

Inquiry-based learning in science education

Jessa Mae Paez Buendia

Teacher III, Kalamansig National High School

Miraleachona Reforsado Arciaga

Master Teacher I, Balibago Integrated High School

Jenny B. Cortez

Teacher III, Highway Region National High School

John Michael M. Dela Cruz

Cabucgayan National High School

Cabucgayan, Biliran, Philippines

Email: delacruzjohnmichael97@gmail.com

Abstract: Development of progressive instructional approaches is one of the demands in the changing educational landscape. As such, inquiry-based learning becomes one of its concrete instructional product. This study described and examined the effectiveness of inquiry-based learning in science education based on the perceptions of Junior High School learners among the selected schools in the Philippines. It was participated by 200 respondents. The study also employed descriptive correlational design. Findings revealed that inquiry-based learning as an instructional approach in science education was perceived as highly effective in terms of knowledge construction and also perceived by the learners as effective in terms of active learning and contextual learning. The perceptions of learners in the effectiveness of inquiry-based learning showed that the use and implementation of learner-centered approach was significant element to establish retentive and meaningful teaching and learning experiences under science instruction. Meanwhile, the study also concluded that there was a weak positive correlation between general weighted average and knowledge construction. Also, the study found out that general weighted average has a significant higher correlation with contextual learning.

Keywords: science, inquiry-based learning, teachers, knowledge construction, active learning, general weighted average

Date Submitted: May 15, 2025

Date Accepted: May 27, 2025

Date Published: June 4, 2025

INTRODUCTION

Teaching and learning science is fun as it reflects the physical realities of the world and it is where the learners can relate their existence. Science education has been the forefront in the continued pursuit of discoveries and innovation. In the global education settings, science education trains and develops learners to become inquisitive and rational in the way they can help develop the improvement of life under different scientific discipline. On the other hand, the current needs and

demands in the Philippine Educational settings, science education has been rigorously reviewed in order to respond with the current trends in the 21st Century teaching and learning process. In this line, academic performance of learners in the normal classroom settings ins continually challenged as the result of Programme for International Student Assessment (PISA) under science remain at the dismal bottom ranking in the year 2022. This reflects the overall conditions of the science education the country. With this result, the Department of Education as the primary organ of the government to deliver quality-based education in the basic education levels, is extending its efforts and continually developing certain instructional areas in the Philipin Educational System.

Consequently, one of the apparent instructional process forming part of the solution relative to the academic performance of learners in science education is the use and implementation of inquiry-based learning. This is a progressive teaching and learning approach where science teachers fundamentally use practical exercises and learner-centered approach. As shown in the study of Qureshi et al. (2020) showed that inquiry-based learning has positively influenced learners' academic performance in science where they are exposed with different science activities for retentive learning. In addition, based from the study of Anderson (2020) which reveals that effective classroom culture encourage inquiry in which teachers implement inquiry-based instruction as an effective mean to develop their critical thinking skills. Moreover, according to the study Loukomies et al. (2017) which reveals that teachers from the Philippine and Japan has been evaluated themselves as strong users of inquiry-based learning methods to help their learners develop their scientific skills. Further, in the study of Bako (2020) concludes that science teachers are good in posting Higher Order Thinking Skills questions which form inquiry-based teaching and learning process. Similar study also shows that inquiry-based learning yield positive results on the learning outcomes of the learners. Also, in the scientific words of Ge and Wang (2015) which shows that science engagement of learners during the teaching and learning process is significantly developed. The development of their engagement commonly caused by their practical experiences which they can relate.

The researchers observed that while inquiry-based learning become a popular instructional approach in science education, learners who are the main clientele of science instruction have had heard less where their perceptions on the effectiveness of inquiry-based learning are less described and examined through scientific undertaking. This causes the researcher to describe and examine the effects of inquiry-based learning as perceived by learners in the Junior High School Program within the Philippine educational landscape.

Research Objectives

This study described and examined mathematics teachers' level of understanding in the design and development of problem-solving activities in teaching and learning mathematics under the 21st Century teaching and learning process. Specifically, this study answered the following questions:

1. How may the profile of the respondents be described in terms of age, sex, civil status, educational attainment, number of years in teaching mathematics and seminars attended related to the development and design of the problem-solving activities in mathematics?
2. How may the level of understanding of the respondents in the design and development of problem-solving activities in terms of real-world relevance, activity structure, and creativity?
3. Is there a significant relationship between the profile of the respondents and their assessed level of understanding in designing and developing problem-solving skills in mathematics?

