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Challenges and coping practices of grade 6 science teachers in applying inquiry-based learning in rural educational settings

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ABSTRACT

The stark pedagogical disconnect between macro-level curricular mandates and the resource-deprived realities of peripheral classrooms demands a critical investigation into how frontline educators navigate instructional execution. This study investigated the lived experiences, operational challenges, and adaptive strategies of Grade 6 science teachers implementing inquiry-based learning (IBL) in rural public schools within SDO Laoag City. Employing a descriptive phenomenological research design rooted in Husserlian philosophy, the study utilized purposive sampling to select eight full-time educators. Data were gathered through expert-validated, semi-structured interviews and processed using reflexive thematic analysis following the Braun and Clarke framework. The findings revealed that a triad of operational challenges severely restricts IBL implementation: language barriers and expression deficiencies, severe resource and material constraints, and time constraints coupled with classroom management pressures. To navigate these structural bottlenecks, teachers successfully deployed targeted practices, including pedagogical adaptations with scaffolded inquiry, proactive resource management, and differentiated, inclusive learning models like mother-tongue translation and blended tasks. The study demonstrates that instructional resilience in peripheral schools relies heavily on grassroots teacher agency and localized contextualization. It is recommended that policymakers actively fund low-cost, bilingually scaffolded print materials and establish flexible time-blocking schedules to accommodate authentic, student-led scientific exploration.

Introduction

A substantial body of international research has documented both the benefits and challenges of implementing inquiry-based learning (IBL) in science classrooms. Studies have consistently shown that inquiry-based instruction enhances learners' conceptual understanding, critical thinking, scientific

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reasoning, and problem-solving skills (Dobber et al., 2020; Gholam, 2018). At the same time, researchers have identified several barriers to its effective implementation, including limited instructional resources, insufficient teacher training, large class sizes, time constraints, and assessment pressures (Mthethwa & Mkhize, 2018; Omodan, 2022; Ramnarain, 2024). Collectively, these studies demonstrate that the successful implementation of inquiry-based learning depends not only on sound pedagogical practices but also on the institutional and contextual conditions that support teaching and learning.

Within the Philippine educational context, research has primarily examined the effectiveness of inquiry-based learning in improving students' academic achievement, science process skills, and classroom engagement. Other studies have explored teachers' perceptions of inquiry-based instruction and the challenges associated with implementing the science curriculum in public schools. However, the existing literature has largely focused on urban settings, secondary education, or quantitative evaluations of student outcomes. Consequently, there remains a limited understanding of how elementary science teachers, particularly those in rural and semi-urban public schools, experience and implement inquiry-based learning in their everyday classroom practice.

This gap is especially significant at the Grade 6 level, where learners are introduced to increasingly complex scientific concepts and are expected to demonstrate higher-order thinking, scientific inquiry, and problem-solving skills. Although previous studies have identified common implementation challenges, such as inadequate facilities, limited instructional resources, language barriers, and curriculum demands, they provide little insight into how Grade 6 science teachers respond to these constraints in their day-to-day practice. Moreover, there is a paucity of qualitative research examining teachers' lived experiences, instructional adaptations, coping strategies, and context-specific practices in implementing inquiry-based learning within resource-constrained public elementary schools in the Philippines.

Addressing this gap, the present study explored the experiences of Grade 6 science teachers in implementing inquiry-based learning in the Schools Division Office (SDO) of Laoag City. Specifically, it sought to examine the challenges they encounter, the strategies they employ to overcome them, and how they adapt inquiry-based instructional practices to facilitate meaningful and equitable science learning despite contextual and resource constraints.

Literature review

Inquiry-based Learning

Inquiry-based learning (IBL) has emerged as a prominent educational strategy globally, promoting critical thinking and active student participation. Research from South Africa reveals that although educators acknowledge the advantages of IBL, such as increased student motivation and deeper comprehension of complex scientific ideas, they encounter substantial obstacles to its implementation (Maboya & Mavuso, 2018). These challenges include insufficient laboratory resources, a scarcity of teaching materials, and overcrowded classrooms, which hinder teachers' efforts to implement inquiry-based methodologies effectively. The disparity between teachers' favorable perceptions of IBL and their actual teaching practices highlights a significant need for improved teacher training and resource support.

