

**Research Article****OUT-OF-FIELD SCIENCE TEACHERS IN BOHOL: CHALLENGES IN THE PPST AND ADAPTIVE MEASURES*****Regine D. Remulta, Fe R. Janiola and Vera A. Villocido**

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Abstract

This study addressed the gap between teaching competence and subject readiness by examining the challenges and adaptive measures of forty-six (46) out-of-field high school science teachers in the Division of Bohol, with a focus on selected PPST domains. Utilizing a mixed-method sequential explanatory design, the research analyzed teachers' competency in Content Knowledge and Pedagogy, Learning Environment, Curriculum and Planning, Assessment and Reporting, and Personal Growth and Professional Development, alongside the adaptive strategies they employ to cope with teaching outside their specialization. Quantitative findings revealed that teachers generally demonstrate a Very Competent level across PPST domains, though gaps remain in content mastery, confidence, pedagogical strategies, and assessment design. One-way ANOVA results indicated that teaching experience and participation in science-related trainings significantly influenced competency levels, whereas field of specialization had no significant effect. Thematic analysis further highlighted recurring challenges such as difficulty explaining complex concepts, designing assessments, and implementing inquiry-based lessons, as well as adaptive measures including advance lesson preparation, collaboration with colleagues, and interactive teaching strategies. The study concludes that while out-of-field science teachers face challenges in content knowledge and pedagogy, their demonstrated competence reflects adaptability and effective use of professional support. To address these challenges, the study proposes the RISE (Raising Instructional Skills in Science Education) Program, designed as a 4-week crash course conducted during the school break. Each week focuses on one of the four core branches of science—Biology, Chemistry, Physics, and Earth and Space Science. This program aims to strengthen teachers' content understanding, improve pedagogical skills, and promote more effective and inquiry-based science instruction.

Keywords: Out-of-field science teachers, PPST, Teaching competence, Professional development, Adaptive strategies, Science education, Philippines.

INTRODUCTION

Out-of-field teaching remains a persistent issue in education systems worldwide, particularly in developing contexts where teacher shortages and resource constraints influence subject assignments. In the Philippines, this practice is especially evident in science education, a discipline that requires strong content knowledge and specialized pedagogical skills. When teachers are assigned to teach subjects outside their field of specialization, they often encounter difficulties in explaining complex concepts, addressing student misconceptions, and implementing inquiry-based instruction, which may ultimately affect the quality of learning (Hobbs, 2012; Comendador and Paglinawan, 2025). National reports further highlight the extent of this issue, with a significant proportion of public high school teachers handling subjects that do not align with their academic training, reflecting systemic challenges in teacher deployment and workforce planning (PIDS, 2025). These conditions contribute to broader concerns in science education, as reflected in international assessments such as the 2018 Programme for International Student Assessment (PISA), where Filipino learners demonstrated low performance in science. Grounded in Pedagogical Content Knowledge (PCK) Theory, Self-Efficacy Theory, and Person-Environment Fit Theory, this study posits that effective science teaching depends not only on pedagogical skills but also on the alignment between teachers' subject expertise, confidence, and assigned roles. PCK emphasizes the integration of content knowledge and pedagogy as essential for meaningful instruction (Shulman, 1987), while Self-Efficacy Theory explains how teachers' confidence in their abilities influences their instructional practices and motivation (Bandura, 1997).

Person-Environment Fit Theory further suggests that mismatches between teachers' qualifications and job demands can lead to reduced performance, stress, and inefficiency (Kristof, 1996). Within the Philippine context, these theoretical perspectives are operationalized through the Philippine Professional Standards for Teachers (PPST), which define the competencies required for effective teaching across domains such as content knowledge, learning environment, curriculum planning, assessment, and professional development (Department of Education, 2017). Despite existing policies and standards, out-of-field science teachers continue to face significant challenges that may hinder their ability to meet PPST expectations. Previous studies have identified issues related to limited content mastery, low confidence, and difficulty in selecting appropriate teaching strategies, as well as the need for continuous professional development and institutional support (Lopez and Roble, 2022; Roxas, 2022; De La Cruz and Alda, 2023). However, there remains limited research that systematically examines how these challenges manifest across specific PPST domains and how teachers adapt to these constraints within the Philippine public school context.

This study aims to examine the level of competency of out-of-field high school science teachers across selected PPST domains, identify the challenges they encounter, and explore the adaptive measures they employ in their teaching practice. By integrating quantitative and qualitative approaches, the study provides a comprehensive understanding of how teachers navigate the demands of teaching science outside their specialization. The findings are expected to inform targeted professional development programs, improve teacher support systems, and contribute to policy initiatives aimed at strengthening science education in the Philippines.

