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Challenges Encountered by Science Teachers in Inquiry-Based Learning: Basis for In-Service Training

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ABSTRACT

Inquiry-based learning (IBL) is central to learner-centered science education, yet its classroom implementation may be constrained by learners' readiness, available resources, and teachers' pedagogical support. This phenomenological study investigated how science teachers understood IBL, the challenges they encountered in using it, and the strategies they employed to address those challenges as a basis for a contextualized in-service training program. Ten high school science teachers from the Schools District of Santa Barbara, Iloilo, were purposively selected. Data were collected through virtual in-depth interviews using a validated researcher-developed interview schedule and were analyzed thematically. The findings showed that teachers understood IBL as experiential learning that awakens curiosity and facilitates thinking, although their views differed regarding the degree of learner independence and the teacher's facilitative role. The principal challenges were learners' low affective engagement, limited higher-order thinking, inadequate school resources, low motivation, and difficulty with collaboration. Teachers responded by varying instructional strategies, using sequenced critical questions, reviewing prerequisite concepts, providing conferencing and guidance, integrating technology, and strengthening teamwork. These findings informed the Recast Science Teacher Education In-Service Training (ReSTEd INSET), a five-day contextualized professional development program aligned with the Framework for Philippine Science Teacher Education. The study concludes that effective IBL requires structured guidance, sufficient conceptual foundations, responsive classroom support, and sustained professional learning tailored to local conditions.

Keywords: *inquiry-based learning; science teachers; phenomenology; thematic analysis; in-service training*

INTRODUCTION

Scientific inquiry enables learners to ask questions, investigate evidence, construct explanations, and communicate conclusions. In science classrooms, IBL is intended to move learners beyond factual recall toward the application, evaluation, and creation of knowledge. Warner and Myers (2008) described inquiry-based instruction as an approach that combines learners' curiosity with scientific processes to develop critical thinking. Likewise, Furtak et al. (2012) reported generally positive effects of inquiry-based science teaching, especially when teachers provide appropriate guidance.

IBL is consistent with constructivist and experiential views of learning. Dewey's learning-by-doing perspective emphasizes meaningful participation in experience, while Bruner's constructivism positions learners as active builders of knowledge. However, discovery does not imply the absence of teacher support. Bruner (1960) and Mayer (2004) stressed that learners require appropriate prior knowledge, scaffolding, and feedback. Thus, successful inquiry depends on the interaction of learner readiness, teacher expertise, classroom culture, and material resources.

In the Philippine K to 12 context, science instruction is learner-centered and inquiry-based. Nevertheless, implementing inquiry remains difficult. Gutierez (2015) identified limited support, training, materials, assessment practices focused on content, and the time-intensive character of inquiry as continuing concerns. Orbe et al. (2018) similarly noted challenges involving teacher competence, laboratory adequacy, school resources, assessment, and institutional support. These conditions may be more pronounced in schools where teachers must adapt inquiry to limited facilities and diverse learner needs.

Although prior studies have examined inquiry outcomes and broad implementation barriers, locally grounded evidence is needed on how teachers themselves interpret IBL, what challenges arise in their classrooms, and what coping practices they consider workable. A context-specific account is particularly useful when designing professional development because generic training may not address the actual conditions of a school district.

Research Objectives

This study aimed to investigate the challenges encountered by science teachers in using IBL as the basis for an in-service training program. Specifically, it sought to determine: (1) how science teachers view IBL; (2) the challenges they encounter in employing IBL; (3) how they manage these challenges; and (4) the in-service training program that may be developed from the findings.

Theoretical and Conceptual Basis

The study was anchored in Dewey's learning-by-doing theory, Bruner's constructivism, and deliberate practice. These perspectives propose that learners develop understanding through purposeful experience, active construction of meaning, guided engagement, reflection, and repeated practice. The conceptual process treated teachers' views,

classroom challenges, and coping strategies as inputs to thematic analysis, with a contextualized training program as the intended output.

METHODOLOGY

Research Design

The study used a descriptive qualitative method and a phenomenological approach to capture the lived experiences of science teachers who employed IBL. Phenomenology was appropriate because the inquiry focused on how participants understood and experienced a shared instructional phenomenon (Neubauer et al., 2019).

Participants and Sampling

Ten high school science teachers from barangay high schools in the Schools District of Santa Barbara, Iloilo, participated. Purposive sampling was used. Inclusion required that a participant: (1) was a science teacher; (2) taught in a barangay high school within the district; and (3) had employed IBL during school year 2021–2022. The sample was considered appropriate for an in-depth phenomenological examination of a bounded local context.

