International Journal of Sustainability and Advanced Integrated Research
Volume 2, Issue 2 (April-June 2026) | ISSN: 3107-7854
DOI: https://doi.org/10.65339/ijsair.V2.I2.519

Learning Models of Inquiry Towards Development on Science Process Skills: Basis for Proposed Action Plan

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Publication history: Received: May 2, 2026; Revised: May 26, 2026; Accepted: May 30, 2026
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Abstract

This study examined the perceptiveness of Grade 8 learners toward inquiry learning models and their contribution to the development of Science Process Skills (SPS) as the basis for a proposed action plan. Grounded in Constructivist Learning Theory and Inquiry-Based Learning Theory, the study explored learners' perceptions in terms of interaction, clarification, questioning, and design, as well as the relationship between selected profile variables and inquiry learning dimensions. A descriptive-correlational research design with a quantitative approach was employed. The respondents were 234 Grade 8 learners from Jaen National High School during the School Year 2023–2024, selected through complete enumeration sampling. Data were collected using an adopted and modified questionnaire and analyzed using frequency, percentage, weighted mean, and Pearson Product-Moment Correlation Coefficient. The findings revealed that learners exhibited positive perceptions of inquiry-based learning across all dimensions, with questioning obtaining the highest level of agreement. Learners perceived inquiry-based learning as effective in enhancing curiosity, participation, critical thinking, creativity, problem-solving, and Science Process Skills. Results further indicated that gender was significantly related only to clarification, while parents' educational attainment and monthly income showed no significant relationship with any inquiry-learning dimension. Science grades demonstrated significant relationships with interaction, clarification, questioning, and design. The study concluded that inquiry-based learning positively contributes to the development of Science Process Skills and recommended the continued implementation of inquiry-based activities, practical work, collaborative learning experiences, and institutional support for inquiry-oriented science instruction. The study aligns with SDG 4 (Quality Education) by promoting learner-centered science education and SDG 9 (Industry, Innovation and Infrastructure) by fostering inquiry, creativity, and problem-solving skills. Its sustainability contribution lies in strengthening educational practices that support scientific literacy, continuous learning, and improved learner outcomes.

Keywords: Critical Thinking, Grade 8 Learners, Inquiry-Based Learning, Problem-Solving, Science Education, Science Process Skills

1. Introduction

Inquiry-based learning has emerged as a student-centered approach that promotes active participation, curiosity, critical thinking, and deeper understanding of scientific concepts. Science Process Skills (SPS), which include observing, investigating, analyzing, and interpreting scientific phenomena, are fundamental to science education. Within the Philippine K–12 curriculum, inquiry-based learning is emphasized to enhance learners' engagement and scientific literacy. This study examines the perceptiveness of Grade 8 learners toward inquiry learning models in terms of interaction, clarification, questioning, and design, and explores their contribution to the development of Science Process Skills. The findings serve as the basis for a proposed action plan aimed at strengthening inquiry-based science instruction.

1.1 Inquiry-Based Learning Models and Science Process Skills Among Grade 8 Learners

Science education develops learners' scientific literacy, critical thinking, and problem-solving abilities through the acquisition of Science Process Skills. Inquiry-based learning encourages learners to actively engage in scientific investigations through exploration, questioning, and evidence-based reasoning (Vilela et al., 2025). Practical and project-based learning experiences further enhance engagement and higher-order thinking by connecting scientific concepts to authentic contexts (Kaewmanee et al., 2024; Rapi et al., 2025). In the Philippine educational system, the K–12 curriculum promotes inquiry-based and experiential learning through a spiral progression approach. This framework encourages the use of innovative instructional strategies that foster participation and strengthen Science Process Skills. Inquiry-based learning has been associated with improved student engagement, autonomy, and critical thinking; however, challenges such as limited resources, varying learner abilities, and sustaining student interest in science remain evident (Idris et al., 2022; Strat & Jegstad, 2022). Grade 8 learners experience inquiry-based activities across Biology, Chemistry, and Physics, yet they demonstrate varying levels of competence in interaction, clarification, questioning, and design, which are essential components of inquiry learning (Chengere et al., 2025; Senisum et al., 2022). Recent innovations, including differentiated

inquiry instruction and digital learning platforms, have shown positive effects on learners' critical thinking and inquiry skills (Bónus et al., 2024; Ramlawati et al., 2025).

