's practices, descriptive-correlational design, Pearson's r correlation

INTRODUCTION

Background of Study

In teaching Physical Science, many teachers struggle to apply inquiry-based teaching methods. In senior high school level, Physical Science requires approaches that actively involve students in scientific inquiry and problem-solving, and students' attitudes toward the subject depend on how well these strategies are implemented in the classroom. When inquiry-based methods are not fully used, students may lose interest, become less motivated, or even develop negative views about the subject. This situation highlights the need to explore whether a significant relationship exists between teachers' use of inquiry-based strategies and students' attitudes toward Physical Science. Understanding this connection is key to improving teaching practices and learning outcomes.

In a global context, inquiry-based learning has emerged as a powerful teaching method that boosts students' motivation, attitudes, and performance in science across different educational systems. Studies from the United States (Furtak et al., 2022) and Finland (Jäppinen & Sarivaara, 2021) show that inquiry-based strategies improve students' understanding of concepts, teamwork skills, and confidence in learning science. Similarly, studies in developing countries like Indonesia (Syahrir et al., 2023) show that inquiry-based methods boost engagement, foster positive attitudes toward science, and build essential 21st-century skills.

In the Philippines, many classrooms still use traditional teaching methods, even though inquiry-based learning is recognized in the K-12 curriculum. This limits the potential benefits of inquiry approaches. Recent studies show that Filipino students often struggle with Physical Science due to its abstract ideas and lack of real-world context (Sarsale & Langub, 2023). Teacher readiness, classroom resources, and limited time also prevent the full use of inquiry-based strategies, especially in public schools. While some research shows that inquiry learning positively affects Filipino students' attitudes and performance, more localized studies are needed to assess its effectiveness in areas like Mindanao.

In Southern Mindanao's educational setting, including Tacurong City, Sultan Kudarat, science education faces unique challenges. These challenges stem from socio-economic conditions, limited lab resources, and different levels of teacher training. As a result, students often feel disengaged and develop negative attitudes toward Physical Science. Studies in nearby areas show that student-centered methods can significantly improve motivation and participation in class (Alcoseba & Mahinay, 2021). However, there is still limited research on how inquiry-based strategies affect Grade 12 students' attitudes in Tacurong City. It is important to examine this relationship to understand how new teaching methods can change the way Physical Science is taught and learned in the province.

This study looks at the challenges of using inquiry-based teaching methods in Physical Science. These methods are important for keeping students engaged and shaping their attitudes toward learning. The United Nations' Sustainable Development Goal 4 (SDG 4) highlights the need for quality education that encourages critical thinking, problem-solving, and lifelong learning. However, if inquiry-based strategies are not applied consistently in lesson planning, implementation, and assessment, students may form negative or indifferent attitudes towards Physical Science. This can limit their interest and success in the subject.

The main goal of this study was to find how inquiry-based teaching strategies affect the attitudes of Grade 12 students toward Physical Science in selected secondary schools in the Division of Tacurong City, Sultan Kudarat. By examining how inquiry-driven approaches affected student engagement, motivation, and views, the study aimed to share insights into teaching practices that can encourage positive attitudes toward science. Additionally, it sought to give suggestions for improving teaching methods and the quality of science education in the area, which would help lead to better learning outcomes and prepare students for their future academic and career paths.

Statement of the Problem

This study aimed to determine the relationship between inquiry-based pedagogical strategies and Grade 12 students' attitudes toward Physical Science in selected secondary schools in the Division of Tacurong City, Sultan Kudarat. Specifically, it aimed to provide answers to the following questions:

1. To what extent do teachers apply inquiry-based pedagogical strategies when teaching Grade 12 students in Physical Science, in terms of:

   1.1 lesson planning;

   1.2 implementation; and

   1.3 assessment?

2. What is the level of students' attitudes toward Physical Science, in terms of:

   2.1 positive attitudes;

   2.2 negative attitudes; and

   2.3 neutral attitudes?

3. Is there a significant relationship between the use of inquiry-based pedagogical strategies and Grade 12 students' attitudes towards Physical Science?

METHODOLOGY

Research Design

This study used a descriptive-correlational research design within a quantitative framework. It examined the relationship between inquiry-based teaching strategies and Grade 12 students' attitudes toward Physical Science in selected secondary schools in the Division of Tacurong City, Sultan Kudarat.

