

Instructional Skills in Inquiry-Based Learning In Science

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Abstract — This study is concerned with the level of instructional skills in inquiry-based learning in Science in Public Elementary Schools in San Manuel District, Pangasinan Division II for SY 2024 -2025.

Specifically, this study determined the level of instructional skills in inquiry-based learning in Science. (1) It looked into the profile of the respondents in terms of age, sex, civil status, highest educational attainment, number of years teaching, and number of relevant training and seminars attended. (2) the level of instructional skills in inquiry-based learning in Science, (3) the significant difference in the level of instructional skills in inquiry-based learning in Science across the profile variable. (4) the significant relationships between the teacher's level of instructional skills in inquiry-based learning in Science and the profile variables.

Statistical measures were used for data analysis and interpretations to address the problems raised in this study. These are the frequency counts (f) and percentage (%), the average weighted means (AWM), Analysis of Variance (ANOVA) Pearson Product Moment of Coefficient Correlation were used.

This study examined public elementary school teachers' use of inquiry-based learning. The teachers are primarily female, married, and hold Master's degrees, with a significant portion having extensive teaching experience. They frequently use inquiry-based learning to foster critical thinking and scientific literacy. The usage does not change based on teacher demographics, but higher educational attainment correlates with better inquiry skills. This study found that experienced, mostly female public elementary school teachers with Master's degrees effectively use inquiry-based learning to enhance critical thinking, scientific literacy, and collaboration, with support from both teachers and administrators. While demographic factors did not significantly impact implementation, teachers' higher education levels correlated positively with their science inquiry skills.

This study suggests improving science education through several strategies: offering accessible and relevant professional development, continuing and expanding inquiry-based learning, providing universal professional development for inquiry-based learning, and prioritizing professional development that supports teachers in higher education.

Keywords — *inquiry-based learning, elementary science instruction, instructional skills in inquiry-based learning*

I. Introduction

Inquiry-based learning is gaining attention in the Philippines as a pedagogical approach for teaching science, particularly in elementary education. Inquiry-based learning encourages students to explore scientific concepts through hands-on experiments and investigations, rather than traditional didactic methods. However, its widespread utilization in elementary science instruction remains limited due to the reliance on traditional teaching methods, time-consuming and challenging implementation in classrooms with limited resources and large student-teacher ratios. Despite these challenges, several education institutions have incorporated elements of Inquiry-based learning into their curricula. The Philippine Science High School (PSHS) System and some private schools and organizations have successfully implemented Inquiry-based learning. However, the lack of teacher training and support, as well as the heavily reliant standardized testing system, hinder the large-scale adoption of Inquiry-based learning in elementary science instruction. The Department of Education (DepEd) and NGOs are working to promote Inquiry-based learning (IBL) in the Philippines, but efforts to address teacher training and support needs, as well as cultural and systemic challenges, are crucial for scaling up Inquiry-based learning in elementary science instruction.

Hewson (2020) also noted that inquiry-based learning is a vital part of elementary science education in the United States. It helps students build scientific literacy and understanding. This approach encourages active participation and investigation. When students engage in hands-on experiences and real-world applications, they form a deeper connection with scientific concepts.

Statement of the Problem

This study determined the level of instructional skills in inquiry-based learning in Science in San Manuel District, Pangasinan, Division II, for the school year 2024 –2025.

Specifically, this study sought to answer the following questions:

1. What is the profile of the respondents in terms of:
 - a. age;
 - b. sex;
 - c. civil status;
 - d. highest educational attainment;
 - e. number of years teaching; and
 - f. relevant trainings attended?
2. What is the level of instructional skills in inquiry-based learning in Science along:

- a. Critical thinking;
 - b. Scientific literacy;
 - c. Inquiry skills;
 - d. Science Process Skills; and
 - e. Collaboration and communication?
3. Is there a significant difference in the level of instructional skills in inquiry-based learning in Science of the respondent teachers across their profile variable?
 4. Is there a significant relationship between the level of instructional skills in inquiry-based learning in Science of the respondent's teachers and their profile variables?