Cultural factors are crucial for the effective implementation of inquiry-based learning (IBL). Research by Yang (2024) indicates that differing cultural viewpoints can lead to misconceptions about inquiry methodologies. This underscores the importance of employing culturally responsive teaching strategies tailored to local contexts, particularly in diverse rural areas. Recognizing the impact of cultural contexts on IBL practice is vital to creating successful educational frameworks.

Challenges in implementing inquiry-based learning

The implementation of Inquiry-Based Learning (IBL) introduces distinct operational, systemic, and psychological obstacles that differ significantly from traditional lecture-based instructional designs. The most immediate challenge stems from the complex paradigm shift required of the educator, who must transition from an authoritative supplier of answers to a facilitator of knowledge creation (Crawford, 2014). Deficiencies frequently hinder this transition in pedagogical content knowledge, as many teachers lack formal exposure to IBL in their own educational backgrounds and struggle to design curricula that lack predictive, step-by-step outcomes (Kori, 2021). Furthermore, educators often wrestle with misconceptions of inquiry rigor, occasionally conflating simple "hands-on" tasks with true inquiry, which leads to difficulties in regulating the delicate balance between open exploration and strategic cognitive scaffolding (Alfieri et al., 2011; Colburn, 2000).

Beyond these individual pedagogical limitations, teachers must navigate rigid systemic, institutional, and structural barriers embedded within modern schooling systems. High-stakes standardized testing and packed syllabus pacing guides strongly incentivize rapid memorization of factual content over deep critical thinking, causing intense systemic strain on teachers attempting to balance extensive curricular mandates with student-led discovery (Office for Climate Education [OCE], 2025). This structural friction is compounded by a frequent lack of infrastructural support, funding, and material resources—such as digital source libraries and laboratory equipment—necessary to sustain open-ended research (Learning by Inquiry, 2021). Additionally, traditional 45- to 50-minute class periods and large class sizes make it logistically overwhelming for a single educator to provide close observation, individual guidance, and continuous formative assessment for multiple independent student teams (Tseng et al., 2013).

Finally, educators face profound hurdles stemming from student-related behavioral variables and flawed institutional support structures. Because inquiry shifts the cognitive burden to the learner, teachers routinely encounter resistance, low self-efficacy, and academic anxiety among students accustomed to passive learning who experience "analysis paralysis" when faced with open-ended hypotheses (Wolpert-Gawron, 2016). Managing unequal group participation, interpersonal conflicts, and off-task behavior within collaborative teams requires constant teacher intervention, thereby pulling focus away from academic facilitation (Suarez et al., 2018). These classroom difficulties are rarely mitigated by institutional support; school districts frequently offer ineffective, single-session professional development workshops that lack long-term classroom coaching, leaving teachers without the practical strategies or the process-based evaluation frameworks required to accurately measure and grade qualitative student growth (Pedaste et al., 2015).

Managing classroom problems in inquiry-based learning

While inquiry-based learning (IBL) yields substantial cognitive benefits, its non-linear and student-directed nature often introduces distinct classroom problems, including off-task behavior, collaborative conflicts, profound student frustration, and severe time-management constraints (Learning by Inquiry, 2021; Wolpert-Gawron, 2016). To mitigate these obstacles and maintain an orderly, productive environment, effective practitioners implement highly proactive and responsive classroom management techniques. Research indicates that when teachers encounter student resistance, disengagement, or systemic group dysfunction, their success depends heavily on structured interventions that re-establish behavioral parameters without stifling student autonomy or curiosity (Alison, 2024; Edutopia, 2022).

A primary classroom challenge in IBL is the psychological discomfort or analysis paralysis students experience when transitioning away from traditional, teacher-led rote memorization. Many learners exhibit a profound inability to identify if they are succeeding or struggle heavily with the open-ended nature of scientific and academic investigation techniques (Learning by Inquiry, 2021; Roslan et al., 2017, 2023). To address this problem, effective teachers actively model the "productive struggle." Rather than directly providing answers to anxious students, practitioners use deliberate, open-ended questioning and Socratic dialogue to prompt self-correction and guide learners in developing and reframing their own hypotheses (Scribd, 2019; TeachThought, 2022). Furthermore, teachers combat this hesitation by starting small and adjusting the degree of student autonomy based on immediate readiness. They begin units with highly prescriptive, structured inquiry (providing both the research question and the investigative method) and transition only to open inquiry once students demonstrate the requisite content knowledge and metacognitive stability (Alison, 2024; Edutopia, 2022).