According to Bhandari (2021), a correlational research design examined relationships between variables without the researcher controlling or manipulating any of them. Additionally, correlation indicated the strength and direction of the relationship between two or more variables, which could be positive or negative. Correlational research is used when gathering data from natural settings, allowing researchers to apply their findings to real-life situations while ensuring the validity of the results.

Respondents of the Study

The respondents of the study were the Physical Science teachers and Grade 12 students in selected secondary schools in the Division of Tacurong City, Sultan Kudarat, during the school year 2025-2026.

Table 1. Distribution of Respondents in Terms of Population and Sample

Respondents	Population	Sample	Total
Physical Science Teachers	7	7	7
Students	50	50	50
Total	**57**	**57**	**57**

Sampling Technique

The respondents were selected using two sampling methods. First, total enumeration sampling was used for the Physical Science teachers in selected secondary schools in the Division of Tacurong City, Sultan Kudarat, for the S.Y. 2025-2026.

Second, simple random sampling was used to select the Grade 12 students enrolled in the Physical Science subject in selected secondary schools in the Division of Tacurong City, Sultan Kudarat.

Research Instruments

This study used a survey questionnaire developed by the researcher. It was reviewed and validated by experts from the DepEd-Tacurong City Division to ensure its accuracy and relevance. A five-point Likert scale was used in this study to analyze participants' responses. The data gathered from the surveys were reviewed and interpreted using the rating scales adopted from previous researchers. The use of these scales helped quantify participants' perceptions and provided a clearer understanding of how inquiry-based strategies were applied in teaching Physical Science.

To assess the extent of inquiry-based pedagogical strategy in teaching Physical Science in selected secondary schools in the Division of Tacurong City for the School Year 2025–2026, the rating scale below was used. This scale helped determine how frequently and effectively these strategies were implemented in classroom instruction, thereby providing valuable insights into current teaching practices.

The extent of inquiry-based pedagogical strategies in Grade 12 Physical Science was measured using a five-point frequency scale (1 = Never, 2 = Seldom, 3 = Sometimes, 4 = Often, 5 = Always). This structure was adapted from Bigcas, Pontemayor, Retanal, and Arpilleda (2024), who measured teachers' utilization of inquiry-based and other pedagogical approaches through a questionnaire survey.

Table 2. Rating Scale for Extent of Teachers' Application of Inquiry-Based Pedagogical Strategies in Teaching Grade 12 Physical Science

RATING	RANGE OF MEANS	DESCRIPTIVE RATING	INTERPRETATION
5	4.20-5.00	Always	Very High Extent of Application
4	3.40-4.19	Often	High Extent of Application
3	2.60-3.39	Sometimes	Moderate Extent of Application
2	1.80-2.59	Seldom	Low Extent of Application
1	1.00-1.79	Never	Very Low Extent of Application

Another set of rating scales was used to assess students' attitudes toward Physical Science in selected secondary schools in the Division of Tacurong City, Sultan Kudarat, for the School Year 2025–2026. This scale helped identify how students felt about learning Physical Science, including their interest, motivation, and perception of the subject.

To assess students' attitudes toward Physical Science, particularly the use of inquiry-based learning approaches, the rating scale presented in Table 3 was used. This scale determined the extent to which students agreed or disagreed with statements reflecting their positive, negative, and neutral attitudes toward Physical Science activities, including their motivation, interest, engagement, and perceptions of inquiry-based instruction.

Students' attitudes toward Physical Science were measured using a five-point Likert scale, where 5 = Strongly Agree, 4 = Agree, 3 = Neutral, 2 = Disagree, and 1 = Strongly Disagree. The computed weighted means were interpreted using the following ranges: 4.20–5.00 (Strongly Agree), 3.40–4.19 (Agree), 2.60–3.39 (Neutral), 1.80–2.59 (Disagree), and 1.00–1.79 (Strongly Disagree). This scale systematically interpreted students' attitudes, with higher mean scores indicating stronger agreement and intensity. It was adapted from Lantajo (2022), who used a similar approach to assess students' attitudes toward science across affective domains.

