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A Qualitative Study of the Practices of a Special Science Teacher in a Rural National High School in Mountain Province, Philippines

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ABSTRACT

Teacher pedagogical practices play a critical role in shaping student learning experiences, particularly in science education contexts characterized by geographic isolation and limited resources. This qualitative study examined the teaching practices of a Special Science Teacher in a rural national high school in Mountain Province, Philippines, with a focus on pedagogy, teaching-learning processes, and the integration of instructional strategies that support student learning in Biological Sciences. Guided by constructivist learning theory and learner-centered pedagogy, the study explored how instructional decisions were made and enacted in real classroom contexts. Data were collected through semi-structured interviews, analysis of lesson plans and instructional materials, classroom-related records, and reflective teaching notes, and were analyzed using thematic analysis. Findings revealed that effective science teaching was characterized by contextualized instruction, inquiry-based learning, ICT-supported pedagogy, and adaptive teaching practices responsive to learners' needs. Despite contextual constraints, reflective teacher practice and professional commitment enabled sustained pedagogical effectiveness. The study concludes that teacher agency and pedagogical innovation are essential in enhancing student learning in rural science education and offers implications for teachers, school leaders, and policy makers.

Keywords: *science pedagogy, teacher practices, student learning, biological sciences, rural education, qualitative study*

I. INTRODUCTION

Science education is fundamental to developing learners' understanding of life processes, critical thinking skills, and informed decision-making abilities that are essential for participation in contemporary society. Through science instruction, learners acquire the capacity to analyze evidence, evaluate scientific claims, and apply knowledge to personal, social, and environmental issues. In secondary education, Biological Sciences in particular serve as a foundation for scientific literacy by fostering understanding of human health, ecological systems, and the interdependence of living organisms. Research has shown that strong biology education contributes to learners' awareness of health-related behaviors and environmental responsibility, enabling them to make informed choices that affect both individual well-being and sustainable development (Bybee, 2014; Tilbury, 2011). Despite its importance, effective science teaching remains a challenge in rural school contexts, where teachers often contend with limited instructional resources, inadequate laboratory facilities, large or multilevel classes, and diverse learner needs that require differentiated instruction (Azano & Stewart, 2016).

Within the Philippine education system, Special Science Teachers play a vital role in delivering quality science instruction, particularly in schools that offer science-focused or enriched programs. These teachers are expected to demonstrate strong content mastery while also employing pedagogical strategies that promote inquiry, conceptual understanding, and active learner engagement. Learner-centered and inquiry-based approaches have been widely recognized as effective in science education, as they support deeper understanding and scientific reasoning by involving learners in questioning, investigation, and evidence-based explanation (Hmelo-Silver et al., 2007; Prince &

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Felder, 2006). However, in rural and mountainous areas such as Mountain Province, the demands placed on Special Science Teachers are intensified by geographic isolation, limited access to professional development opportunities, and infrastructural constraints. These conditions often require teachers to rely on personal initiative, adaptability, and reflective practice to sustain effective instruction (Sterling, 2010).

While numerous studies have examined science teaching practices in urban or well-resourced school settings, there remains limited empirical research documenting how Special Science Teachers enact pedagogy and support student learning in rural contexts, particularly in geographically isolated regions. Existing literature suggests that rural education settings present unique challenges and opportunities that shape teaching practices in ways not fully captured by studies conducted in urban environments (Azano & Stewart, 2016). Understanding how Special Science Teachers navigate these contextual realities is crucial for strengthening science education, informing professional development, and addressing persistent educational inequities between urban and rural schools. This study addresses this gap by examining the teaching practices of a Special Science Teacher in a rural national high school in Mountain Province, Philippines, with the aim of contributing context-sensitive insights into effective science pedagogy in rural settings.

II. REVIEW OF RELATED LITERATURE

Effective pedagogy in science education places strong emphasis on learner-centered instruction, inquiry, and active engagement as key drivers of meaningful learning. Grounded in constructivist learning theory, science pedagogy views learners as active constructors of knowledge who develop scientific understanding through interaction with concepts, hands-on experiences, and social exchanges within the learning environment (Vygotsky, 1978). Empirical research consistently demonstrates that inquiry-based and learner-centered approaches enhance learners' conceptual understanding, motivation, and long-term retention of scientific knowledge by encouraging questioning, investigation, and reflective thinking (Prince & Felder, 2006; Hmelo-Silver et al., 2007). Such pedagogical approaches shift the focus of instruction from teacher-led transmission of information to learner-driven exploration, which is particularly effective in developing scientific reasoning and problem-solving skills.