The decentralized structure of an IBL classroom can easily devolve into unequal group participation, interpersonal conflict, or general off-task chaos. To preemptively manage group dynamics, master teachers explicitly establish collaborative norms and co-create behavioral expectations directly with their students (Scribd, 2019; Warner Pacific University, 2025). Rather than leaving group interactions unmonitored, effective practices involve assigning specific, highly interdependent roles within teams—such as research leads, data scribes, and project managers—to ensure individual accountability and equitable workloads (Roslan et al., 2023). When behavioral deviations or off-task actions occur, teachers do not rely on punitive, top-down lecturing; instead, they implement structural checkpoints. By requiring groups to maintain interactive science journals, use centralized resource hubs, or present frequent mini-milestones, teachers ensure that students' curiosity remains tightly anchored to specific academic standards and predefined learning outcomes (Alison, 2024; Edutopia, 2022; Poon et al., 2009).

Because student-driven research is inherently unpredictable, teachers frequently face the systemic problem of falling behind on packed pacing guides or dealing with extreme resource overload (Alison, 2024; Mohammed, 2017). To avoid time loss without prematurely halting authentic exploration, experienced educators restructure the classroom's physical and digital architecture. They design centralized resource hubs and implement strict, time-bound classwork sessions in which the teacher serves as the primary "head researcher" in the room, actively modeling reliable data-collection methods in short, strategic bursts (Edutopia, 2016; Learning by Inquiry, 2021). By embedding consistent, fiveminute formative reflections at the conclusion of every lesson, teachers force students to analyze their own operational efficiency (Edutopia, 2016; Poon et al., 2009). This shift from a content-delivery model to an explicit focus on time management and process-based self-regulation allows teachers to satisfy strict curricular demands while successfully preserving the core tenets of student-led discovery (Alison, 2024; Edutopia, 2022)

Statement of the problem

This study investigated the lived experiences, operational challenges, and adaptive strategies of Grade 6 science teachers implementing inquiry-based learning (IBL) in rural public schools within SDO Laoag City.

Specifically, it sought answers to the following questions:

1. What challenges do Grade 6 science teachers encounter when applying inquiry-based learning methods in rural educational environments?

2. What effective practices do Grade 6 Science teachers utilize to navigate the challenges linked to inquiry-based learning?

Methodology

This section outlines the research methodologies employed in the study, which is based on a qualitative phenomenological approach. It details the participants involved, including their selection process. Additionally, the researcher explains the data collection instrument to be used and outlines the procedures to be implemented throughout the study.

Research design

This study employed a descriptive phenomenological approach to systematically investigate the lived experiences, operational challenges, and adaptive practices of Grade 6 science teachers implementing inquiry-based learning (IBL) frameworks in rural public schools of SDO Laoag City. Rooted in the transcendental philosophy of Edmund Husserl, descriptive phenomenology is uniquely suited to this inquiry, as it seeks to look beyond pre-existing theoretical assumptions to capture the core "essence" of a human phenomenon through the eyes of those who experience it firsthand. By focusing on description rather than premature psychological interpretation, this design allowed the researcher to uncover the granular, structural realities of rural science instruction. To preserve the descriptive validity of the empirical data, the researcher strictly observed the phenomenological practice of epoche, or bracketing. This process involved consciously documenting and suspending the researcher’s personal preconceptions, professional biases, and assumptions as an educator to ensure the final themes purely reflected the authentic voices and lived realities of the participants.

Population and sampling

The participant cohort consisted of Grade 6 science teachers from selected rural public elementary schools within SDO Laoag City. The sample demonstrated exact gender parity, comprising four female and four male educators, with an average instructional workload of 24 students per classroom. To secure data-rich narratives directly aligned with the core objectives of the study, participants were selected using non-probability purposive sampling based on rigid, predetermined inclusion criteria: (1) status as a full-time, permanent public school educator; (2) current assignment to a school officially classified as rural or peripheral by the Department of Education; and (3) a minimum of two consecutive years of experience implementing the K-to-12 Science 6 curriculum with embedded IBL elements. This small, highly focused sample size aligns with the established standards of phenomenological research, which values deep, information-rich individual narratives over broad statistical generalization.