Table 3. Rating Scale for Student's Attitudes Toward Physical Science

RATING	RANGE OF MEANS	DESCRIPTIVE RATING	INTERPRETATION
5	4.20-5.00	Strongly Agree	Indicates a **very high level** of attitude. For positive items, this reflects a **very positive attitude**; for negative items, it reflects a **very strong negative attitude**; for neutral items, it indicates **strong neutrality**.
4	3.40-4.19	Agree	Indicates a **high level** of attitude. Respondents generally show **positive agreement** with the statements presented.
3	2.60-3.39	Neutral	Indicates a **moderate level** of attitude. Respondents neither agree nor disagree, reflecting **indifference or uncertainty**.
2	1.80-2.59	Disagree	Indicates a **low level** of attitude. Respondents tend to **reject or show unfavorable perception** toward the statements.
1	1.00-1.79	Strongly Disagree	Indicates a **very low level** of attitude. Respondents show **strong rejection** of the statements.

Data Gathering Procedure

To ensure reliable and valid findings, the researcher followed a systematic data-gathering procedure. Before data collection, permission was secured from the Dean of the College of Graduate Studies (CGS), the DepEd Division Superintendent of Tacurong City, and the school heads of the selected secondary schools in the Division of Tacurong City. In addition, Physical Science teachers were also informed of the study's purpose and scope.

The primary instrument used for data collection was a researcher-developed survey questionnaire. The instrument was subjected to content validation by experts, to ensure clarity, relevance, and appropriateness of the items. The study employed total enumeration sampling for all Grade 12 Physical Science teachers and simple random sampling in selecting Grade 12 students enrolled in Physical Science.

Upon approval, the survey questionnaires were personally distributed to the selected respondents. Data collection was conducted in strict compliance with the health and safety protocols set by the Department of Health (DOH) and DepEd. Respondents were informed of the study and that their voluntary consent was obtained before participation.

After retrieval, the data were organized, tabulated, and encoded, then analyzed using appropriate statistical methods to assess the impact of inquiry-based teaching strategies on Grade 12 students' attitudes toward Physical Science. Finally, the results were interpreted to draw conclusions and provide recommendations.

Statistical Treatment

The collected data were tabulated, analyzed using appropriate statistical tools, and interpreted to answer the research questions. The statistical techniques ensured objective analysis and valid conclusions.

First, the Weighted Mean was used to determine the extent to which teachers applied inquiry-based pedagogical strategies in teaching Grade 12 students in Physical Science, specifically in terms of lesson planning, implementation, and assessment. The interpretation was based on a Likert scale to describe the level of application.

Second, the Weighted Mean measured students' level of attitudes toward Physical Science, whether positive, negative, or neutral. This provided insights into how students perceived the subject.

Finally, the Pearson r correlation was used to examine the significant relationship between the extent of teachers' use of inquiry-based pedagogical strategies and Grade 12 students' attitudes toward Physical Science. This established whether the application of inquiry-based strategies was associated with students' attitudes toward the subject.

Scope and Delimitation

This study examined the relationship between inquiry-based teaching strategies and Grade 12 students' attitudes toward Physical Science in selected secondary schools in the Division of Tacurong City, Sultan Kudarat. The research included only senior high school students who were enrolled in Physical Science during the academic year 2025–2026. It specifically investigated how lesson planning, implementation, and assessment influenced students' interest, motivation, and perceptions of the subject.

The study did not include other grade levels, subjects, or teaching methods outside the inquiry-based approach. The study used a quantitative research design. Data were collected through survey questionnaires, and statistical methods were employed to analyze the relationship between teaching strategies and student attitudes. The focus of this study was on the academic and students' behavioral responses within the institution. External factors, such as home environment or prior academic performance, that might also affect student attitudes were excluded from the study.

RESULTS AND DISCUSSIONS

This study aimed to determine the extent of teachers' application of inquiry-based pedagogical strategies in teaching Grade 12 Physical Science and to examine students' attitudes toward the subject, as well as the relationship between these variables. Using a descriptive-correlational research design, data were gathered from Grade 12 students and Physical Science teachers through survey questionnaires. Statistical tools, such as the weighted mean and Pearson's r were used to analyze the data.

