



OUT-OF-FIELD ELEMENTARY SCIENCE TEACHERS: A NARRATIVE INQUIRY

Rozenith E. Bayonito, Bryan J. Nobleza, EdD

*School of Teacher Education, University of Nueva Caceres,
Naga City, Philippines*

<https://doi.org/10.5281/zenodo.20265237>

ABSTRACT

This qualitative narrative inquiry analyzes the teaching strategies of five out-of-field elementary science teachers in the Calabanga West District, Philippines, addressing the gap in literature regarding adaptive pedagogy used by teachers facing limited content knowledge. Drawing on Experiential Learning Theory, Cognitive Load Theory, and Social Cognitive Theory, the study employed semi-structured interviews to examine how out-of-field teachers implement core science teaching strategies based on their home disciplines (Filipino, Mathematics, EPP, and English). Findings revealed that teachers systematically adapted pedagogical practices from their disciplines to science lessons, resulting in epistemological misalignment across eight strategies: Reciprocal Teaching, 5E Instructional Model, Lead-Learner Role, Inquiry-Based Learning, Think-Pair-Share, Simulation Activities, Mirroring Strategy, and Hands-on Learning. Language specialists approached science texts as stories emphasizing grammar over conceptual understanding; the math teacher introduced procedural certainty into open-ended inquiry; the EPP specialist executed hands-on activities flawlessly but could not explain science concepts. However, teachers demonstrated valuable assets including narrative approach, logical organization, and precise description that can benefit science instruction. The study concludes that out-of-field teachers struggle not merely from content knowledge deficits but from epistemological mismatches shaped by their disciplinary training, causing them to focus on surface elements while ignoring scientific sensemaking. Recommendations include discipline-specific professional development focused on epistemological realignment, coaching to unlearn misaligned habits, and mentoring that highlights home discipline assets.

Keywords: *Out-of-field Teaching, Elementary Science Education, Pedagogical Content Knowledge, Teaching Strategies, Epistemological Mismatch, Adaptive Pedagogy, Narrative Inquiry*

INTRODUCTION

Effective science teaching was identified as crucial for encouraging scientific literacy and STEM motivation. Pedagogical approaches were among the key variables affecting student achievement within a school setting (Luft & Hewson, 2022, citing National Research Council, 2021). Research showed the link between effective science teaching and constructivist theories, inquiry-based learning (Furtak et al., 2021), dialogic teaching, and representational work. At the same time, the implementation of such pedagogical approaches in class requires deep subject-specific knowledge and PCK—an important aspect, which proved to be problematic for teachers assigned to teach subjects out of their specialization (out-of-field (OOF) teachers). It showed that assignments of out-of-field teachers are prevalent throughout the world due to teacher shortages. Similar patterns of out-of-field assignments are prevalent in the Philippines, where there is a great shortage of teachers in certain subjects including science. For example, in the Bicol Region, where the research site of the current project was located, numerous elementary schools employ generalists to teach science because they have not been able to hire specialized teachers. Out-of-field science teachers face many problems in teaching this subject effectively, among them low self-efficacy, high levels of stress, reliance on teacher-centered methods isolation from other professionals, and simply surviving without being able to fully function (Du Plessis, 2021).

This deficit-oriented body of literature exhaustively describes what OOF science teachers lack. It is noteworthy that despite the vast body of research devoted to the difficulties that OOF science teachers experience, one key problem remained unexplored—the strategies that help some OOF teachers become effective in teaching science and helping students to develop their literacy skills. The focus on deficiencies and weaknesses makes this problem evident, since researchers and practitioners have yet to learn about the effective adaptive practices of successful OOF teachers in order to apply the lessons learned to professional development and mentorship programs.

In the context of Philippine elementary education and particularly the Calabanga West District in the Philippines, no research has been done to identify the teaching strategies used by successful OOF science teachers who overcome the difficulties of teaching this subject. It is important to note this problem, considering the focus of the national K to 12 curriculum on fostering scientific literacy.