Literature Review

A study of Gray (2021) was conducted to explore fourth and fifth-grade science teachers' implementation of inquiry-based instruction in a mid-Atlantic state. The study used the concern-based adoption model and self-efficacy to capture the experiences and perceptions of the teachers. Data was collected from nine teachers, including interviews, lesson plans, and classroom observations. Open-coding strategies were used to analyze the data. The findings suggested the need for increased professional development for elementary teachers to implement inquiry-based lessons. A professional development plan was developed to address teachers' concerns and provide information on the implementation of a new inquiry-based curriculum based on NGSS. The results could positively influence social change by supporting teachers' practices that support students' learning in science.

According to Belo (2021), Learners of all ages deserve the best instructional strategies and methods that equip them with the skills and learnings they need to keep up with the changing world. The educational system around the world has been doing its best to provide quality education for all. For over four decades, Inquiry-based Learning (IBL) has been utilized along with different disciplines and has become pivotal in changing classrooms into delightful, engaging and, student-centered learning environments. Belo (2021) reviewed different articles and journals that talk about the Effects of Inquiry-based Learning on the Performance of the Learners and be able to identify research gaps of this study. The various articles included in this review date back from 2011-present (2021). This paper revealed that Inquiry-based learning is indeed an effective learning and teaching strategy as the reviewed articles suggest and has a positive effect on the performance of learners along with the different contributing factors to learners' achievement.

The study of Kacar, Terzi, Irfan & Kirikci (2021) said that Inquiry Based Learning (IBL) is a student-centered strategy that enhances academic achievement by promoting active participation in both the classroom and outside the classroom. This study conducted a meta-

analysis of articles and theses in Turkey between 2000 and 2020 to investigate the impact of IBL on academic achievement. The meta-analysis method was used to determine the effects of IBL on students' academic achievement based on grade levels and publication types. The results showed that IBL significantly increases academic achievement, with effect sizes being meaningful when grade levels are compared. High school-level IBL was found to be more effective than other educational levels, and no significant differences were found based on publication types.

According to the study of Zeleke, Destaw & Yenus (2022), the nature and status of inquiry-based learning (IBL) research in Ethiopia, focusing on biology and chemistry. The research, which used a quantitative method, found that the most frequently investigated IBL science areas were biology (43.5%) and chemistry (34.75%). Guided inquiry (69.6%) studies were the most frequently investigated inquiry types. Teaching and learning (47.5%) were the most frequently focused subject matters, with cognitive elements (58.6%) being the most frequently used research elements. Quantitative studies with quasi-experimental methods (60.9%) were widely employed. IBL is a new research area in Ethiopia, where it is practiced at the primary level in science education. The study provides valuable insights into IBL research in Ethiopia and future developments.

II. Methodology

Research Design and Strategy

The researcher used an ex post facto one-shot case study design. This is represented symbolically as follows: X, O. Here, X stands for the respondents' exposure, characteristic, or condition being examined, and O stands for the measurement or observation of the subject's status or behavior.

The researcher also used a descriptive research design. This design aims to give a detailed description of a phenomenon, population, or situation. It often addresses questions like "What is the current situation?" or "What are the characteristics of...?" (Cooper & Schindler, 2020). The researcher collects data to describe the traits, trends, and patterns of the studied phenomenon or population. Descriptive research is often conducted to gather information about a specific topic or issue when there is no clear hypothesis or research question to test. For example, a study might describe the demographics of a specific population, such as the age range, gender, and occupation of people living in a particular city. This type of research can also establish a baseline for future studies or guide policy decisions (Creswell & Creswell, 2020).

Population and Locale of the Study

The subjects of this study are the intermediate teachers who teach Science and the school heads in San Manuel District, Pangasinan Division II, for the school year 2024 to 2025. All intermediate Science teachers in San Manuel District are respondents in this study. The twenty-

three School Heads in San Manuel District are also respondents. Their participation helps verify the teachers' answers about using inquiry-based learning in Science instruction. The table below shows the distribution of teacher respondents across five zones in San Manuel District.