Based on the results, teachers demonstrated a very high extent of application of inquiry-based pedagogical strategies across the three domains: lesson planning, implementation, and assessment. In lesson planning, teachers consistently integrated activities that encouraged questioning, exploration, real-life application, and student-centered investigations. In terms of implementation, teachers actively facilitated discussions, encouraged collaboration, allowed students to design experiments, and acted as facilitators rather than direct sources of answers.

Regarding assessment, teachers frequently used performance-based tasks, reflective tools, and feedback mechanisms that emphasized inquiry processes and higher-order thinking skills. The overall weighted mean confirmed that inquiry-based strategies were always practiced at a very high level.

In terms of students' attitudes toward Physical Science, the findings revealed that they generally had a positive attitude toward the subject. Students expressed enjoyment in inquiry-based activities, active participation in group discussions, and appreciation for real-life applications of scientific concepts. While some indicators showed moderate motivation and

confidence in independent inquiry, the overall results still reflected a favorable perception of inquiry-based learning.

Moreover, the level of students' negative attitudes was low, indicating that most learners were not discouraged by inquiry tasks or extended experiments. Although a few students had trouble when lessons were not clearly explained, negative perceptions were generally minimal.

Meanwhile, students demonstrated a moderately neutral attitude toward Physical Science, suggesting that some learners remained adaptable to different teaching approaches and occasionally preferred traditional methods. However, students were not indifferent toward collaborative and experimental activities, indicating that these strategies played a significant role in shaping their engagement.

Finally, the study revealed a strong positive and statistically significant relationship between the extent of teachers' application of inquiry-based pedagogical strategies and students' attitudes toward Physical Science. This implies that increased use of inquiry-based approaches is associated with more positive student attitudes toward the subject.

Conclusion

Based on the findings of the study, the following conclusions were drawn:

The application of inquiry-based pedagogical strategies among Grade 12 Physical Science teachers is highly evident in lesson planning, classroom implementation, and assessment practices. Teachers consistently integrate student-centered and inquiry-driven approaches that promote critical thinking, collaboration, and real-world connections. This indicates a strong commitment to fostering meaningful and engaging science learning experiences.

Students generally exhibit positive attitudes toward Physical Science, particularly when inquiry-based methods are employed. Their active participation, enjoyment of collaborative work, and appreciation of real-life applications demonstrate that inquiry strategies increased motivation and engagement. The low level of negative attitudes further suggests that students are receptive to investigative and hands-on learning experiences.

Although some students show moderate neutrality toward inquiry-based instruction, their adaptability indicates potential for engagement when strategies are consistently and clearly implemented.

Most importantly, the significant positive relationship between teachers' inquiry-based practices and students' attitudes confirms that effective instructional strategies directly influence learners' perceptions and interest in science. Therefore, the null hypothesis stating that there is no significant relationship between teachers' inquiry-based pedagogical strategies and students' attitudes toward Physical Science is rejected. This highlights the value of inquiry-based pedagogy in enhancing both cognitive and affective learning outcomes.

Recommendations

Considering the findings and conclusions of the study, the following recommendations are proposed:

1. **School Administrators:** School administrators are encouraged to support continuous professional development programs that strengthen teachers' skills in implementing inquiry-based instruction. They should also ensure the provision of adequate resources, laboratory equipment, and instructional materials that promote hands-on and inquiry-driven learning experiences. Such support can enhance the quality of science instruction and create an environment conducive to meaningful student learning.
2. **Science Teachers:** Science teachers are encouraged to sustain and enhance the use of inquiry-based strategies in lesson planning, implementation, and assessment to maintain student engagement. They should provide clear guidance during activities and integrate real-life applications and collaborative tasks to strengthen students' interest and positive attitudes toward Physical Science.
3. **Students:** Students are encouraged to actively participate in inquiry-based and collaborative activities and develop confidence in conducting independent investigations and solving problems to improve their understanding of Physical Science.
4. **Future Researchers:** Future researchers are encouraged to conduct similar studies in other subjects or grade levels and explore additional factors influencing students' attitudes toward science. Longitudinal studies are also recommended to examine the long-term effects of inquiry-based instruction on achievement and motivation.

Ethical Considerations

Ethical considerations were essential in this study to protect the rights, safety, and dignity of the Physical Science teachers and Grade 12 student participants. The researcher ensured that the study was conducted fairly, transparently, and in accordance with established ethical standards.