Research Instrument

The researcher developed an interview package composed of a letter to participants, consent form, participant profile sheet, and interview schedule. The interview schedule contained three open-ended questions aligned with the first three research objectives. The instrument underwent face, content, and construct validation by experts in science education, measurement, and statistics. Revisions suggested by the validators were incorporated before data collection.

Data Collection Procedure

Permission was obtained from the Schools Division Superintendent, district supervisor, and school heads. Qualified teachers were invited and provided with study information and consent documents. Interviews were conducted at mutually convenient times through Zoom or Facebook Messenger. With permission, interviews were audio-recorded. Some participants elected to submit written responses. Recordings were transcribed, translated when necessary, collated, and prepared for analysis.

Data Analysis

Thematic analysis based on Miles and Huberman (1994) was used. The researcher read the transcripts repeatedly, identified meaning units, grouped similar responses, developed categories, and generated themes and subthemes. Interpretations were compared across participants and linked to the research questions. The process prioritized recurring patterns while retaining meaningful variations in teachers' perspectives.

Ethical Considerations

Participation was voluntary. Participants received information about the study, consented to interview recording, and were informed that their responses would be treated confidentially. Participant numbers were used in reporting quotations. Data collection followed applicable school permissions and public-health protocols in effect at the time of the study.

RESULTS

The thematic analysis yielded three major themes: (1) teachers' perspectives on IBL; (2) challenges encountered in IBL; and (3) strategies for managing those challenges. Fifteen related subthemes were identified.

Science Teachers' Perspectives on IBL

Teachers generally described IBL as experiential learning connected to real-world situations and prior experience. They emphasized that inquiry awakens curiosity and provides opportunities to explore, question, solve problems, and develop higher-order thinking. Several participants described the teacher as a facilitator who guides questioning and resource use. However, perspectives varied. Some participants favored broader learner independence, whereas others stressed the need for a strong knowledge base, explicit cues, and tighter instructional control before learners could complete complex inquiry tasks.

Theme	Subtheme	Interpretive summary
Teachers' perspectives	Experiential learning	IBL connects new concepts with prior experience and real-life contexts.
Teachers' perspectives	Curiosity	Questions, exploration, and hands-on tasks stimulate interest.
Teachers' perspectives	Thinking processes	Inquiry supports critical thinking, problem solving, and transfer.
Teachers' perspectives	Divergent views of guidance	Teachers differed on learner independence and the extent of teacher control.

Challenges Encountered in IBL

Low affective engagement was reflected in inattention, weak task persistence, frustration, hesitancy to participate, and limited responsibility for checking work. Teachers also reported low thinking processes, including weak comprehension, difficulty expressing ideas, limited background knowledge, dependence on spoon-feeding, and uncertainty about whether an inquiry task had been completed correctly.

Other constraints involved insufficient books, internet connectivity, equipment, and laboratory resources. Low motivation reduced sustained engagement in guided inquiry,

while difficulty organizing group work weakened teamwork and collaboration. Together, these challenges limited learners' capacity to benefit from open-ended investigation.

Challenge	Observed indicators	Instructional implication
Low affective level	Inattention, frustration, hesitation, weak task responsibility	Provide emotional support, clear expectations, meaningful tasks, and feedback.
Low thinking process	Weak comprehension, limited prior knowledge, difficulty articulating ideas	Sequence questions, review prerequisites, and scaffold inquiry.
Limited resources	Insufficient equipment, books, connectivity, or signal	Contextualize materials and use accessible technologies.
Low motivation	Loss of interest or initiative during inquiry	Use relevant problems, varied strategies, and learner choice.
Difficulty collaborating	Problems organizing group work and shared responsibility	Teach teamwork explicitly and structure group roles.

Strategies Used to Manage IBL Challenges

Teachers addressed the challenges through six recurring strategies. First, they varied teaching approaches and contextualized activities to learners' needs. Second, they sequenced critical questions from foundational to complex and clarified what each question required. Third, they reviewed prior lessons and prerequisite concepts. Fourth, they used individual or small-group conferencing, guidance, reflection, and communication with parents when behavioral concerns persisted. Fifth, they integrated video, online resources, and technology-assisted assessment. Finally, they deliberately developed teamwork, organization, and shared responsibility during collaborative inquiry.

Management strategy	Purpose
Employ varied teaching strategies	Respond to different learner needs and sustain engagement.
Use critical questioning	Guide analysis progressively and make expectations explicit.
Review previous lessons	Activate prerequisite knowledge and correct misconceptions.
Provide conferencing and guidance	Offer structure, feedback, behavioral support, and reflection.
Integrate technology	Expand access to representations, resources, and assessment tools.
Develop teamwork and collaboration	Improve group organization, responsibility, and peer learning.