Intermediate teachers, who instruct students in grades 4 to 6, play a vital role in shaping students' understanding of Science. They need to create a supportive learning environment that encourages curiosity, creativity, and critical thinking. One challenge for these teachers is making Science accessible and relevant to students' lives through hands-on activities, real-world examples, and project-based learning. This approach helps students develop a deeper appreciation for Science and its significance. Teachers should use various assessment strategies to evaluate student understanding. This includes both formative and summative evaluations to effectively track progress and identify areas that need extra help. They also play a key role in developing students' scientific literacy skills, such as reading and analyzing scientific texts, identifying patterns and relationships, and using data to form conclusions.

Data Gathering Tool

The researcher used a questionnaire checklist instrument designed specifically for this study. This approach is based on RA No. 10533, which outlines the essential learning competencies (MELCs). The Department of Education (DepEd) in the Philippines has implemented Essential Learning Competencies (ELCs) to guide what is taught and how it is taught in all public schools. MELCs aim to ensure that students gain necessary competencies and skills for future success. The goal of MELCs is to ensure that students acquire the required skills essential to their future. MELCs assist educators in designing and delivering engaging learning experiences that meet the curriculum's needs and goals (Zalun J.G., 2023).

The MELCs will help the Department focus instruction on the most essential competencies our learners need to acquire as we prepare for challenges in learning delivery (Zalun J.G., 2023). Essential learning competencies are defined as the skills that students need, which are crucial in the teaching-learning process to build skills that prepare learners for higher grade levels and for lifelong learning. Desirable learning competencies are those that may enhance education but are not necessary for foundational skills. Experts evaluated the questionnaire checklist, including the Public Schools District Supervisor, the School Principal, the Education Program Supervisor in charge of Science, the Science Supervisor, the Master Teacher, and the District Science Coordinator. Their suggestions were included in the final draft. The questionnaires were finalized after approval from the examination committee. The main goal of the validation is to ensure that every question is clear and relevant to the actual respondents in the study. The questionnaire was validated by a Master Teacher, Principal, Program Specialist, and Program Supervisor. This validates that respondents can easily answer the questionnaire and that the gathered data are both valid and reliable.

Data Gathering Procedure

Before administering the research instrument, permission was obtained from the Schools Division Superintendent of Pangasinan Division II and the School Heads.

The researcher personally distributed and administered the questionnaires to all Science teachers in San Manuel District, Pangasinan Division II. Similarly, the researcher collected the completed questionnaires. The researcher ensured the confidentiality of the responses and data to maintain objectivity in the results. The researcher informed and briefed the Science teachers and school heads about the study's purpose.

Treatment of Data

The following statistical tools were used to address the specific problems of the study. To determine the profile of the respondent teachers—age, sex, civil status, highest educational attainment, number of years teaching, and number of relevant trainings and seminars attended—frequency counts and percentages were used. The weighted average mean was applied to determine the level of instructional skills in inquiry-based learning in Science. The responses were categorized on a five-point scale with corresponding numerical values. The choices were classified as “Very Skillful,” “Skillful,” “Moderately Skillful,” “Slightly Skillful,” and “Not Skillful” with assigned numerical values of 5, 4, 3, 2, and 1.

The average weighted mean (AWM) interpreted the corresponding values as follows: To address specific problem number 3, which asks about the differences in the level of instructional skills in inquiry-based learning in Science among respondent teachers across their profile variables, analysis of variance (ANOVA) was used.

III. Results and Discussion

1. The respondents' profile shows that the majority are female (77%), married (77%), and have a Master's degree (45%), with 39% of the respondents aged between 41-50 years and 26% having 21 years or more of teaching experience. The respondents have limited international training experiences, with 95% having three or fewer international trainings, but have more frequent national, regional, and division-level trainings, with 38% and 58% having 4-6 national and division-level trainings, respectively. The research reveals a predominantly female, married, and highly educated (45% holding Master's degrees) respondent pool, with a significant portion (39%) aged 41-50 and substantial teaching experience (26% with 21+ years). While international training opportunities appear limited (95% with three or fewer experiences), respondents have a more extensive history of national, regional, and divisional training, with substantial participation in these latter categories.