METHODOLOGY

This study employed a sequential explanatory mixed-methods research design to examine the competency, challenges, and adaptive measures of out-of-field high school science teachers in relation to selected domains of the Philippine Professional Standards for Teachers (PPST). The quantitative phase utilized a descriptive-comparative approach to determine the level of competency across PPST domains and to examine differences when grouped according to profile variables. The qualitative phase followed to provide deeper insights into the challenges encountered and adaptive strategies employed by teachers, allowing for a more comprehensive interpretation of the quantitative results. The study was conducted in selected public high schools in the Division of Bohol, Philippines, during the School Year 2024–2025. The division comprises both urban and rural schools with varying levels of access to instructional resources, particularly in science education. It was selected due to the prevalence of out-of-field teaching assignments and its representation of typical conditions in Philippine public secondary schools. The participants consisted of forty-six (46) out-of-field high school science teachers identified from official records of the Bohol Schools Division Office. Stratified random sampling was used to ensure representation across the three congressional districts of the division. Inclusion criteria required participants to be currently teaching science subjects such as Biology, Chemistry, or Physics despite having a different field of specialization. All respondents participated in the quantitative phase, while nine (9) participants three from each district who obtained the lowest competency scores were selected for the qualitative interviews. Ethical considerations were strictly observed, including informed consent, voluntary participation, confidentiality, and the right to withdraw at any stage of the study.

Data were collected using a questionnaire adapted from the PPST framework, consisting of two parts: (1) demographic profile, including field of specialization, length of service teaching science, and number of hours attended in science-related trainings; and (2) competency indicators across five selected PPST domains: Content Knowledge and Pedagogy, Learning Environment, Curriculum and Planning, Assessment and Reporting, and Personal Growth and Professional Development. A five-point Likert scale ranging from 1 (Least Competent) to 5 (Highly Competent) was used to measure responses. For the qualitative phase, semi-structured interviews were conducted to explore participants' experiences, challenges, and adaptive measures in teaching science outside their specialization.

Data collection was conducted in three phases: (1) securing ethical clearance from the Holy Name University Ethics Review Board and approval from the Department of Education Division of Bohol; (2) administration of the survey questionnaire through an online platform after obtaining informed consent; and (3) conduct of semi-structured interviews with selected participants. All data were treated with strict confidentiality and stored securely, with identifiers removed to ensure anonymity. The study complied with institutional ethical standards and the Data Privacy Act of 2012 (R.A. 10173), and no conflicts of interest were declared. Quantitative data were analyzed using descriptive and inferential statistics. Frequency and percentage were used to describe the respondents' profile, while the weighted mean

was used to determine the level of competency across PPST domains. One-way Analysis of Variance (ANOVA) was employed to test for significant differences in competency when grouped according to profile variables. Qualitative data were analyzed using Colaizzi's thematic analysis, which involved extracting significant statements, formulating meanings, clustering themes, and validating findings with participants. The integration of quantitative and qualitative results provided a comprehensive understanding of the PPST-related challenges and adaptive measures of out-of-field science teachers.

Table 1. Distribution of participants

Participants	Population	Sample
Congressional District 1	18	15
Congressional District 2	24	20
Congressional District 3	13	11
Total	55	46

RESULTS AND DISCUSSION

Demographic Profile of Respondents

A total of forty-six (46) out-of-field high school science teachers from public schools in the Division of Bohol participated in the study. The majority of respondents were Mathematics majors (92%), while only a small proportion specialized in Filipino, Values Education, Technology and Livelihood Education (TLE), and Computer Education (2% each). In terms of teaching experience in science, most respondents had 1–3 years of experience (28%), followed by those with less than one year (26%), 10 years and above (20%), and those with 4–6 years and 7–9 years (13% each). With respect to professional development, the largest group had attended 1–10 hours of science-related training (39%), while 17% reported no training. The remaining respondents participated in 11–20 hours (15%), 21–40 hours (15%), and more than 40 hours (13%) of training. This profile suggests that out-of-field science teaching is largely handled by teachers with a Mathematics background who have relatively limited experience and exposure to science-specific professional development. The distribution reflects common patterns in the Philippine public school system, where teacher assignments are often based on availability or perceived subject alignment rather than formal specialization. The limited number of training hours further indicates gaps in structured support for out-of-field teachers, which may influence their ability to effectively deliver science instruction. Similar trends have been observed in previous studies, highlighting that out-of-field teaching is prevalent and often associated with constraints in content mastery and access to professional development opportunities (Lopez and Roble, 2022; Comendador and Paglinawan, 2025).