Data gathering instrument

The primary data-gathering instrument was an investigator-developed, semi-structured interview guide consisting of open-ended questions. This qualitative technique provided a flexible yet consistent conversational framework, enabling the researcher to probe deeply into specific operational bottlenecks—such as linguistic barriers and material resource limitations—while allowing participants the freedom to share unexpected insights regarding their localized strategies. To ensure content validity and ethical safety, the interview guide was evaluated and validated by a panel of qualitative research experts and master teachers before deployment.

The formal data collection process was initiated upon securing written administrative clearance from the Schools Division Superintendent of SDO Laoag City. Individual interviews were scheduled at the participants' convenience and conducted in a private, neutral school setting to encourage open dialogue. The interviews, which averaged 45 to 60 minutes, were conducted in a bilingual format (English and Ilokano/Tagalog) to facilitate precise conceptual expression. With the explicit written consent of the participants, all conversations were audio-recorded, meticulously transcribed verbatim, and returned to the respective interviewees for member checking to ensure descriptive accuracy.

Data analysis

The text corpus was processed using reflexive thematic analysis, following the six-step iterative framework established by Braun and Clarke (2006, 2020). The analysis began with familiarization, involving repeated reading of the transcripts and noting initial conceptual impressions. Second, initial codes were generated line-by-line using open coding to identify recurring semantic features across the datasets. Third, these codes were clustered to generate overarching themes that directly addressed the study's core research questions. Fourth, the candidate themes were reviewed and refined against the raw data to ensure internal homogeneity and external heterogeneity. Finally, the analysis concluded with the *production of the report*, weaving together raw participant extracts with relevant literature to build a cohesive narrative.

Ethical standard

This study strictly adhered to institutional ethical guidelines governing human subject research. Before data collection, each participant was issued an informed consent form detailing the study's purpose, risks, benefits, and data protection protocols. Participation was entirely voluntary, and individuals were informed of their unconditional right to withdraw from the study at any point without administrative consequences. To protect the identities of the educators and their schools, rigorous anonymization was maintained throughout the research process by assigning alphanumeric pseudonyms (e.g., Participant A, School 1) to all transcripts, codebooks, and final written outputs. All digital audio recordings and transcriptions were secured in an encrypted cloud storage folder accessible only to the primary researcher.

Data presentation and analysis

Problem 1. What challenges do Grade 6 science teachers encounter when applying inquiry-based learning methods in rural educational environments?

The primary operational challenges encountered by Grade 6 science teachers are **Language Barriers and Expression Deficiencies**, **Severe Resource and Material Constraints**, Time Constraints, **and Classroom Management Pressures**.

Table 1: Challenges encountered by the teachers when applying inquiry-based learning.

Theme	Category	Extracted Statement
1. Language barriers and expression deficiencies	Student expression gaps	Grade 6 learners experience significant difficulty expressing their scientific ideas, hypotheses, and explanations comprehensively in English.
	Instructional comprehension gaps	A distinct language barrier hinders the teaching process, as some learners cannot fully comprehend core scientific concepts when instruction is delivered exclusively in English.
2. Severe resource and material constraints	Material and reference scarcity	There is a critical lack of locally developed instructional materials, textbooks, and science references needed to guide structured scientific inquiry in rural schools.
	Infrastructure and equipment gaps	The specialized technologies, laboratory equipment, and digital tools needed to execute practical science activities are widely unavailable.
	Systemic resource and infrastructure limits	Rural educational environments face systemic resource constraints that severely restrict students' access to modern scientific applications,

		experimental software, and data-tracking tools.
3. Time constraints and classroom management pressures	Time-intensive nature of inquiry	Genuine inquiry-based learning is inherently difficult to implement because learners require extended time to explore, investigate, and freely test scientific variables.
	Instructional pacing and assessment limits	Rigid class schedules leave insufficient time to balance the extensive pacing required for student experimentation with the demands of standardized assessments.
	Operational coordination hurdles	Teachers encounter severe time constraints and heightened classroom management pressures when trying to facilitate active, chaotic hands-on laboratory activities within short instructional periods.