1.2 Themes and Insights from Literature on Inquiry Learning Dimensions and Science Process Skills

The literature consistently highlights interaction, clarification, questioning, and design as critical dimensions of inquiry-based learning that support Science Process Skills development. Interaction promotes collaboration, learner engagement, peer learning, and active participation in scientific investigations. Guided inquiry models support Science Process Skills and cognitive outcomes by encouraging communication, collaboration, and critical questioning (Senisum et al., 2022). Interactive learning experiences likewise improve participation and academic performance in science (Anselmo et al., 2024), while inquiry-based learning combined with project-based assessment enhances problem-solving and collaborative skills (Rapi et al., 2025). Integrating STEM principles within inquiry learning further strengthens engagement and scientific competence (Kaewmanee et al., 2024). Clarification enables learners to evaluate information, distinguish facts from opinions, reflect on scientific ideas, and address misconceptions. Inquiry learning supports cognitive processes that refine understanding and strengthen scientific literacy (Rapi et al., 2025). Hands-on inquiry activities encourage deeper participation and cognitive engagement (Kaewmanee et al., 2024), while structured inquiry models facilitate communication, reflection, and conceptual clarification (Senisum et al., 2022). Questioning is central to scientific inquiry because it stimulates curiosity, analytical thinking, self-directed learning, and scientific reasoning. Inquiry-based learning enhances Science Process Skills and critical thinking through exploration and questioning activities (Rapi et al., 2025). It also improves analytical thinking and learner engagement (Udonsathian & Worapun, 2024), strengthens curiosity and scientific reasoning (Ramlawati et al., 2025), and promotes academic achievement through meaningful learning experiences (Anselmo et al., 2025). Design focuses on creativity, problem-solving, critical thinking, and the application of scientific knowledge to real-world situations. Inquiry-based learning supports the development of Science Process Skills through exploration and problem-solving activities (Rapi et al., 2025). STEM-integrated inquiry learning enhances creativity, engagement, and scientific competence (Kaewmanee et al., 2024), while interactive learning environments positively influence learners' participation and perceptions toward science learning (Anselmo et al., 2025).

1.3 Philippine Context of Inquiry-Based Learning and Science Education

The Philippine K–12 curriculum advocates inquiry-based science instruction as a means of developing scientifically literate and critically minded learners. Through inquiry-oriented and experiential approaches, students are encouraged to engage actively in scientific investigations and problem-solving activities. Despite policy support, schools continue to encounter challenges related to instructional resources, learner diversity, and sustained engagement in science learning (Idris et al., 2022; Strat & Jegstad, 2022). At the school level, learners' exposure to inquiry-based activities varies across scientific disciplines. Teachers therefore play a crucial role in facilitating meaningful inquiry experiences and providing appropriate support that strengthens learners' Science Process Skills (Chengere et al., 2025; Senisum et al., 2022).

1.4 Constructivist and Inquiry-Based Foundations of Science Process Skills Development

The study is grounded in Constructivist Learning Theory and Inquiry-Based Learning Theory. Constructivist Learning Theory posits that learners actively construct knowledge through engagement and experience, emphasizing meaningful learning through exploration and reflection. Inquiry-Based Learning Theory asserts that learners acquire knowledge through active investigation, discovery, and questioning. The conceptual framework of the study proposes that learner characteristics, including gender, parents' educational attainment, parents' monthly income, and science grades, may influence learners' perceptiveness toward inquiry learning models. These perceptions are reflected through interaction, clarification, questioning, and design, which collectively contribute to the development of Science Process Skills and inform the proposed action plan.

1.5 Research Gaps and Rationale for Examining Grade 8 Learners' Perceptiveness of Inquiry Learning Models

Although numerous studies have established the effectiveness of inquiry-based learning in improving Science Process Skills, critical thinking, and learner engagement, limited research has examined how Filipino learners perceive inquiry learning models, particularly in relation to interaction, clarification, questioning, and design (Chengere et al., 2025; Senisum et al., 2022). Furthermore, there remains a lack of localized action plans derived from learners' perceptions and experiences regarding inquiry-based science instruction. This gap underscores the need to investigate Grade 8 learners' perceptiveness of inquiry learning models and determine how these perceptions contribute to the development of Science Process Skills. The findings may provide evidence-based recommendations for improving science instruction and supporting learner development.