Thus, studying the adaptive practices of effective OOF science teachers is a pressing need that must be addressed now. To fill the gap described above, the current project proposes to investigate the teaching strategies used by out-of-field elementary science teachers in the Calabanga West District. The main goal of the study is to identify, document, and analyze the effective adaptive practices used by successful OOF science

teachers in order to help them overcome difficulties of teaching content not included in their specialization.

Research Objective

The study sought to analyze the Teaching Strategies of Out-of-field Elementary Science Teachers in the Calabanga West District.

METHODOLOGY

Research Design

The study made use of the Narrative Inquiry, anchored on the assumptions of the social constructivist philosophical worldview, where it is believed that both knowledge and meaning are not absolute concepts, rather, they are socially constructed, influenced by context. The adoption of such paradigm is congruent with the study's purpose of exploring how out-of-field elementary science teachers from Calabanga West district make meaning and construct adaptation techniques in order to cope with the difficulties of teaching in the area without expertise in the subject matter. In this particular paradigm, the research acknowledges that whatever experiences, beliefs and practices of the teachers are not absolute knowledge, rather, they are socially constructed through interaction with various social elements within the educational environment. This allows the researcher to focus on exploring various realities of the teachers, particularly how they understand being out-of-field teachers, coping and constructing knowledge that would help them teach science despite having content deficiencies.

The research method used for the study was narrative inquiry, which was carefully chosen since narrative inquiry is an approach that provides insights into the experiences and life stories of out-of-field elementary science teachers. In narrative inquiry, which can be described as a qualitative method, it is the process whereby people construct personal meanings about their careers and professional experiences by means of storytelling that takes the center stage. Narrative inquiry was especially relevant to the current study because it offered the opportunity for participants to describe the use of particular teaching strategies, along with the process that led them to adopt such teaching strategies within their particular career journeys. Narrative inquiry provided the possibility of identifying the history and evolution of adaptive teaching, exploring significant incidents that led teachers to select certain approaches to instruction, and analyzing the link between personal history, professional problems, and adaptive response strategies.

The research methods included specific processes of collecting and analyzing the data used to produce high-quality findings. For data collection, a set of semi-structured in-depth interviews was performed, relying on an interview guide developed based on the main domains identified using the theoretical framework. In particular, the following areas were covered in the interviews: participants' professional backgrounds, their experiences of teaching science out-of-field, the teaching strategies used by them, the resources and support services they applied, and the assessment of participants' self-efficacy and

learning opportunities. Semi-structured interviewing allowed researchers to combine some degree of flexibility and openness with consistency across interviews to obtain high-quality data. Audio recordings of each interview session were obtained after obtaining informed consent from the participants. Moreover, transcripts were prepared manually and subjected to thorough analysis. As for data analysis, a set of thematic analysis steps, formulated by Braun and Clarke (2021) as including six stages, was followed. The stages of this analysis method included familiarization with data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the report. It should be noted that thematic analysis is one of the best ways to identify patterns and relationships between different aspects of the phenomenon of interest in qualitative studies.

For the purpose of ensuring that researcher biases do not influence data collection and analysis, a number of reflexive practices were used during this study. For instance, prior to interviewing, a reflexive journal was kept to document initial expectations and assumptions regarding out-of-field teaching, including those that could be influenced by the current literature focused on this topic and reflecting a deficit-oriented perspective. Additionally, reflective notes were written during interviews, as well as during data analysis. In addition, the researcher actively engaged in active listening during conversations with participants and used open-ended questions such as "Can you tell me more about that?" and "What did that experience mean to you?." Moreover, member checking was used to discuss the results of data analysis with the participants.

This study was conducted in the Calabanga West District, Philippines, focusing on public elementary schools within this district. The names of specific institutions are not disclosed as permission was not obtained for this purpose.

Sampling Method

Purposive sampling was employed to select participants who met specific criteria relevant to the research objective. Participants were initially nominated by the Public Schools District Supervisor and then validated through school heads' referrals.