Source: Geronimo (2026)

Implementing inquiry-based learning (IBL) in rural settings is constrained by distinct linguistic barriers that impede students' expression and conceptual understanding. During tasks, Grade 6 learners experience significant difficulty articulating abstract thoughts, hypotheses, and conclusions in English, and delivering instruction exclusively in a non-native language spikes extraneous cognitive load, exhausting the working memory capacity needed for scientific processing (Sweller et al., 2011; Zhang, 2021). When working memory is overwhelmed by literal translation, the generative processing required to build cognitive schemas is halted (Mayer, 2011; Zheng, 2023). Consequently, the peer dialogue essential to social constructivism breaks down, resulting in passivity and conceptual withdrawal (Vygotsky, 1978; Mercer et al., 2020).

A profound scarcity of physical resources, localized materials, and specialized educational infrastructure compounds this pedagogical strain. Rural public schools suffer from a critical lack of contextualized materials, reference textbooks, and science guides necessary to orchestrate structured, hands-on inquiry. Furthermore, specialized laboratory equipment and digital variable-tracking tools are widely unavailable. Grounded in Functional Context Theory, empirical learning is optimized only when anchored in tangible environmental interactions that make the experience meaningful (Sticht, 1975; King & Ritchie, 2022). Without vital infrastructure, teachers make defensive curriculum changes that shift active exploration toward passive simulations, deepening the educational divide between rural and urban peers (Li & Zhang, 2020; Ramnarain, 2024).

Finally, an operational friction exists between the expansive, non-linear nature of scientific inquiry and the rigid, linear structure of school schedules. Authentic inquiry requires an open-ended timeline that provides learners with extended periods to explore, test variables, and self-correct (Gagne, 1985; Dobber et al., 2020). However, teachers face an administrative "pacing trap" in which the time required for student experimentation directly conflicts with tight daily class allocations and standardized assessment deadlines. This structural tension generates heightened classroom management pressures during practical setups. To maintain operational control and satisfy compliance audits, educators are frequently forced to abandon student-led discovery in favor of traditional lectures (Fitriani et al., 2021; Crawford, 2022).

Problem 2: What effective practices do Grade 6 Science teachers utilize to navigate the challenges linked to inquiry-based learning?

The qualitative data demonstrate that Grade 6 science teachers counter structural, material, and linguistic constraints in rural environments by deploying targeted mitigation strategies. These adaptive strategies are analyzed under three primary themes: Pedagogical Adaptation and Scaffolded Inquiry; Proactive Resource Management and Teacher Resourcefulness; *and* ***Differentiated and Inclusive Learning Models***.

Table 2: Effective practices to navigate the challenges linked to inquiry-based learning

Theme	Category	Extracted Statement
1. Pedagogical adaptation and scaffolded inquiry	Experiential & activity-oriented learning	Teachers shift from traditional lectures to an activity-oriented, experiential approach that grounds scientific concepts in concrete actions.
	Structured scientific methods	Instruction is explicitly designed around the steps of the scientific method, utilizing structured experimentation to keep student explorations focused.
	Strategic scaffolding and guidance	Educators actively navigate pacing and cognitive hurdles by providing learners with clearly defined guide questions and structured task guidance.
2. Proactive resource management and teacher resourcefulness	Advance material preparation	To mitigate rigid time constraints, teachers proactively prepare all necessary laboratory and activity materials well ahead of the scheduled class time.
	Adaptive professional attributes	Teachers overcome systemic resource limitations by deliberately remaining highly adaptable, imaginative, and

		resourceful in their daily instructional delivery.
3. Differentiated and inclusive learning models	Linguistic scaffolding	To dismantle barriers to instructional comprehension, teachers actively translate complex scientific questions and vocabulary into learners' mother tongues.
	Flexible blended learning delivery	Educators maximize limited instructional contact hours by implementing a blended learning approach, assigning strategic tasks for home or independent study.
	Commitment to inclusive equity	Teachers design and adjust their inquiry practices with an underlying mandate to promote equity, ensuring that no individual learner is left behind due to cognitive or environmental barriers.