1.6 Alignment with Relevant Sustainable Development Goals (SDGs)

This study aligns with SDG 4 – Quality Education by promoting inquiry-based learning approaches that enhance learners' Science Process Skills, critical thinking, problem-solving abilities, and scientific literacy. Through active participation, questioning, clarification, interaction, and design-based learning experiences, students are encouraged to become independent and engaged learners. The study also supports SDG 8 – Decent Work and Economic Growth by developing

essential competencies such as creativity, collaboration, analytical thinking, and problem-solving, which are valuable for future academic and professional success. Furthermore, the study contributes to SDG 9 – Industry, Innovation and Infrastructure by fostering innovation-oriented thinking and scientific inquiry skills that enable learners to apply knowledge in addressing real-world challenges. By strengthening science education through inquiry-based learning, the study contributes to the development of a knowledgeable, skilled, and innovative generation capable of supporting sustainable societal progress.

1.7 Importance of the Study to Multidisciplinary Sustainability

The study contributes primarily to educational sustainability by supporting instructional practices that improve learning outcomes and strengthen Science Process Skills. It also contributes to socio-economic sustainability by developing competencies such as critical thinking, creativity, collaboration, and problem-solving that are essential for future educational and employment opportunities. In addition, the study supports innovation and technological sustainability by encouraging inquiry-oriented thinking, evidence-based reasoning, and scientific problem-solving. At the community and institutional levels, the proposed action plan may assist schools in strengthening science instruction and fostering a culture of continuous improvement in teaching and learning. Through these contributions, the study supports the long-term development of scientifically literate and competent learners capable of addressing contemporary societal challenges.

2. Material and methods

2.1 Research Design

The study employed a descriptive-correlational research design using a quantitative approach. The descriptive component was used to determine the learners' perceptiveness of inquiry-based learning models in terms of interaction, clarification, questioning, and design, while the correlational component examined the relationship between respondents' profile variables and their perceptiveness toward inquiry learning. The findings were utilized in developing a proposed action plan. The study was guided by a theoretical-conceptual framework that explained the relationship between learner characteristics, inquiry learning dimensions, and the development of Science Process Skills. The framework identified gender, parents' educational attainment, parents' monthly income, and science grades as profile variables that may influence learners' perceptions of inquiry-based learning. These perceptions were examined through the dimensions of interaction, clarification, questioning, and design, which emphasize active participation, critical thinking, curiosity, collaboration, and problem-solving. The framework posited that positive perceptions of inquiry-based learning contribute to improved scientific thinking, engagement, and Science Process Skills, ultimately serving as the basis for the proposed action plan.

2.2 Locale of the Study

The study was conducted at Jaen National High School during the School Year 2023–2024. The school was selected because it implements inquiry-based learning approaches consistent with the K–12 Science curriculum.

2.3 Respondents of the Study

The respondents consisted of 234 Grade 8 learners enrolled at Jaen National High School during the School Year 2023–2024. They were selected because they had prior exposure to inquiry-based learning activities in science subjects, making them suitable participants for the study.

2.4 Sample and Sampling Procedure

The study utilized complete enumeration sampling, wherein all Grade 8 learners were included as respondents. This sampling technique ensured full representation of the target population and allowed the researcher to gather comprehensive data from all eligible learners.

2.5 Research Instrument

Data were collected using an adopted and modified questionnaire. The instrument consisted of two parts: the respondents' profile and their perceptiveness of inquiry learning models toward the development of Science Process Skills. A four-point Likert scale was used to measure the respondents' perceptions. Prior to administration, the questionnaire underwent validation by experts to ensure its relevance, clarity, and suitability for the study objectives.

2.6 Data Gathering Procedure

Permission to conduct the study was first secured from the school administration. Upon approval, the researcher distributed the questionnaires to the respondents with the assistance of teachers. The participants were informed of the study's purpose and were given adequate time to complete the instrument. After collection, the responses were checked, organized, tabulated, and prepared for statistical analysis.