Theoretical Framework

This study is based on Constructivism Theory in the teaching and learning process. The theory asserts that learners construct their own understanding and knowledge in the world through experiences and manifesting these experiences as fundamental agents for meaningful learning. Further, the theory strongly points out that knowledge construction is its active and core element rather than passive acquisition. This current undertaking directly relate its intent and purpose as the same emphasizes the effects of inquiry-based learning in science education such as active learning, knowledge construction and contextual learning aspects. This current work also points out that effectiveness of inquiry-based learning should be assessed by learners being the main clientele of science education.

METHODOLOGY

Research design

This study utilized descriptive correlational research. As cited in the study of Sy Gusto Jr. (2024), descriptive correlational research described the variables and measures the extent of the relationships that exist between and among the variables. Here, this current work described the profile of the respondents and the level of understanding of mathematics teachers in the design and development of problem solving activities in mathematics and examined their relationships.

Respondents and Locale of the Study

The subject respondents of the study were the 200 randomly selected learners in Junior High School among the selected public schools in the Philippines. Apparently, the selection of the respondents was based on the selection criteria established by the researchers such as: (1) experienced or exposed in inquiry-based learning as an approach in their teaching and learning process and (2) willingness to participate in the study.

Data Gathering Instruments

This undertaking utilized a researcher-made survey-questionnaire. It contained two (2) parts where part 1 contained the profile information of the respondents while part 2 contained items relating to the perceived effectiveness of inquiry-based learning in science education in terms of active learning, knowledge construction and contextual learning aspects. The study used 4-Likert Scale: 4-Highly Effective 3-Effective, 2-Not Effective and 1-Highly Not Effective.

The researcher-made survey questionnaires underwent reliability testing through pilot testing among non-included respondents. Items under part 2 of the developed survey-questionnaire obtained a Cronbach Alpha result of .798 which signified that items were “Acceptable.”

Data Gathering Procedure and Data Analysis

There were formal communication letters and informed consent sent to the respondents, to their parents and to the school authorities. Upon the receipt of the approval letter from the school concerned officials, the researchers conducted short online orientation through Zoom teleconferencing among the respondents as virtually accompanied by their teachers who happened to allocate their time to hear the intent and purpose of the undertaking. Thereafter, the researchers sent a Google Form link on the respondents’ individual Messenger accounts. After all the responses have been recorded, the researchers carefully downloaded those obtained raw data from Google

Forms and eventually, the researchers organized the same in alpha numeric format through the use of MS Excel. Hence, relevant statistical tools were applied. Consequently, relevant statistical tools were used. Frequency and percentage were used to identify the profile of the respondents. Further, mean, standard mean and general weighted mean were employed in order to describe the perceived effectiveness of inquiry-based learning based while Pearson R was utilized in order to examine if there would be significant relationship between the profile of the respondents and the perceived effectiveness of inquiry-based learning in science education.

DISCUSSION OF FINDINGS

Profile of the Respondents

Based from the results, majority of the learners' age falls within a range of 13-15 (f=187) years old at the time the study is conducted. On the other hand, majority of them are female learners (f=167) whose socio-economic status lies on the average line (f=156) according to the normal family income baseline. In addition, most number of learners obtained a general weighted average which ranged from 88%-94% (f=171). However, only few number among the respondents possess learning materials such as books and other printed academic resources at home (f=43). The result shows that majority of the respondents are in the average socioeconomic living conditions where their academic performance based on the general weighted average falls within proficiency to advancing proficiency which indicates that they perform meaningfully during teaching and learning process under science instruction. But, there are less number of respondents who possess academic related learning materials which indicates that only few of them are able to use efficient learning materials which may be of greater help for their studies among scientific concepts and principles.

