Original Article

Shaping Future Scientists: Exploring the Teaching Experiences of Secondary Educators in Special Science Classes

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Abstract

This phenomenological study explored the lived experiences of ten secondary educators assigned to Special Science Classes in public schools within Carmen District, Division of Davao del Norte. Through in-depth interviews and reflexive thematic analysis, the study uncovered the complex realities of specialized science instruction. Findings revealed that teachers navigated significant challenges, specifically limited instructional resources, diverse student abilities, and balancing specialized science instruction with other responsibilities. To overcome these hurdles, participants employed dynamic coping strategies, relying on differentiated instruction, visual and hands-on learning materials, and collaborative peer support. These experiences yielded profound professional insights, emphasizing enhanced teaching confidence, deeper appreciation for student curiosity, and renewed passion for science education. Teachers characterized Special Science Classes as demanding yet deeply meaningful, requiring continuous adaptation, creativity, and commitment to inquiry-oriented learning. These findings underscore the need for targeted resource planning, comprehensive teacher support, and continuous professional development.

Keywords: phenomenology, science teaching, secondary educators, special science classes, teacher experiences

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1. Introduction

Special Science Classes are often positioned as school-based pathways for strengthening scientific literacy, inquiry skills, and learner interest in science. In these classes, teachers are expected to deliver enriched science instruction, sustain student curiosity, and support higher-order thinking while still responding to ordinary school constraints such as limited materials, varied learner readiness, and time pressure. The role therefore requires more than content delivery because it involves pedagogical adaptation, classroom leadership, and sustained professional judgment in resource-sensitive contexts (Urdanivia Alarcon et al., 2023; Gordon et al., 2023).

The need to strengthen science learning remains urgent. International assessments continue to indicate persistent learning gaps in reading, mathematics, and science among many education systems, including the Philippines, with implications for the pipeline of learners who may pursue STEM pathways later in schooling (OECD, 2023a, 2023b, 2023c). For schools that operate Special Science Classes, this pressure is often amplified because teachers are expected to provide richer learning experiences and nurture scientific thinking early, even when resources and institutional support are uneven.

Teaching specialized science classes can be rewarding, but it also carries specific demands. Science instruction frequently requires experiments, demonstrations, models, and inquiry-based activities that depend on materials, preparation time, and classroom management skill. Systematic review evidence on inquiry-based science teaching and learning shows that effective implementation depends on instructional design, teacher capability, and contextual conditions, not only curriculum intent (Urdanivia Alarcon et al., 2023). In many schools, science teachers additionally handle other subjects, grading, reporting tasks, and co-curricular responsibilities, which can constrain the time available for planning and implementing enriched lessons and may affect well-being when demands remain high (Dreer, 2023; Aziku et al., 2024).

Qualitative inquiry is especially useful for understanding these realities because it captures how teachers interpret and navigate complexity in practice. Rather than focusing only on outcomes or curriculum documents, a phenomenological lens foregrounds the lived experiences of educators and reveals how they make decisions, cope with constraints, and construct meaning around their work. Such evidence is valuable for designing support systems that are context responsive and practically useful, especially when paired with rigorous thematic analysis procedures (Braun & Clarke, 2022, 2023; Byrne, 2022).

Recent evidence also underscores the importance of student curiosity, engagement, and teacher efficacy in science-related classrooms. Studies on curiosity-promoting instructional practices in math and science lessons indicate that such practices are often infrequent yet educationally meaningful, while active-learning pedagogy is linked to learner engagement, which in turn supports curiosity and participation (Evans et al., 2023; Liu et al., 2024). At the teacher level, self-efficacy

and support during reform conditions influence how confidently educators implement demanding instructional expectations, which is relevant for teachers assigned to enriched or specialized programs (Gordon et al., 2023).

This study examined the teaching experiences of secondary educators in Special Science Classes in the Carmen District, Division of Davao del Norte. Specifically, it explored the challenges they encountered, the coping strategies they used, and the insights they developed through these experiences. By centering teachers' narratives, the study seeks to inform school leaders, curriculum implementers, and policymakers who aim to strengthen specialized science education and support teachers who deliver it.