2.7 Data Analysis Techniques

Frequency and percentage distributions were used to describe the respondents' profile variables. Weighted mean and average weighted mean were employed to determine the learners' level of perceptiveness toward inquiry learning models in terms of interaction, clarification, questioning, and design. The Pearson Product-Moment Correlation Coefficient was utilized to determine whether significant relationships existed between the respondents' profile variables and their perceptiveness of inquiry learning models.

2.8 Ethical Considerations

The study adhered to established ethical standards throughout the research process. Approval was obtained from the appropriate school authorities before data collection commenced. Participation was voluntary, and respondents were informed of the objectives of the study. Confidentiality and anonymity were maintained at all times, and all information gathered was used solely for research purposes.

3. Results and Discussion

3.1 Respondents' Profile and Perceptiveness of Inquiry Learning Models

3.1.1 Profile of the Grade 8 Learners

The respondents were predominantly female, comprising 52.60% of the total participants, while 47.40% were male. Most fathers were high school graduates, followed by college graduates, whereas most mothers were college graduates, followed by high school graduates. The majority of learners belonged to households with a monthly income ranging from Php 10,001 to Php 20,000. In terms of academic performance, more than half of the respondents obtained outstanding grades in science, while a large proportion achieved very satisfactory ratings. These findings indicate that the respondents generally came from families with at least secondary or tertiary educational backgrounds and demonstrated strong academic performance in science. Such characteristics may contribute to learners' engagement in science-related activities and their exposure to supportive learning environments.

3.1.2 Perceptiveness of Inquiry Learning Models in Terms of Interaction

The respondents demonstrated a positive perception of inquiry learning models in terms of interaction, with an overall level categorized as "Agree." Learners expressed strong interest in participating in science activities, found science lessons enjoyable, and preferred additional inquiry-based sessions, particularly in Biology and Chemistry. They also recognized the role of inquiry learning in promoting analytical skills and collaborative engagement with peers. The findings suggest that learners value interactive and student-centered learning environments that encourage participation and collaboration. This supports the view that guided inquiry enhances Science Process Skills and cognitive outcomes through communication, collaboration, and critical questioning (Senisum et al., 2022). Likewise, engaging learning experiences improve participation and academic outcomes (Anselmo et al., 2024), while inquiry-based learning integrated with project-based assessment strengthens critical thinking and problem-solving abilities (Rapi et al., 2025). Similar benefits have been reported in STEM-integrated inquiry approaches that increase learner engagement and scientific skills (Kaewmanee et al., 2024).

3.1.3 Perceptiveness of Inquiry Learning Models in Terms of Clarification

The respondents generally agreed that inquiry-based learning supports clarification. They believed that inquiry activities help evaluate the credibility of sources, clarify personal understanding, distinguish facts from opinions, encourage reflection, and address misconceptions. They also disagreed with the notion that practical science work is boring, indicating a positive attitude toward hands-on learning experiences. These results suggest that inquiry learning promotes deeper understanding and reflective thinking among learners. Inquiry-based approaches help refine ideas, support conceptual understanding, and eliminate misconceptions, thereby strengthening Science Process Skills and scientific literacy (Rapi et al., 2025). The positive perception of practical activities aligns with evidence that hands-on inquiry fosters participation and cognitive engagement (Kaewmanee et al., 2024). Furthermore, structured inquiry models that emphasize communication and reflection have been shown to improve science process skills and learning outcomes (Senisum et al., 2022).

3.1.4 Perceptiveness of Inquiry Learning Models in Terms of Questioning

The respondents showed the highest level of agreement in the area of questioning. They expressed a strong desire to study science to develop their skills, acknowledged the role of science in enhancing thinking skills, and agreed that inquiry learning promotes curiosity, self-directed learning, and the generation of questions, ideas, and opinions. Although some learners found science challenging, their overall perception remained highly positive. The findings indicate that inquiry-based learning effectively cultivates curiosity, questioning abilities, and scientific thinking. These outcomes support studies showing that inquiry learning enhances Science Process Skills and critical thinking through exploration and questioning activities (Rapi et al., 2025). Inquiry approaches also improve analytical thinking and learner engagement (Udonsathian

and Worapun, 2024), while strengthening curiosity and scientific reasoning (Ramlawati et al., 2025). Moreover, meaningful learning experiences foster academic achievement, engagement, and problem-solving skills (Anselmo et al., 2025).