Level of Competency of Out-of-Field High School Science Teachers in the Division of Bohol across PPST Domains

The findings of the study reveal that out-of-field high school science teachers in the Division of Bohol demonstrate a consistently high level of competency across all selected PPST domains, with all areas interpreted as *Very Competent*. Among the domains, Learning Environment obtained the highest mean, followed by Curriculum and Planning, Assessment and Reporting, Personal Growth and Professional Development,

and Content Knowledge and Pedagogy, which, while still rated very competent overall, showed comparatively lower mean scores in specific indicators.

Table 2. Level of competency of Out-of-Field high school science teachers in Division of Bohol across PPST domains (n=46)

PPST Domain	SD	Weighted Mean	Description
Content Knowledge and Pedagogy	0.67	3.50	Very Competent
Learning Environment	0.76	3.72	Very Competent
Curriculum and Planning	0.74	3.61	Very Competent
Assessment and Reporting	0.74	3.56	Very Competent
Personal Growth and Professional Development	0.67	3.52	Very Competent

Legend: 1.0-1.8 Least Competent, 1.81-2.40 Less Competent, 2.61-3.40 Competent, 3.41-4.20 Very Competent, 4.21-5.0 Highly Competent

This pattern suggests that out-of-field teachers possess strong foundational teaching skills, particularly in managing classrooms, engaging learners, and organizing instruction. Their ability to maintain safe, inclusive, and well-structured learning environments indicates that general pedagogical competencies are transferable, even when teaching outside their field of specialization. Similarly, their competence in curriculum planning and assessment reflects adaptability and familiarity with standard teaching processes required by the educational system. However, the relatively lower ratings in content knowledge and pedagogy highlight a critical area of concern. While teachers are able to perform instructional tasks effectively, their depth of subject matter understanding and application of research-based teaching approaches in science remain less robust. This suggests that their competence may be more practice-driven rather than content-driven, which aligns with the nature of out-of-field teaching where educators rely on general teaching strategies rather than specialized expertise. The findings also imply that professional experience and exposure to teaching practices may have enabled teachers to develop coping mechanisms that allow them to function effectively despite content limitations. Their competency in personal growth and professional development further indicates a willingness to improve, adapt, and engage in continuous learning, which serves as a key factor in sustaining their performance. Overall, the results present a nuanced perspective: while out-of-field science teachers are capable of meeting professional standards at a functional level, underlying gaps in content mastery persist. This indicates that competence alone does not fully equate to subject expertise, and highlights the need for targeted interventions, particularly in strengthening science content knowledge and discipline-specific pedagogy. Strengthening these areas would not only enhance teacher effectiveness but also improve the overall quality of science education delivery.

Differences across Demographic Profiles

The analysis revealed no significant differences in competency when grouped according to field of specialization ($p > 0.05$), indicating that out-of-field science teachers demonstrate relatively similar levels of competence regardless of academic background. This suggests that teaching competency is not primarily determined by specialization, but by transferable pedagogical skills and adaptability. However, significant differences were found when grouped according to length of service and training exposure ($p < 0.05$), indicating that experience and professional development play a more critical role in shaping competency. This aligns with previous studies

showing that continuous training and teaching experience, rather than specialization, are key factors in improving teacher effectiveness (Lopez and Roble, 2022; Comendador and Paglinawan, 2025).

Thematic Summary of Challenges of Out-of-Field Science Teachers in Meeting PPST Standards

Analysis of the responses revealed four interrelated challenges: limited content knowledge and conceptual gaps, low confidence in teaching science concepts, difficulty in explaining complex ideas, and challenges in selecting appropriate inquiry-based teaching strategies. Collectively, these reflect deficiencies in both subject mastery and pedagogical competence that hinder effective science teaching.

Table 3. Thematic summary of challenges of Out-of-Field Science Teacher

Major Theme	Category (PPST-Aligned)	Sample Narrative Responses
Limited Content Knowledge and Conceptual Gaps	Content Knowledge and Pedagogy	"One of the main difficulties is limited content knowledge, which makes it harder to explain complex scientific concepts." / "There are many terminologies that I am not familiar with."
Low Confidence in Teaching Science Concepts	Content Knowledge and Pedagogy	"I feel less confident discussing topics like chemistry formulas and physics computations." / "I'm not always fully confident with deeper science concepts."
Difficulty in Explaining Complex Concepts	Content Knowledge and Pedagogy	"It is challenging to explain complex scientific concepts clearly and accurately." / "It can be difficult to break down complex topics into something students can easily understand while still keeping the lesson accurate."
Challenges in Selecting Appropriate Teaching Strategies and Inquiry-Based Approaches	Curriculum and Planning	"I find it challenging to select appropriate teaching strategies and experiments aligned with the lesson." / "I find it hard to come up with hands-on activities or experiments, especially in areas where I don't have much background."