2. Methodology

This study employed a qualitative phenomenological design to explore the lived experiences of secondary educators teaching in Special Science Classes in the Carmen District, Division of Davao del Norte. A phenomenological approach was appropriate because the inquiry sought to understand how teachers experienced, interpreted, and made meaning of the demands and opportunities of teaching specialized science classes in actual school contexts. The study was aligned with a constructivist orientation that recognized teaching experiences as shaped by interactions among educators, learners, curriculum expectations, and institutional conditions.

Participants were selected through purposive sampling to ensure information-rich cases relevant to the study aims. The study included 10 public secondary educators who were actively teaching in Special Science Classes and who had direct experience in managing science instruction in these settings. Inclusion criteria emphasized active teaching assignment in Special Science Classes and sufficient teaching experience to describe instructional practices, classroom realities, and professional reflections in detail.

Data were collected through in-depth semi-structured interviews. The interview guide was aligned with the study's three research questions and covered three domains: challenges encountered in teaching Special Science Classes, coping strategies used to address those challenges, and insights gained from these experiences. The semi-structured format allowed consistency across interviews while preserving flexibility for follow-up questions that clarified classroom situations, decision-making, and examples of practice. This format supported detailed narratives on instructional planning, learner engagement, resource limitations, and professional adaptation.

Ethical procedures were observed throughout the study. Participants were informed about the purpose of the research, the voluntary nature of participation, confidentiality protections, and their right to withdraw at any stage without penalty. Written informed consent was secured prior to interviews. Interview recordings and

transcripts were stored securely, and participant identities were anonymized using codes in all transcripts, analyses, and quoted excerpts. Interviews were conducted in settings that supported privacy and uninterrupted sharing.

Data analysis followed a thematic process within a phenomenological frame. The researchers repeatedly reviewed transcripts for familiarization, identified significant statements, generated initial codes, and clustered these codes into themes aligned with the three research aims. Themes were then reviewed for internal coherence and distinction before final naming and narrative interpretation. The analysis was guided by contemporary reflexive thematic analysis principles, particularly iterative interpretation, transparency in analytic decision-making, and careful theme development (Braun & Clarke, 2022; Byrne, 2022). Trustworthiness was strengthened through reflexive attention to interpretation, audit trail documentation, and close alignment between themes and participant quotations, consistent with recent guidance on qualitative rigor (Ahmed, 2024).

3. Results

3.1 Challenges

Theme 1: Limited Teaching Resources and Materials

Teachers described difficulty delivering effective science instruction because of limited laboratory equipment, teaching aids, and instructional materials. They frequently reported improvising demonstrations and adjusting lessons when standard science tools or visual supports were unavailable. They mentioned:

> *"Sometimes I have to improvise experiments because we do not have the proper science kits." (P1)*
> *"It's challenging to teach complex concepts when there are no models or visuals for students to understand." (P6)*
> *"Sometimes it is very hard to do demonstrations because there are no materials, so I need to make my own equipment." (P8)*
> *"There are no sufficient science resources, so I struggle to explain experiments to the students." (P10)*

Theme 2: Diverse Student Abilities and Engagement

Teachers reported difficulty addressing varied learning paces and sustaining student engagement during science lessons. They described classrooms where some students quickly understood concepts while others needed repeated support and where attention was easily disrupted. They stated:

"Some students grasp scientific concepts quickly, while others struggle to keep up, which makes pacing difficult." (P2)
"It's hard to sustain students' interest when some of them get easily distracted or discouraged." (P5)
"Many students have different learning paces, and sometimes it is hard to keep up with all of them." (P3)
"One of my challenges is getting the attention of all students because they are easily distracted." (P7)

Theme 3: Balancing Science Instruction with Other Teaching Responsibilities

Teachers highlighted the difficulty of managing specialized science teaching alongside other subject assignments and administrative tasks. They reported that science lessons often require additional planning time, especially for experiments and visual preparation, which intensified role strain. They verbalized:

"I often have to prepare for multiple subjects, so finding enough time for science experiments is challenging." (P3)
"Sometimes I feel overwhelmed because science requires extra planning while still handling my other teaching responsibilities." (P6)
"It is very hard to balance the science lesson with other subjects because I have many tasks that need to be completed." (P8)
"Sometimes I feel stressed because there are many assignments and grading tasks, but I still need to provide quality science instruction." (P9)

3.2 Coping Strategies

Theme 1: Differentiated Instruction

Teachers described adjusting lessons, activities, and pacing to match students' different ability levels, interests, and learning readiness. They emphasized flexibility in lesson planning so that all students could participate meaningfully in science tasks. They mentioned:

"I often modify experiments and activities to suit students' different learning levels, so everyone can participate meaningfully." (P1)
"I design my science lessons with multiple entry points, allowing students to explore concepts at their own pace." (P3)
"Sometimes I adjust the activities depending on the students' knowledge so they can understand the lesson better." (P8)

"I combine different approaches to cater to all students' interests, especially those who have difficulty with the lesson." (P10)

Theme 2: Use of Visual and Hands-On Learning Materials

Teachers emphasized using visual aids, models, and practical experiments to make abstract science concepts more understandable. They described hands-on demonstrations as important for improving comprehension and making lessons more memorable. They verbalized:

"I use charts, diagrams, and simple experiments to help students grasp complex science ideas." (P3)
"Practical demonstrations allow students to see the concepts in action, which makes learning more enjoyable and memorable." (P5)
"I regularly bring visual aids such as charts and models so the students can understand the lesson better." (P7)
"I use experiments so they can physically see the concepts and understand them more easily." (P8)

Theme 3: Collaborative Learning and Peer Support

Teachers used group work, peer discussions, and cooperative experiments to strengthen participation and understanding during science lessons. They reported that peer support helped students stay engaged and provided additional assistance when some learners struggled. They stated:

"I organize students into small groups so they can learn from each other and collaborate on experiments." (P2)
"Peer discussions often lead to new ideas and make science lessons more interactive and fun." (P4)
"I start group activities so students can help one another and understand the lesson better." (P6)
"Peer support really helps students, especially when someone does not understand because they can learn from classmates." (P10)

3.3 Insights

Theme 1: Professional Growth and Confidence

Teachers reported that teaching Special Science Classes strengthened their instructional skills, pedagogical creativity, and confidence in handling varied learner needs. They described the challenges of science teaching as experiences that pushed them to innovate and improve their practice. They mentioned:

"Teaching special science has pushed me to be more innovative in designing lessons and activities." (P1)
"I feel more confident in my ability to handle diverse learning needs and make science lessons engaging." (P3)
"Teaching special science helped me develop my teaching skills and improve my confidence." (P7)
"I learned many new ways of teaching, and I now better understand the needs of my students." (P9)

Theme 2: Student Engagement and Curiosity

Teachers reported that students' curiosity, questioning behavior, and enthusiasm during experiments provided strong motivation to continue improving instruction. They interpreted student interest as evidence that their teaching practices were making a meaningful impact. They verbalized:

"Seeing students ask questions and explore concepts on their own shows that my teaching is making an impact." (P1)
"When students get excited about experiments, it motivates me to keep finding new ways to teach science." (P5)
"I can see that students are interested in science lessons, and this gives me motivation to keep improving my teaching." (P8)
"The excitement of the students truly inspires me to create more creative lessons." (P10)

Theme 3: Personal Fulfillment and Passion for Teaching Science

Teachers expressed deep satisfaction in helping students understand scientific ideas and develop critical thinking. They described teaching science as personally meaningful because it allowed them to inspire curiosity and contribute to student growth. They stated:

"Teaching science allows me to inspire young minds to think critically and explore the world around them." (P2)
"I find it personally rewarding to see students succeed in science and develop a genuine interest in learning." (P6)
"I am happy that I can help the students understand the world of science and develop their critical thinking." (P8)
"It gives me satisfaction to see that students enjoy the lesson and learn from my teaching." (P9)

4. Discussion

The findings show that teaching in Special Science Classes is shaped by a combination of pedagogical demands, resource constraints, and professional commitment. Across the challenge themes, teachers described science instruction as requiring additional preparation, materials, and adaptive decision-making, especially when classrooms included mixed learning needs and competing responsibilities. This pattern is consistent with broader concerns about teacher workload and well-being, where high demands can affect instructional capacity unless supported by adequate resources and institutional structures (Dreer, 2023; Urdanivia Alarcon et al., 2023). This aligns with evidence emphasizing that science teaching quality depends on inquiry-supportive implementation and teacher capability under real classroom constraints (Urdanivia Alarcon et al., 2023; Gordon et al., 2023).