Source: Geronimo (2026)

To overcome the cognitive complexities of inquiry-based learning, educators shift from traditional lectures to an activity-oriented, experiential approach that grounds abstract scientific concepts in concrete physical actions. Instruction is designed around the rigorous steps of the scientific method, utilizing structured experimentation to keep student explorations focused and goal-oriented. Furthermore, teachers navigate pacing hurdles and cognitive difficulties by providing learners with clearly defined guide questions and structured task guidance. This practice operates as a vital scaffold within the students' Zone of Proximal Development (Vygotsky, 1978). By implementing these directed cues, teachers manage the *essential processing* demands of the lesson, preventing cognitive overload while preserving the critical inquiry framework necessary for 21st-century science skills (Mayer, 2011; Dobber et al., 2020).

To circumvent the systemic limitations typical of peripheral educational landscapes, teachers rely heavily on tactical preparation and personal professional agency. To mitigate severe daily time constraints, teachers proactively prepare all necessary laboratory and activity materials well ahead of the scheduled class duration. This preparation ensures that minimal instructional minutes are wasted on setup, maximizing students' time on task for empirical manipulation. When structural funding and standardized resources are absent, teachers overcome these constraints by deliberately remaining highly adaptable, imaginative, and resourceful in their daily instruction. In accordance with Functional Context Theory, this adaptive professional capability allows teachers to substitute missing lab equipment with accessible, low-cost environmental alternatives (Sticht, 1975). This agentic behavior shifts the narrative from one of structural deficit to one of pedagogical adaptability, which is a key predictor of instructional resilience in rural schools globally (Ramnarain, 2024).

Finally, educators dismantle systemic linguistic and developmental barriers to democratize access to science in heterogeneous, rural classrooms. To overcome barriers to instructional comprehension, teachers actively translate complex scientific questions and vocabulary into learners' mother tongues. This strategic translanguaging serves as a linguistic bridge, reducing the extraneous cognitive load associated with learning abstract science through an English-only medium (Sweller et al., 2011; Zhang, 2021). Additionally, educators maximize limited instructional contact hours by implementing a flexible blended learning approach, assigning strategic tasks for home or independent study to absorb time-intensive demands outside of class (Fitriani et al., 2021). Driving these tactical choices is a profound ethical commitment to inclusive equity; teachers intentionally adjust their inquiry practices with the underlying mandate to promote equity, ensuring that no individual learner is left behind due to cognitive, linguistic, or environmental barriers (Li & Zhang, 2020).

Results and discussion

A primary contradiction in rural science education is the expectation that students must construct abstract scientific knowledge through a language they have not fully mastered. Grade 6 learners experience a profound double-barrier, characterized by an inability to internalize abstract instructions and a corresponding struggle to express their own observations, hypotheses, and conclusions in English. When learning is mediated entirely through a second language, the limited capacity of human working memory is exhausted by decoding text and literal translation mechanisms (Sweller et al., 2011; Zhang, 2021). Consequently, the generative processing required to filter, organize, and integrate empirical observations into long-term mental schemas is structurally bottlenecked (Mayer, 2011; Zheng, 2023). To counter this cognitive friction, rural educators strategically embed linguistic scaffolding and translanguaging into their routines, translating complex prompts into learners' mother tongues to reduce extraneous cognitive load and re-establish collective classroom discourse. Without this targeted dual-language management, the peer dialogue that is foundational to Vygotskian social constructivism collapses, leaving marginalized students isolated in passivity and conceptual withdrawal (Vygotsky, 1978; Mercer et al., 2020).

A profound scarcity of physical resources, local materials, and specialized educational infrastructure in rural areas severely compounds this instructional strain. Rural public schools suffer from a critical lack of contextualized materials, reference textbooks, and science guides necessary to orchestrate structured, hands-on inquiry. At the same time, specialized laboratory equipment and digital variable-tracking tools remain widely unavailable. This environmental deficit directly jeopardizes the uncoupling of lessons from the core tenets of Functional Context Theory, which holds that cognitive acquisition is maximized only when anchored in meaningful, real-world interactions (Sticht, 1975; King & Ritchie, 2022). The results show that teachers actively bridge this material gap by leaning into their personal professional agency and deploying adaptive professional attributes. When standardized lab apparatuses are completely absent, educators step into the role of curriculum developers, using imagination and resourcefulness to substitute missing equipment with accessible, low-cost environmental alternatives, thereby shifting the narrative from structural deficit to pedagogical adaptability (Li & Zhang, 2020; Ramnarain, 2024).