In this study, ethical issues were given primary importance to ensure the well-being and respect of the participants while maintaining research integrity and credibility. The following ethical principles were observed:

Informed Consent: Ethical considerations were strictly observed to uphold the rights, safety, and dignity of all participants. The research adhered to ethical guidelines by ensuring that participants were treated with respect, fairness, and confidentiality throughout the study. Participants were fully informed about the purpose, procedures, and scope of the research, and

their informed consent was obtained before participation. Data was used solely for academic purposes and were kept confidential.

Confidentiality: The researcher ensured that all information shared by the participants remained confidential and anonymous. All data collected were stripped of personal identifiers and securely stored to prevent unauthorized access. Any details that could reveal the identity of students, teachers, or the schools were carefully protected and kept strictly private during and after the study.

Beneficence and Non-maleficence: The study aimed to help teachers and students by examining how inquiry-based teaching strategies improve Grade 12 students' attitudes toward Physical Science. All necessary measures were taken to minimize risks and ensure that no participant experienced psychological, emotional, or academic harm.

Voluntary Participation: Participation of Grade 12 students and Physical Science teachers was voluntary. They were informed of their right to withdraw at any time without any negative consequences, and participation did not affect their grades, job performance, or school standing.

Equity and Fairness: All participants were treated fairly and equally, without discrimination or favoritism. The researcher ensured that every student and teacher had equal opportunities to participate in and benefit from the study.

Feedback and Dissemination: The results of the study were shared with the school community, including teachers, administrators, and students, in a clear and meaningful manner. This ensured that participants and stakeholders understood and used the findings to enhance teaching and learning practices in Physical Science.

Researcher Reflexivity: The researcher continuously reflected on personal beliefs, values, and possible biases as an educator-researcher. This self-awareness helped maintain objectivity and ensured that the study was conducted with fairness, respect, and integrity toward all participants.

Ethics Review: Before conducting the research, approval was obtained from the appropriate school authorities and, when necessary, from the institutional ethics review committee. This process ensured that the study complied with recognized ethical guidelines and institutional standards.

Acknowledgment

The researcher sincerely expresses her deepest and most heartfelt gratitude to all the individuals who, in their own meaningful ways, extended their time, knowledge, and unwavering support to make this study possible and successful:

THE ALMIGHTY AND HEAVENLY FATHER, our Savior, Provider, and Source of wisdom and strength, for His divine guidance, endless blessings, and perfect will that made everything possible. To Him, the researcher offers all the glory, honor, and praise**;**

MARJUNI M. MADDI, Director General, MBHTE – Higher Education, for his steadfast leadership, encouragement, and invaluable support that greatly contributed to the fulfillment of this study;

BAILAH B. SANDIGAN, MAED, East-West Mindanao Colleges, Inc., President, for being a true inspiration to persevere and continue striving for academic excellence despite life's challenges;

EMILIA M LOTILLA, PhD, Dean of the Graduate School, for her kindness, wisdom, and motherly guidance served as a beacon of light during moments of difficulty and doubt;

JULIET P, TAMBUNGALAN, MAED, GS Consultant, for her patience, meaningful advice, and constant encouragement that helped the researcher move forward and overcome challenges along the way**;**

JOSEVIC F. HURTADA, PhD, Research Adviser, for the insightful guidance, motivation, and expertise that strengthened the quality of this study and helped bring it to completion;

JAIME BOY U. NGAG JR., PhD, Graduate School Research Consultant, for the constructive feedback, wise suggestions, and words of encouragement that inspired the researcher to persevere despite hardships;

LEODIE M. MONES, PhD, for his valuable contributions, wisdom, and expertise generously shared in the realization of this study;

GILDO G. MOSQUEDA, CEO VI, Schools Division Superintendent of Tacurong City, for granting permission to conduct the study and for his dedicated leadership, which served as a genuine source of inspiration;

SCHOOL HEADS of selected secondary schools in Tacurong City Division, Sultan Kudarat, for their kind consideration and continued encouragement during the conduct of the study;

MARTIN I. DIAZ, Principal III of Tacurong National High School, **RIZA P. VELASCO, Principal I** of Upper Katungal National High School, **MA. TERESA H. RUZ, Assistant Principal II** of Apolinario S. Bernardo National High School, **RONALD D. DELA PEÑA, School Head** of Rajah Muda National High School, Tacurong City, Sultan Kudarat, for the active participation during the conduct of her study;

ALL PARTICIPANTS, for their invaluable time, effort, and honest responses in making the research possible. Their contributions have provided meaningful insights that greatly enriched the study.