Proposed ReSTEd INSET

The findings became the basis for Recast Science Teacher Education In-Service Training (ReSTEd INSET), a five-day contextualized program guided by the Framework for Philippine Science Teacher Education. The program links identified local challenges with professional learning topics and practical workshops. Its intended participants are science teachers in the Schools District of Santa Barbara, with resource persons drawn from science supervision, higher education, psychology, and information technology.

Local issue	Initial teacher response	Proposed training focus
Low affective level	Conferencing and guidance	Reflective teaching and emotionally supportive learning
Low thinking process	Critical questioning; review of lessons	Constructivist and inquiry-based teaching
Lack of resources	Technology integration	Assessment, multimedia, and instructional resource development
Low motivation	Varied teaching strategies	Linking theory and practice; materials design
Difficulty collaborating	Teamwork development	Collaborative lesson and research development

DISCUSSION

The teachers' descriptions of IBL as experiential, curiosity-driven, and cognitively demanding were consistent with inquiry literature. Warner and Myers (2008) emphasized curiosity and scientific processes, while Friesen and Scott (2013) described inquiry as a hands-on, minds-on approach that shares responsibility between learners and teachers. The findings indicate that teachers recognized the central features of inquiry but did not uniformly interpret the balance between learner autonomy and teacher guidance.

This variation is important because inquiry is sometimes misinterpreted as minimally guided discovery. The present findings support a more structured view. Learners with weak prior knowledge or comprehension may struggle when tasks are too open. Mayer (2004) argued against pure discovery without guidance, and Furtak et al. (2012) found stronger effects in studies that included teacher-led activities. The teachers' use of sequenced questioning, review, clearer success criteria, and conferencing can therefore be understood as scaffolding rather than a departure from inquiry.

The reported challenges also reflect the interaction of cognitive, affective, and contextual conditions. Learners' uncertainty, frustration, and hesitancy were not isolated from comprehension difficulties; they often appeared together. Weak background knowledge constrained higher-order thinking, while limited resources reduced opportunities for hands-on investigation. Similar concerns about training, materials,

facilities, assessment, and teacher support were identified by Gutierez (2015) and Orbe et al. (2018).

The management strategies described by participants demonstrate practical adaptation. Varied pedagogy and contextualization made inquiry more accessible. Critical questioning and lesson review established cognitive readiness. Conferencing and guidance supported accountability and reflection. Technology increased access to demonstrations and learning resources, although connectivity remained a constraint. Explicit teamwork instruction addressed the assumption that collaboration develops automatically.

ReSTEd INSET responds to these findings by aligning professional development with actual classroom needs. Rather than providing a generic lecture on IBL, the program combines conceptual clarification, workshops, instructional-material development, assessment design, and demonstration teaching. This approach is consistent with the Framework for Philippine Science Teacher Education, which favors active, reflective, collaborative, problem-oriented, and context-sensitive teacher development.

Implications for Practice

Science teachers should calibrate the openness of inquiry tasks to learners' prior knowledge and gradually transfer responsibility as competence develops. School heads should support subject-specific professional learning, access to low-cost laboratory and multimedia resources, and collaborative lesson development. Training organizers should use teachers' local problems and outputs as the core of INSET activities rather than treating participants as passive recipients of information.

Limitations

The study involved ten purposively selected teachers from one school district, so the findings are context-specific and are not intended for statistical generalization. Data were based primarily on self-reported experiences, and classroom observations were not included. Some responses were gathered in writing rather than through a synchronous interview, which may have affected depth. Future research may triangulate interviews with observations, learner data, and implementation evidence from the proposed training program.

CONCLUSION AND RECOMMENDATIONS

Science teachers viewed IBL as experiential learning that stimulates curiosity and thinking, but they varied in how they understood learner independence and teacher facilitation. Their implementation was challenged by low affective engagement, weak thinking processes, insufficient resources, low motivation, and difficulty collaborating. They managed these conditions through varied instruction, structured critical questioning, review of prerequisites, conferencing and guidance, technology integration, and explicit support for teamwork.

The findings show that inquiry is most workable when it is guided, contextualized, and responsive to learner readiness. ReSTEd INSET offers a locally grounded professional development response by connecting documented needs with active workshops and concrete teacher outputs. The program should be implemented and evaluated in the district, with adjustments based on participant feedback and evidence of classroom transfer.

It is recommended that science teachers use graduated scaffolding and varied inquiry tasks; school heads organize discipline-specific INSET or Learning Action Cell sessions; education officials provide sustained support for resources and teacher development; and future researchers replicate the study in other districts and assess the effectiveness of ReSTEd INSET using observation, participant outcomes, and learner indicators.

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CONFLICT OF INTEREST

The author declares no conflict of interest.

DATA AVAILABILITY

The qualitative data contain confidential participant information and are not publicly available. Reasonable requests may be directed to the corresponding author, subject to ethical and institutional restrictions.

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