3.1.5 Perceptiveness of Inquiry Learning Models in Terms of Design

The respondents likewise agreed that inquiry learning models contribute to the development of design-related skills. They believed that inquiry learning promotes creativity, problem-solving, group collaboration, critical thinking, and the ability to design solutions to scientific problems. Many learners also expressed interest in engaging in science activities beyond the classroom to further develop their creativity. These findings demonstrate the effectiveness of inquiry-based learning in enhancing creativity and problem-solving competencies. Inquiry learning supports the development of Science Process Skills by encouraging exploration and the application of knowledge to authentic situations (Rapi et al., 2025). Similar findings indicate that STEM-integrated inquiry learning improves creativity, engagement, and scientific competence (Kaewmanee et al., 2024). Interactive learning environments also contribute positively to students' engagement and participation in science learning (Anselmo et al., 2025).

3.2 Relationship Between Learner Profile and Perceptiveness of Inquiry Learning Models

A significant relationship was observed between gender and the clarification dimension of inquiry learning, while no significant relationships were found between gender and interaction, questioning, or design. Likewise, parents' educational attainment and monthly income showed no significant relationship with any inquiry learning dimension. However, science grades demonstrated significant negative relationships with interaction, clarification, questioning, and design, indicating that academic performance was associated with learners' perceptiveness toward inquiry learning models. The results suggest that most background characteristics did not substantially influence learners' perceptions of inquiry-based learning. Instead, learners generally perceived inquiry learning positively regardless of parental education and income levels. The significant relationship between science grades and inquiry learning dimensions highlights the connection between academic achievement and engagement with inquiry-based activities. These findings support the work of Ramlawati et al. (2025), who emphasized that inquiry-based learning enhances critical thinking and Science Process Skills across diverse learner backgrounds. Similarly, Senisum et al. (2022) reported that inquiry learning promotes Science Process Skills through active participation and guided learning experiences.

3.3 Synthesis of Findings on Inquiry Learning and Science Process Skills Development

The overall findings revealed that Grade 8 learners possessed positive perceptions of inquiry learning models across the dimensions of interaction, clarification, questioning, and design. Among these dimensions, questioning received the highest level of agreement, followed by design, interaction, and clarification. Learners perceived inquiry-based learning as beneficial in developing curiosity, participation, critical thinking, creativity, and Science Process Skills. The results collectively demonstrate the value of inquiry-based learning in supporting meaningful science education. Consistent positive perceptions across all dimensions suggest that inquiry-oriented instruction provides opportunities for learners to engage actively in scientific investigations, collaborate with peers, reflect on learning, and solve problems. These outcomes reinforce the importance of continuing inquiry-based practices in science classrooms to further strengthen learners' Science Process Skills and scientific understanding.

4. Conclusion and Recommendations

The study concluded that Grade 8 learners demonstrated positive perceptions of inquiry learning models in terms of interaction, clarification, questioning, and design. Learners believed that inquiry-based learning enhanced their curiosity, participation, critical thinking, and Science Process Skills. Most respondents also performed well in science and viewed inquiry-based activities as engaging and meaningful, indicating that inquiry learning contributes positively to the development of Science Process Skills.

Science teachers are encouraged to continue implementing inquiry-based learning activities, practical work, and collaborative tasks to further strengthen learners' Science Process Skills. Schools should provide adequate instructional materials, laboratory resources, and professional development opportunities for teachers to support inquiry-based instruction. Learners should be encouraged to participate actively in science-related activities both inside and outside the classroom to enhance their creativity, critical thinking, and problem-solving abilities. Future studies may also be conducted in different settings and with other groups of respondents to further validate the findings.

The study was limited to Grade 8 learners of Jaen National High School during the School Year 2023–2024, which may restrict the generalizability of the findings. The research relied on self-reported responses that may affect the accuracy of the data collected. In addition, the study focused only on selected dimensions of inquiry learning and did not examine other factors that may influence the development of Science Process Skills.

Compliance with ethical standards

The author declares no conflict of interest. This study received no external funding and acknowledges the participation of the Grade 8 learners of Jaen National High School during the School Year 2023–2024. Participation was voluntary, respondents were informed of the study objectives, and data were collected through a non-invasive questionnaire. Confidentiality and anonymity were strictly maintained, and no identifying information was disclosed.

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