2. The public elementary school teachers demonstrate a highly extensive use of inquiry-based learning in developing critical thinking, inquiry skills, and collaboration/communication, as assessed by both teachers and school heads. Furthermore, the development of scientific literacy and science process skills are rated as extensive. This research highlights that public elementary school teachers extensively employ inquiry-based learning strategies to foster essential skills such as critical thinking, inquiry, collaboration, and communication among students, as evaluated by both teachers and school leaders. Additionally, the findings indicate that these teachers are highly effective in developing students' scientific literacy and science process skills, suggesting a strong emphasis on engaging students in active, investigative learning processes that enhance their understanding and application of scientific concepts.
3. There are no significant differences in the extent of inquiry-based learning utilization among public elementary school teachers based on their age, gender, civil status, highest educational attainment, years of teaching experience, or relevant training/seminars attended. The research findings indicate that there are no statistically significant variations in how public elementary school teachers utilize inquiry-based learning, regardless of their demographic or professional backgrounds. Specifically, factors such as age, gender, civil status, highest level of educational attainment, years of teaching experience, and participation in relevant training or seminars do not significantly influence the extent to which teachers incorporate inquiry-based approaches into their teaching practices. This suggests that the adoption of inquiry-based learning is relatively uniform across different teacher profiles, highlighting a potential consistency in pedagogical strategies within the studied context.
4. There are significant positive relationship exists between the highest educational attainment of teachers and their Inquiry Skills (Science Process Skills). This indicates that teachers with higher educational attainment tend to have better Inquiry Skills, which is crucial for effective science instruction.

Research reveals a strong positive correlation between teachers' highest level of education and their ability to employ inquiry-based science teaching methods. Teachers with more advanced degrees demonstrate superior inquiry skills, a vital component of effective science instruction. This suggests that higher educational attainment equips teachers with the knowledge and competencies necessary to facilitate student learning through active investigation and scientific processes.

IV. Conclusion

Based on the data analysis and interpretation, these main conclusions were discovered. It shows that 39% of the respondents are 41 to 50 years old; 26% have 21 years or more of teaching experience. With 95% having three or fewer international training sessions, the respondents' global

experience is limited, but their national, regional, and divisional-level training is more frequent. Thirty-eight percent and fifty-eight percent have 46 national and division-level training sessions, accordingly. According to teacher and school head evaluations, public elementary school teachers show a widespread use of inquiry-based learning in building critical thinking, inquiry skills, cooperation, and communication. Moreover, the growth of scientific literacy and scientific process skills is regarded as great. The use of inquiry-based learning among public elementary school teachers is not significantly different depending on Age, gender, marital status, maximum educational level, years of teaching experience, or participation in pertinent training or workshops. There is a strong favorable correlation between the greatest level of education teachers have and their Inquiry Skills (Science Process Skills). This implies that teachers with more degrees have better Inquiry Skills, which are essential for successful science education.

V. Recommendations

Based on the salient findings and conclusion of this study, the following are hereby recommended. Offer professional development targeted at filling knowledge gaps and capitalizing on current teacher skills. Explore more global training possibilities and utilize accessible and pertinent material and delivery systems. Feedback from educators and administrators indicates that, given its successful development of critical thinking, cooperation, scientific literacy, and science skills, inquiry-based learning should be used more in public elementary schools. Professional development should seek to enhance inquiry-based teaching techniques for all teachers rather than concentrating on particular demographic groups given the equal use of inquiry-based learning among elementary instructors irrespective of Age, gender, or experience. High priority should be given to professional development initiatives enabling teachers to seek higher credentials in order to improve science instruction. This method will probably improve the efficiency of their teaching techniques and help them to develop their scientific investigation abilities.

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