HUSBAND, Ariel B. Dalugdug, for his unconditional love, patience, and unwavering encouragement, serving as a source of strength and motivation throughout this academic journey; and

SON, Sean Garrett A. Dalugdug, for being the inspiration, joy, and reason to strive harder and accomplish this milestone with determination and love.

Declaration AI Tools Utilization

I do hereby declare the use AI tools, such as Chat GPT and Grammarly for grammar checking and setence organization purposes only.

REFERENCES

Alcoseba, M. A., & Mahinay, R. T. (2021). Student-centered learning approaches and student motivation in science education. *Journal of Science Education in Mindanao*, *15*(2), 45–58.

Andrade, H. L., & Brookhart, S. M. (2020). *Classroom assessment as the co-regulation of learning*. Routledge.

Bashir, M. A. (2024). Digital transformation in science education: Challenges and opportunities in Physical Science learning. *International Journal of STEM Education*, *11*(1), 56–72.

Bautista, R. L., Gomez, A. P., & Torres, J. D. (2023). Challenges in implementing inquiry-based science teaching in Philippine secondary schools. *Philippine Journal of Science Education*, *27*(2), 112–128.

Bautista, R. M., Santos, L. P., & Villanueva, J. A. (2023). Inquiry-based pedagogy and student engagement in Physical Science classrooms. *Philippine Journal of Science Education*, *18*(2), 45–58.

Bhandari, P. (2021). Correlational research: Definition, methods, and examples. *Scribbr*. https://www.scribbr.com/methodology/correlational-research/

Bigcas, R. M., Pontemayor, J. L., Retanal, P. D., & Arpilleda, M. S. (2024). Teachers' utilization of inquiry-based pedagogical strategies in science instruction. *Philippine Journal of Educational Research*, *30*(1), 45–60.

Bruner, J. S. (1961). *The act of discovery*. Harvard University Press.

Bybee, R. W. (2019). *The BSCS 5E instructional model: Personal reflections and contemporary implications*. BSCS Science Learning.

Chen, L. (2023). Blended laboratory instruction in Physical Science education: Integrating virtual and hands-on learning. *Journal of Educational Technology Research*, *18*(3), 201–215.

Chen, Y., Wang, H., & Liu, X. (2021). Inquiry-based learning in science education: Implementation challenges and student outcomes. *International Journal of Science Education*, *43*(8), 1256–1274.

Chiu, M. M., Chow, B. W. Y., & McBride-Chang, C. (2021). Students' motivation and engagement in science learning across countries. *Educational Psychology Review*, *33*(2), 567–589.

Darling-Hammond, L., Flook, L., Cook-Harvey, C., Barron, B., & Osher, D. (2020). Implications for educational practice of the science of learning and development. *Applied Developmental Science*, *24*(2), 97–140.

Dematea, R. P., Santos, J. L., & Cruz, M. A. (2025). Evaluating the MATATAG curriculum reform: Implications for science instruction in the Philippines. *Philippine Educational Review*, *12*(1), 34–50.

Department of Education. (2016). *K to 12 science curriculum guide*. Department of Education Philippines.

Department of Health. (2020). *Health and safety protocols for educational institutions*. Department of Health Philippines.

Estrella, K. L. (2024). Students' perception of Physical Science and its impact on academic performance. *Philippine Journal of Educational Research*, *29*(1), 65–81.

Furtak, E. M., Seidel, T., Iverson, H., & Briggs, D. C. (2022). Experimental and quasi-experimental studies of inquiry-based science teaching: A meta-analysis. *Review*

of Educational Research, *92*(2), 241–282. https://doi.org/10.3102/00346543211019166

Google Earth. (2025). *Map of Tacurong City, Sultan Kudarat, Philippines* [Map]. https://earth.google.com

Harlen, W., & James, M. (2021). Assessment and learning: Differences and relationships between formative and summative assessment. *Assessment in Education: Principles, Policy & Practice*, *28*(3), 325–340.