Teachers reported struggles with unfamiliar scientific concepts and terminologies, which align with Content Knowledge and Pedagogy concerns. This limited mastery also reduces teaching confidence and self-efficacy, particularly in handling complex topics in chemistry and physics. Additionally, participants noted difficulty in translating scientific ideas into clear, student-friendly explanations, indicating gaps in pedagogical content knowledge. Lastly, many teachers experienced challenges in designing and implementing inquiry-based and hands-on activities due to limited preparation in science pedagogy. Overall, the findings highlight the interconnected nature of content limitations, low confidence, and pedagogical difficulties among out-of-field science teachers, underscoring the need for sustained professional development, mentoring, and targeted capacity-building programs aligned with PPST standards.

Thematic Summary of Adaptive Measures of Out-of-Field Science Teachers in Meeting PPST Standards

Analysis of the responses revealed four key adaptive measures: advance lesson preparation and self-directed learning, utilization of multiple instructional resources and technology, collaboration with experienced colleagues, and the use of interactive teaching strategies with continuous professional improvement. Collectively, these demonstrate how out-of-field science teachers actively address gaps in content knowledge, confidence, and pedagogy to meet PPST standards. Teachers reported engaging in extensive pre-lesson preparation by studying textbooks, reviewing lesson exemplars, and using online resources to strengthen content understanding. They also relied on various instructional materials, including books, digital modules, videos, and ready-made presentations, to support lesson delivery and improve clarity of concepts.

Table 4. Thematic summary of adaptive measures of Out-of-Field Science Teachers in Meeting PPST Standards

Challenges Major Theme	Adaptive Measures Major Theme	Category	Sample Narrative Responses
Limited Content Knowledge and Conceptual Gaps	Advance Lesson Preparation and Self-Study	Planning and Professional Development	"I make it a priority to study the lessons ahead of time by reading textbooks, watching educational videos and reviewing reliable online resources." / "The main adaptive measure I took was really to study the subject itself, focusing more on Physical Science because it is the most difficult."
Low Confidence in Teaching Science Concepts	Utilization of Multiple Learning Resources	Instructional Support	"I take time to print concepts from lesson exemplars, purchase online softcopies of PowerPoint presentations, summative tests, and quarterly assessments." / "I use different resources like books, online materials, and videos to help me understand the topics better."
Difficulty in Explaining Complex Concepts	Collaboration with Experienced Colleagues	Professional Engagement	"Collaborating with experienced science teachers helps me gain insights and effective strategies." / "I ask for help or ideas from my co-teachers when needed."
Challenges in Selecting Appropriate Teaching Strategies and Inquiry-Based Approaches	Use of Visual Aids and Interactive Teaching Strategies	Classroom Practices	"In class, I try to use simple explanations, real-life examples, and interactive activities so students can relate more to the lesson." / "I use visual aids and interactive activities to make lessons more understandable."

In addition, collaboration with experienced colleagues served as a key support mechanism for clarifying difficult topics and enhancing instructional strategies. Lastly, teachers applied interactive approaches such as visual aids, real-life examples, and hands-on activities, while continuously improving their instructional practices. Overall, these adaptive measures highlight a proactive and multi-faceted response to the challenges of out-of-field teaching, emphasizing the role of self-learning, collaboration, and resource utilization in improving science instruction aligned with PPST standards.

Conclusion

Based on the findings of the study, out-of-field science teachers in the Division of Bohol can be described as adaptable, committed, and resourceful educators who are capable of delivering science instruction effectively despite not having formal specialization in the subject. They demonstrate a strong sense of professionalism and responsibility, consistently striving to meet teaching standards through self-directed learning, collaboration, and the use of available instructional resources. It can be concluded that these teachers generally exhibit competent teaching practices across the PPST domains, indicating that they are able to perform effectively even when teaching outside their field of specialization. Their original academic background does not significantly determine their overall competency, as experience, continuous professional development, and adaptive strategies play a more crucial role in shaping their teaching effectiveness. Furthermore, teaching experience and participation in science-related training significantly contribute to the enhancement of their competencies, particularly in content knowledge, pedagogy, assessment, and professional growth. However, they still encounter challenges such as limited content mastery, lack of confidence in teaching complex science concepts, and difficulty in simplifying scientific ideas for learners, which highlight the need for targeted support and intervention. To address these challenges, out-of-field science teachers employ various adaptive strategies such as advance lesson preparation, integration of instructional technology, collaboration with colleagues, and the use of interactive teaching methods. These approaches enable them to maintain effective classroom instruction despite limitations in subject specialization. Overall, while they demonstrate resilience and adaptability in their teaching practice, continued and structured professional

development remains essential to further strengthen their content knowledge and enhance their instructional effectiveness.

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