Teaching practices in Biological Sciences require instructional strategies that address complex and often abstract processes, including cellular functions, ecological interactions, and genetic mechanisms. Because these concepts are not always directly observable, effective biology instruction relies on contextualized and experiential approaches that link scientific ideas to real-life examples, local environments, and observable phenomena. Studies indicate that when biological concepts are taught through contextualized lessons, simulations, models, and hands-on activities, learners develop deeper understanding and are better able to connect theoretical knowledge to real-world applications (Bybee, 2014). In addition, effective biology teaching involves the use of formative assessment to monitor learner understanding, scaffolding to support progressively complex learning, and structured opportunities for inquiry that allow learners to ask questions, test ideas, and construct explanations based on evidence.

Teacher agency is a critical factor influencing the quality of instruction in rural education contexts. Defined as educators' capacity to act purposefully, reflectively, and creatively within their professional environments, teacher agency enables teachers to navigate contextual challenges and make pedagogical decisions that support student learning. In rural schools, where structural limitations such as resource scarcity, geographic isolation, and limited access to professional development are common, teacher agency becomes particularly important in sustaining instructional quality (Azano & Stewart, 2016). Research highlights that teachers who engage in reflective practice, demonstrate adaptability, and maintain strong professional commitment are more likely to innovate and respond effectively to learners' needs despite contextual constraints (Sterling, 2010). These qualities allow teachers to transform limitations into opportunities for pedagogical growth and meaningful learning experiences.

III. METHODOLOGY

This study employed a qualitative case study research design to explore the teaching practices of a Special Science Teacher within a real-life rural school context. The case study approach was appropriate as it allowed for an in-depth and holistic examination of pedagogy, instructional decision-making, and teaching–learning processes as they naturally occurred in the classroom. By focusing on a single case, the study captured the complexity of classroom practices and

the contextual factors that shaped how science instruction was planned, implemented, and reflected upon in a rural setting.

The research was conducted at a rural national high school in Mountain Province, Philippines. The primary participant was a Special Science Teacher I handling Biological Sciences and actively involved in instructional planning and daily classroom teaching. The participant's role provided valuable insight into how science pedagogy was enacted in a rural context, particularly in addressing learners' needs while navigating resource limitations and contextual constraints.

Data were collected through multiple qualitative sources to ensure depth and triangulation. Semi-structured interviews with the teacher were conducted to elicit detailed narratives about teaching practices, pedagogical beliefs, and instructional decision-making. In addition, lesson plans and instructional materials were analyzed to examine how biological concepts were structured and delivered in the classroom. Classroom-related documents and reflective teaching notes were also reviewed to provide further insight into instructional strategies and ongoing reflection on student learning and classroom experiences.

Data analysis followed a thematic analysis process involving systematic coding, categorization, and theme development. Patterns and meanings were identified across interview transcripts and documentary data to generate coherent themes that described the teacher's pedagogical practices. To enhance the credibility and analytical rigor of the study, triangulation was employed by comparing findings across multiple data sources, ensuring that interpretations were well-supported and reflective of the participant's teaching practices.

IV. RESULTS AND FINDINGS

Analysis of the data yielded four major themes describing the teaching practices of the Special Science Teacher.

Theme 1: Contextualized Teaching of Biological Concepts

Biological concepts were taught using examples drawn from learners' immediate environment, local ecosystems, and everyday experiences, allowing instruction to be closely aligned with the realities of learners' lives. The teacher deliberately utilized familiar elements such as local plants and animals, nearby forest and agricultural systems, and common health- and environment-related practices in the community to explain abstract biological processes. For instance, lessons on ecosystems and biodiversity were linked to the surrounding natural landscape, while topics on human biology and health were connected to daily routines, nutrition practices, and community health concerns. By grounding instruction in contexts that learners regularly encounter, biological concepts became more concrete, relatable, and easier to comprehend.