Respondents Profile

Five purposely selected out-of-field elementary science teachers from public elementary schools in the Calabanga West District served as the key informants for this study. The selection criteria were as follows: (a) they should be assigned to teach grade levels 4-6 science classes regardless of their specialization in science education; (b) they should have at least two years of teaching experience in science subjects as out-of-field teachers; and (c) they should be teaching in public elementary schools in the Calabanga West District for school year 2025-2026.

The selection of five participants was methodologically justified by established principles in qualitative research. It emphasized that qualitative inquiry prioritizes depth of understanding over breadth of representation. This approach aligned with criteria for

purposive sampling, which prioritizes information-rich cases capable of providing thick descriptions essential for establishing transferability. Furthermore, Polkinghorne (1995) asserted that smaller samples enable sustained, in-depth engagement required to capture the complexity of lived experience, while Fusch and Ness (2022) reinforced that data saturation depends on information richness rather than numerical thresholds.

Data Gathering Procedure

The data gathering procedure involved conducting semi-structured in-depth interviews with the five participants on November 28, 2025. A semi-structured interview guide was developed based on the main domains identified using the theoretical framework. The following areas were covered in the interviews: participants' professional backgrounds, their experiences of teaching science out-of-field, the teaching strategies used by them, the resources and support services they applied, and the assessment of participants' self-efficacy and learning opportunities. Semi-structured interviewing allowed the researcher to combine flexibility and openness with consistency across interviews to obtain high-quality data. Audio recordings of each interview session were obtained after securing informed consent from the participants. Subsequently, a focus group discussion was conducted with all five participants for member checking and validation of individual responses. Transcripts were prepared manually and subjected to thorough analysis.

Research Instrument/s

The primary instrument used was a semi-structured interview guide, which was researcher-made. The interview guide contained open-ended questions designed to elicit participants' teaching strategies, challenges faced, and adaptations made while teaching science out-of-field. The instrument underwent content validation by three experts in qualitative research, science education, and curriculum development.

Data Analysis Techniques

Data were analyzed following the thematic analysis principles outlined by Braun and Clarke (2006). The process involved six phases: (a) familiarization with the data through repeated reading of interview transcripts and listening to audio recordings; (b) generating initial codes by marking interesting features of the data related to the research objective; (c) searching for themes by grouping initial codes under broad themes; (d) reviewing themes at two levels—examining coded data for coherent patterns and assessing validity based on the entire dataset; (e) defining and naming themes by clarifying the essence and significance of each theme to the research question; and (f) writing the findings by weaving together analysis of each theme with relevant anonymized interview extracts. Member checking was used to discuss the results of data analysis with the participants.

Scope and Delimitations

The scope of this study involved carrying out an intensive exploration of the teaching strategies used by out-of-field elementary Science teachers at public schools in the Calabanga West District. Data collection occurred on November 28, 2025. Specifically, the study aimed at determining the strategies that these teachers perceive and adopt as effective, avoiding any assessment of the impact of these strategies on the academic performance of the students, and avoiding examination of the possible reasons for the existence of out-of-field teaching assignments.

Delimitations included limiting the study to this specific target group of five participants and geographical setting (Calabanga West District). A limitation of the study was the restriction to a single date for data collection (November 28, 2025), which prevented the researcher from gaining insight into the development and changes to teaching strategies across various science topics and classroom conditions. Another limitation relates to the qualitative nature of the data gathered, making it impossible to generalize findings statistically. Additionally, there may be some discrepancy between the reported effectiveness of the adaptive teaching strategies and what actually takes place in the classrooms. Therefore, the conclusions drawn from the study must be placed within the context of this geographical area, the availability of resources and facilities, and the specific educational environment at the designated time frame.

RESULTS

Research Objective

To analyze the Teaching Strategies of Out-of-field Elementary Science Teachers in the Calabanga West District.

1. Reciprocal Teaching is implemented by out-of-field teachers as a literary comprehension strategy (storytelling, literal questioning, grammar correction) rather than as a hypothesis-generating and concept-building approach for scientific text.
2. The 5E Instructional Model is executed with disciplinary misalignment: Explore phases are rushed, skipped, or replaced with vocabulary front-loading, while Elaborate phases emphasize hands-on tasks without conceptual explanation.
3. The Lead-Learner Role is enacted as a teacher-centered delegation of procedural tasks (correcting narratives, enforcing scripted steps, managing materials, monitoring grammar) rather than as a peer inquiry facilitator.
4. Inquiry-Based Learning is reduced to descriptive storytelling, grammatical accuracy, numerical computation, hands-on execution without explanation, or vocabulary memorization, omitting experimental variable identification and conceptual discussion.