Hasni, A., Potvin, P., & Belletête, V. (2023). Inquiry-based science teaching and student engagement: A global perspective. *International Journal of Science Education*, *45*(4), 523–541.

International Association for the Evaluation of Educational Achievement. (2023). *International science curriculum and assessment report*. IEA Publishing.

Jäppinen, A., & Sarivaara, E. (2021). Inquiry-based learning in Finnish science classrooms: Effects on collaboration and conceptual understanding. *International Journal of Science Education*, *43*(5), 765–783.

Kang, J., & Keinonen, T. (2020). The role of inquiry-based teaching in fostering conceptual understanding in science education. *International Journal of Science Education*, *42*(7), 1053–1072.

Kang, J., & Keinonen, T. (2023). The impact of inquiry-based learning on students' scientific literacy. *Research in Science Education*, *53*(2), 467–485.

Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*. Prentice-Hall.

Lantajo, M. E. (2022). Students' attitudes toward science learning: Development of a Likert-scale instrument. *Journal of Educational Measurement and Evaluation*, *14*(2), 78–92.

Lazonder, A. W., & Harmsen, R. (2020). Meta-analysis of inquiry-based learning: Effects of guidance on student outcomes. *Review of Educational Research*, *90*(5), 681–718.

Organization for Economic Co-operation and Development. (2024). *Science education for the future: Trends and global challenges*. OECD Publishing.

Osborne, J., & Dillon, J. (2020). *Good practice in science teaching: What research has to say* (2nd ed.). Open University Press.

Panadero, E., Andrade, H., & Brookhart, S. M. (2020). Fostering self-regulated learning through formative assessment. *Educational Psychologist*, *55*(3), 193–205.

Pedaste, M., Mäeots, M., Siiman, L., De Jong, T., Van Riesen, S., Kamp, E., Manoli, C., Zacharia, Z., & Tsourlidaki, E. (2022). Phases of inquiry-based learning: Definitions and the inquiry cycle revisited. *Educational Research Review*, *36*, 100451.

Piaget, J. (1972). *The psychology of the child*. Basic Books.

Potvin, P., & Hasni, A. (2022). Factors influencing students' attitudes toward science learning. *Science Education Review*, *21*(1), 15–29.

Programme for International Student Assessment. (2025). *PISA 2025 results: Global trends in science education*. OECD Publishing.

Reyes, M. D., & Dela Cruz, A. R. (2021). Inquiry-based teaching practices in Philippine secondary science classrooms. *Asia-Pacific Journal of Educational Research*, *9*(2), 88–102.

Reyes, J. L., & Dela Cruz, M. P. (2021). Inquiry-based learning strategies and students' performance in Physical Science. *Asia Pacific Journal of Multidisciplinary Research*, *9*(4), 102–110.

Sarsale, R. D., & Langub, L. P. (2023). Challenges in teaching Physical Science among Filipino students: Implications for instructional strategies. *Philippine Journal of Science Education*, *27*(1), 89–102.

Syahrir, M., Hidayat, A., & Rahman, F. (2023). The effectiveness of inquiry-based learning in improving students' engagement and scientific attitudes. *Indonesian Journal of Science Education*, *12*(1), 34–46.

Tesorio, J. L., & Canizares, M. E. (2018). Assessment practices of secondary science teachers in Cebu. *Philippine Journal of Assessment in Education*, *6*(1), 22–35.

United Nations. (2015). *Transforming our world: The 2030 agenda for sustainable development*. United Nations. https://sdgs.un.org/goals

Villanueva, J. A., & Santos, L. P. (2022). Teacher guidance and student engagement in inquiry-based science learning. *Philippine Educational Research Journal*, *15*(1), 33–46.

Villanueva, P. S., & Santos, R. M. (2022). Inquiry-based teaching strategies and student attitudes toward Physical Science. *Philippine Journal of Science Teaching*, *18*(2), 97–115.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.

Wang, Y., & Li, Q. (2022). Integrating STEM approaches into Physical Science education. *Journal of STEM Education Research*, *5*(1), 44–60.

Zhang, M., & Quintana, C. (2022). Designing inquiry-based learning environments: Challenges and opportunities. *Journal of the Learning Sciences*, *31*(3), 456–478.