This contextualized approach also encouraged learners to actively observe, question, and analyze biological phenomena within their own surroundings, fostering deeper engagement and curiosity. Rather than viewing biology as a collection of disconnected facts, learners were able to recognize its relevance to their environment and daily lives. Such practices supported meaningful learning by enabling students to build new knowledge upon existing experiences and local knowledge systems. Moreover, using the immediate environment as an instructional resource maximized learning opportunities in a resource-constrained rural setting, demonstrating how contextualized pedagogy can enhance understanding and relevance in Biological Sciences instruction.

Participant Responses:

"Mas madaling maintindihan ng mga bata ang biology kapag inuugnay sa paligid nila." P10

"Ginagamit ko ang lokal na halimbawa para maging buhay ang lesson." P9

"Mas nagiging interesado sila kapag may koneksyon sa kanilang komunidad." P14

Contextualized instruction enhanced conceptual understanding by linking abstract biological concepts to familiar contexts, consistent with constructivist learning principles (Vygotsky, 1978).

Theme 2: Inquiry-Based and Learner-Centered Instruction

The teacher employed inquiry-based strategies such as guided questioning, structured observation tasks, and simple hands-on investigations to actively engage learners in the learning process. Lessons were designed around thought-provoking questions that encouraged students to explore biological concepts rather than passively receive information. Through guided questioning, the teacher scaffolded learners' thinking by prompting them to predict outcomes, explain observations, and justify their responses, allowing students to construct meaning gradually. Observation tasks required learners to closely examine real objects, phenomena, or classroom-based specimens, sharpening their analytical and descriptive skills while grounding abstract ideas in concrete experiences. Simple investigations, often using readily available and low-cost materials, enabled learners to test ideas, identify patterns, and draw basic conclusions. Collectively, these inquiry-based practices fostered curiosity, supported higher-order thinking, and positioned learners as active participants in knowledge construction rather than mere recipients of content.

Participant Responses:
"Hinahayaan kong magtanong ang mga bata at maghanap ng sagot." P4
"Mas natututo sila kapag sila mismo ang nag-eexplore." P7
"Ang role ko ay gabayan, hindi lang magpaliwanag." P12
Inquiry-based instruction supported deeper learning and scientific reasoning, aligning with research on learner-centered science pedagogy (Prince & Felder, 2006).

Theme 3: ICT-Supported Teaching and Learning
Explanation:
Despite limited resources, the teacher integrated ICT tools such as presentations, videos, and digital materials to enhance instruction.
Participant Responses:
"Malaking tulong ang ICT kahit simple lang ang gamit." P2
"Mas malinaw ang proseso kapag may visual aids." P10
"Mas nagiging engaged ang mga bata kapag may technology." P5
Interpretation:
ICT integration enhanced learner engagement and understanding, supporting studies on technology-enhanced science learning (Bybee, 2014).

Theme 4: Adaptive and Reflective Teaching Practice
Explanation:
The teacher demonstrated adaptability by modifying strategies based on learner responses and contextual limitations.
Participant Responses:
"Ina-adjust ko ang lesson depende sa sitwasyon." P3
"Mahalaga ang pagninilay sa bawat klase." P9
"Kailangan maging flexible lalo na sa rural school." P11
Interpretation:
Reflective practice and adaptability enabled sustained pedagogical effectiveness, consistent with research on teacher agency in rural education (Azano & Stewart, 2016).

V. DISCUSSION

The findings demonstrate that effective science teaching in rural contexts is shaped by pedagogical flexibility, contextualized instruction, and strong teacher agency. By employing learner-centered and inquiry-based strategies, the Special Science Teacher supported active engagement and meaningful learning in Biological Sciences. ICT integration further enhanced instruction by providing visual and interactive learning supports.

Despite resource limitations, reflective teaching practices enabled sustained instructional quality. These findings reinforce existing literature emphasizing the importance of teacher leadership and agency in rural education settings (Sterling, 2010).

VI. CONCLUSION

This study provides evidence that the pedagogical practices of a Special Science Teacher can significantly enhance student learning in rural secondary schools. Through contextualized, inquiry-based, and ICT-supported instruction, effective teaching can be sustained despite contextual challenges. Teacher agency and reflective practice are central to pedagogical success in rural science education.

VII. IMPLICATIONS AND RECOMMENDATIONS

Teachers are encouraged to adopt learner-centered and contextualized strategies in science instruction. School leaders should support professional development focused on inquiry-based pedagogy and ICT integration. Future research may involve multiple case studies or mixed-methods designs to examine the impact of teaching practices on student learning outcomes across diverse rural contexts.

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