5. Think-Pair-Share is implemented with procedural misalignment: the Think phase is hurried or turned into silent worksheet completion, Pair discussions focus on grammar or answer comparison, and Share emphasizes eloquence over conceptual accuracy.
6. Different Simulation Activities show assets-based transfer: teachers productively use narrative engagement, discussion facilitation, logical structuring, hands-on construction, and descriptive precision to enhance Engage, Explore, and Elaborate phases.
7. Mirroring Strategy is used to verify disciplinary practices (grammar correction, premature symbolization, procedural verification, vocabulary elevation) instead of to scaffold scientific discourse or conceptual clarification.
8. Hands-on Learning & Experiments are treated as tasks to complete (hurrying, over-directing, skipping safety, lacking contingency plans) rather than as meaning-making experiences for students to engage with scientific uncertainty and discovery.

DISCUSSION

Narrative Profile of the Respondents

While working in an ever-changing field and with a constant commitment to providing science education, five teachers from Calabanga, Camarines Sur have each contributed their own individual approach to teaching. Teacher A, who has taught for 15 years at Lope Guisic Elementary School, started teaching Filipino but, for the past 11 years, has been responsible for teaching Science to 6th-grade students and also earned a Master's degree in Administration while leading WINS and Gulayan sa Paaralan programs. Teacher B at Ratay Elementary School has taught for over 10 years; after being recognized as an outstanding teacher, she switched from Filipino to Science and cares for the School Clinic as she teaches 5th-grade Science. Teacher C from Fabrica Elementary School has only taught Science for 14 years and despite having a degree in Math, teaches 4th-grade Science as she works toward completing her Master's degree while acting as coordinator of the Feeding Program, Brigada Pagbasa and National Learning Camp. Teacher D, with 20 years of teaching experience at Pagatpat Elementary, began teaching EPP but after 17 years has transitioned into teaching Science for 4th grade and was recognized as the best NLC Implementer while working in conjunction with LIS-BEIS and Reading Coordination. Teacher E from Fabrica Elementary has taught only 6th-grade Science for the last 11 years regardless of the fact that she originally had a degree in English, has served concurrently as Reading and School Science Coordinators, and is completing her Master's degree.

Collectively, these educator examples provide a powerful but subtle story of teachers' self-improvement through leadership and adaptation. Each of these educators

came from different backgrounds, including different post-collegiate degrees (Writing and Dramatic Writing, Filipino and English Language Arts, EPP and Math). Regardless of the ways in which they continue to improve upon their educational experiences, all of them have made teaching science their long-term vocation, together teaching science to 4th, 5th, and 6th graders across a variety of schools. Their professional advancement—many have or are close to achieving a master's degree in Administration and Supervision—shows their desire to continue improving as teachers and to work on these types of programs. These programs encompass school clinics, food assistance, reading assistance, summer camps, and conservation programs, which illustrate their dedication to their own professional development and to the overall success of their school communities. Each is an anchor for their respective school: no longer simply a teacher of a subject that was not part of their original studies but a holistic nurturer of the mind and the community.