Finally, a profound operational friction exists between the expansive, non-linear nature of authentic scientific inquiry and the rigid, linear structure of school schedules. Authentic inquiry inherently requires an open-ended timeline that provides learners with extended time to explore freely, test variables, make errors, and reflectively self-correct (Gagne, 1985; Dobber et al., 2020). However, teachers are trapped within a systemic administrative "pacing trap," where the time required for student experimentation directly conflicts with rigid daily class allocations and the fast-paced demands of standardized assessments. This structural tension heightens classroom management pressures during practical sessions, often forcing educators to abandon student-led discovery in favor of traditional, direct lectures (Fitriani et al., 2021; Crawford, 2022). To survive this operational squeeze without sacrificing active exploration, rural teachers resort to flexible blended learning delivery and advanced material preparation, setting up experimental kits before the bell rings and pushing theoretical reflection or vocabulary practice into asynchronous, home-based assignments to achieve inclusive equity.

Theoretical contribution

The theoretical contribution of the study is the conceptualization of the teacher as an adaptive curriculum designer who drives ‘instructional resilience' in a structurally disadvantaged environment. Rather than relying on a standardized approach, the results indicate that successful teaching in rural, resource-constrained settings requires ongoing contextualization and practical pedagogical adaptation (Hajar et al., 2026). The finding also provides vital empirical validation for three major educational frameworks in this unique localized context: first, Vygotsky’s Zone of Proximal Development (ZPD). The findings show how teachers act as “more knowledgeable others” (MKOs) by using structured scaffolds to bridge the gap between what rural learners can do independently and what they can do with targeted audiences (Waseem & Aslam, 2020). Second, Sweller’s Cognitive Load Theory. The results of the study validate that proper language scaffolding and guided inquiry effectively reduce extraneous cognitive load, freeing up working memory for meaningful schema building and schema automation in complex science topics (Vorholzer & Aufschnaiter, 2019; Atkinson & Shiffrin, 1968). Third, Sticht’s Functional Context Theory. The findings provide empirical support for the claim that contextualized materials (tailored to students’ rural and linguistic realities) make instruction more functional and easier to integrate with learners’ prior knowledge (Castro et al., 2025). By demonstrating how these established macro-theories apply within the specific realities of Grade 6 science classrooms under the SDO Laoag City division, the study successfully extends the theoretical understanding of constructivist and cognitive instruction into marginalized, resource-limited environments

Conclusion

This study demonstrates that, although implementing inquiry-based learning (IBL) in rural Grade 6 science classrooms is hindered by language barriers, resource scarcity, and rigid administrative pacing, teachers successfully navigate these constraints through structured pedagogical scaffolds, resourcefulness, and differentiated learning strategies. The findings suggest that structural limitations do not necessarily prevent instructional innovation; rather, they highlight the teacher's role as an adaptive curriculum designer who balances contextual realities with learners’ needs. This study, therefore, shows that instructional resilience in resource-constrained schools relies on contextualization and practical adaptations rather than standardized approaches. Furthermore, the findings provide empirical support for Sweller's Cognitive Load Theory, Vygotsky's Zone of Proximal Development, and Sticht's Functional Context Theory by demonstrating how language scaffolding, guided inquiry, and contextualized materials support meaningful learning. As a theoretical contribution, the study strengthens the application of these theories within rural and resource-limited science classrooms. From practical and policy perspectives, the findings support the development of low-cost, contextualized instructional materials, bilingual learning resources, teacher capacity-building programs, and more flexible curriculum pacing to support authentic inquiry-based science instruction better. However, the study is limited to Grade 6 science teachers in SDO Laoag City and focuses primarily on teachers' experiences. Future research may include learners' and school administrators' perspectives, compare rural and urban settings, and employ mixed-methods approaches to examine further the long-term impact of inquiry-based learning on student outcomes**.**

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