Limited teaching resources and materials emerged as a central challenge, and the narratives indicate that this issue affected both instructional depth and demonstration quality. Teachers frequently improvised experiments and visual supports, which reflects professional creativity but also reveals structural gaps in science provision. In the context of system-wide learning challenges and ongoing recovery efforts, the capacity of schools to support science instruction with basic materials remains an important condition for improving student learning experiences (OECD, 2023a, 2023b).

The challenge of diverse student abilities and engagement highlights the complexity of teaching science in heterogeneous classrooms. Teachers described difficulties in pacing, sustaining attention, and balancing support across learners with different readiness levels. These experiences help explain why differentiated instruction, hands-on supports, and collaborative learning became prominent coping strategies. The findings suggest that science teaching effectiveness in Special Science Classes depends not only on content expertise but also on teachers' skill in designing inclusive, responsive learning routines that maintain engagement across varying levels of understanding. This is also consistent with inquiry-oriented science teaching literature that emphasizes scaffolding, task design, and responsive facilitation in heterogeneous classrooms (Urdanivia Alarcon et al., 2023). Related literature on curiosity and classroom engagement suggests that sustaining interest requires deliberate instructional moves and supportive interaction patterns, including in science lessons (Evans et al., 2023; Liu et al., 2024).

Balancing science instruction with other teaching responsibilities also surfaced as a significant workload issue. Participants emphasized that science lessons, especially those involving experiments and visual preparation, require extra planning time while they continued to manage other subjects and administrative tasks. This result supports the interpretation that specialized teaching assignments can intensify role strain when schools do not provide sufficient time, planning support, or resource systems. In practice, teachers responded through prioritization and strategic

adaptation, but the findings indicate that individual coping cannot fully substitute for institutional support.

The coping themes show that teachers used practical pedagogical adaptation to sustain lesson quality under constraints. Differentiated instruction helped them manage mixed-ability classrooms, while visual and hands-on materials supported comprehension of abstract concepts. Collaborative learning and peer support also functioned as both teaching and management strategies by distributing participation, encouraging interaction, and helping students support one another during activities. Together, these strategies show how teachers transformed classroom constraints into workable instructional routines through context-sensitive judgment. These strategies align with science teaching literature that highlights the role of inquiry-supportive practices, visualization, and classroom interaction in making complex concepts more accessible (Urdanivia Alarcon et al., 2023). These strategies are also consistent with work highlighting visualization, inquiry-supportive practice, and interaction-rich teaching for accessibility and engagement (Urdanivia Alarcon et al., 2023; Evans et al., 2023).

The insight themes deepen the interpretation of teachers' experiences by showing how challenge and adaptation contributed to professional meaning. Teachers described professional growth and confidence, stronger motivation from student curiosity, and personal fulfillment in teaching science. These patterns are consistent with research showing that educator well-being and sustained professional engagement are influenced by purpose, perceived impact, and meaningful relationships with learners (Dreer, 2023). In this study, student questioning, curiosity, and visible engagement functioned as important sources of reinforcement for teachers' commitment to science teaching.

The findings also suggest that Special Science Classes can serve as developmental spaces for teachers, not only for students. Participants described becoming more innovative, more reflective, and more confident in handling diverse learner needs. This indicates that specialized teaching assignments may strengthen instructional repertoire when teachers are supported to adapt and reflect, although such growth should not be assumed to occur automatically under high strain. School leaders and program implementers may therefore benefit from treating teacher support and resource provision as integral parts of science program quality, not peripheral concerns.

Overall, the study points to a balanced interpretation. Teachers in Special Science Classes demonstrate high commitment, creativity, and adaptive capacity, but the sustainability of these practices depends on stronger material support, time-sensitive workload planning, and professional development that addresses both pedagogy and classroom realities. Strengthening these supports can improve teacher functioning and increase the likelihood that Special Science Classes achieve their intended role in developing curiosity, scientific thinking, and sustained student engagement.

5. Conclusion

Secondary educators in Special Science Classes in Carmen District described their work as demanding yet professionally meaningful. They faced recurring challenges in resource availability, student diversity and engagement, and balancing science instruction with other responsibilities, but they responded through differentiated instruction, hands-on and visual supports, and collaborative learning strategies. Their reflections also revealed professional growth, motivation from student curiosity, and personal fulfillment in science teaching. These findings support the need for stronger school-level resource provision, workload-sensitive support, and sustained professional development to strengthen specialized science education.

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Conflict of Interest Statement

The authors declare no conflict of interest.

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