Learners' Perceptions on the Effectiveness of Inquiry-Based Learning

Based from the results of the study, learners perceived that inquiry-based learning is highly effective in terms of knowledge construction (wm=3.87). This indicate that learners experienced the positive implication of the using inquiry-based learning where learners are able to draw logical and rational ideas as they discover and explore the knowledge independently. Apparently, the result also show that learners' perception of the higher effectiveness of inquiry-based learning is brought about by their continued exposure to practical exercises where they are given learning opportunities to explore on their own with proper guidance and supervision of their teachers. In this line, the result also emphasizes that learners under the nature of inquiry-based learning are not confined with the knowledge found on textbooks but rather, knowledge is built upon the consistent and active engagement of learners to realities and abstractions. As abstractions are also part of inquiry based learning, learners are able to draw logical conclusions based on questioning facts, principles and concepts. Hence, learners also perceived that they are able to create more scientific investigations enabling them to seek credible answers to the topics or principles. The results are supported by the study of Antonio and Prudente (2024) which reveals that inquiry-based approaches are effective in teaching science. It enabled learners to establish strong meta-analytical skills where they can be able to seek answers through investigations and questions. Practically, the results evidenced the Constructivists Theory where it reaffirms that knowledge construction is independently built by learners as they are consistently exposed to practical scientific investigations and logical lines of inquiries and questioning techniques that on one hand, extracted their knowledge and critical thinking skills.

Relationship between the Profile of the Respondents and the Perceived Effectiveness of Inquiry-Based Learning

Based from the results of the study, there is a weak positive correlation between general weighted average and knowledge construction ($p=.282$). This indicates that inquiry based learning in facilitating learning and knowledge construction may not be strongly perceived as effective by the learners. On the other hand, general weighted average has a significant higher correlation with contextual learning ($p=.412$). This suggests that learners perceive inquiry-based learning as significant instructional strategy in providing context and experiences for their efficient learning experiences, allowing them to associate scientific concepts to real world situations. The results are supported by the study of Huang et al. (2023) which shows that inquiry-based teaching and learning positively implicated retentive learning experiences of learners as perceived by teachers and learners themselves. Similar study also concludes that availability of inquiry-based materials and strong emphasis on assessing content learning are significant factors to effectively deliver science instruction. Practically, the results evidenced the Constructivist theory as learners' scholastic performance is directly associated with the perceive effectiveness of inquiry-based learning, where learners can perform better when they are given wide range of learning opportunities to explore, raise questions and conduct independent scientific investigations to gather facts and deepen their scientific understanding.

CONCLUSION

Inquiry-based learning as an instructional approach in science education was perceived as highly effective in terms of knowledge construction and also perceived by the learners as effective in terms of active learning and contextual learning. The perceptions of learners in the effectiveness of inquiry-based learning showed that the use and implementation of learner-centered approach was significant element to establish retentive and meaningful teaching and learning experiences under science instruction. Meanwhile, the study also concluded that there was a weak positive correlation between general weighted average and knowledge construction. Also, the study found out that general weighted average has a significant higher correlation with contextual learning.

REFERENCES

- Anderson, J. (2020). Inquiry-Based Learning. *Teaching Secondary Mathematics*, 117–145. <https://doi.org/10.1017/cbo9781316442814.007>
- Antonio, R. P., & Prudente, M. S. (2023). Effects of inquiry-based approaches on students' higher-order thinking skills in science: A meta-analysis. *International Journal of Education in Mathematics, Science and Technology*, 12(1), 251–281. <https://doi.org/10.46328/ijemst.3216>
- Bako, A. (2020). Teaching conceptions of inquiry-based learning among Nigerian Secondary School Physics Teachers. *International Journal of Psychosocial Rehabilitation*, 24(5), 5475–5482. <https://doi.org/10.37200/ijpr/v24i5/pr2020254>
- Ge, X., & Wang, Q. (2015). Developing inquiry for learning: Reflecting collaborative ways to learn how to learn in higher education. *Interdisciplinary Journal of Problem-Based Learning*, 9(1). <https://doi.org/10.7771/1541-5015.1549>

Loukomies, A., Juuti, K., & Lavonen, J. (2018). Teachers as educational innovators in inquiry-based Science Teaching and learning. *Contributions from Science Education Research*, 185–201. https://doi.org/10.1007/978-3-319-91406-0_10

Qureshi, S. S., Larson, A. H., & Vishnumolakala, V. R. (2020). Mentoring beginning teachers in implementing process-oriented guided inquiry learning: An example of an inquiry-based pedagogical approach of teaching science. *Mentoring Science Teachers in the Secondary School*, 244–261. <https://doi.org/10.4324/9780429400308-20>