Lope Guisic Elementary School has a very respected teacher and role model as its Teacher A Leader. He has the dual responsibilities of being the lead teacher in his classroom and the program coordinator of both the WINS and Gulayan sa Paaralan programs, creating a positive impact on both student health and environmental awareness. After graduating from Naga College Foundation Inc. in Education/Filipino, Teacher A changed his major to Science and has dedicated 11 of his 15 years in the profession to teaching Science. He is currently pursuing his Master of Arts in Education with an emphasis in Administration and Supervision in an effort to prepare himself for the next level of leadership. Teacher A is currently working at the District Level in Calabanga, Camarines Sur in a rural setting where community involvement and resourcefulness are critical to helping his students succeed. Teacher B is recognized for his commitment to achieving academic excellence and promoting the well-being of his students. He serves as the School Clinic Coordinator at Ratay Elementary School in the Calabanga area of Camarines Sur and teaches Grade 5 Science. Teacher B has a decade of teaching experience, having spent nine of those years teaching Science. He has transitioned from a focus on Filipino to a science-related profession as well as having been recognized as an Outstanding Teacher, which illustrates his ongoing professional development and commitment to excellence. Teacher B also works in a community oriented school in San Isidro, Calabanga, where he is involved in the well-being of the students and the community through the coordination of the feeding program, Brigada Pagbasa, and the National Learning Camp. Holistic education is represented in Teacher C's professional practice. Teacher C has been a specialist in Field Science for his entire teaching career (14 years), having originally been a Mathematics specialist; Teacher C is currently pursuing a Master's degree in Administration and Supervision, with 27 graduate units earned toward this goal. There is a strong academic and community emphasis at Fabrica Elementary School, where Teacher C teaches Grade 4 students. Teacher D is a veteran of Pagatpat Elementary School with 20 years of experience who wears many hats, taking on additional administrative roles in addition to his teaching responsibilities. Teacher D was trained to teach EPP originally; for the past 17 years, he has specialized in teaching Science. Teacher D reflects both adaptability and commitment to his years of teaching. Teacher D teaches Grade 4 at Pagatpat Elementary School, where his leadership and experience provide a benefit to his fellow teachers, as he mentors young teachers while

staying actively involved with the community in which he teaches. Teacher E is well known in the community and among his colleagues and students as being both adaptable and enthusiastic. At Fabrica Elementary School, Teacher E teaches Grade 6 Science, as well as serving as both the Reading Coordinator and the School Science Coordinator. Teacher E's dual role reflects his commitment to developing both literacy skills and scientific curiosity in his students, while working closely with fellow teachers to improve the academic programs in his school. Despite the fact that Teacher E's background is in English (having gained a degree in English from the Central Bicol State University of Agriculture), he decided to pursue a career in Science education rather than continue pursuing an English major. For the past 11 years, Teacher E has enjoyed this change, becoming very familiar with the aspects of the Science curriculum and developing creative ways to teach it. Teacher E is also continuing to earn professional development credits towards a Master's degree in Administration and Supervision at Naga College Foundation Inc., where he has completed 27 graduate units thus far. In the future, Teacher E hopes to utilize his leadership skills in school management and curriculum development. Fabrica Elementary School is where Teacher E spent his entire teaching career, and his professional home, which has allowed him to pursue educational initiatives at Fabrica Elementary School. Because of the encouraging environment at the school and in the community, Teacher E has been able to grow and develop as a teacher. In working to fulfill both the administrative roles that he holds and the role of a classroom teacher, Teacher E is able to create an environment in which both the reading program and the science program will continue to be successful under his leadership.

Their collective epiphany was not a singular moment of clarity, but a slow development of understanding that they had not been "confined" to their respective college majors when they first graduated (Filipino, English, EPP, or Mathematics), and that they were actually free to teach whatever subject would best serve the needs of their students and community. The epiphany was also that regardless of how long they had been teaching their current area of specialisation (e.g., Teacher A and Teacher B both started as teachers of another subject and eventually moved to Science, while Teacher C and Teacher E spent their entire careers teaching only Science), there is no "specialist" training; that is, the development of teaching skill occurs through three major components: developing pedagogical expertise through daily work, obtaining long-term commitment to graduate education, and leading programs extending beyond the classroom (e.g., food programs, reading programs, health programs, environmental programs). All five of them agreed that being a "specialist" has less to do with the degree you earned when you graduated from college than it has to do with being willing to be flexible, that leadership in rural schools means being able to wear a lot of different hats while keeping a focus on the learner, and that the truest measure of an educator is not what subject he or she majored in, but what real, tangible things he or she does to help and support the students and community.

The teaching experiences of Teachers A through E are based on the real lives of teachers in Calabanga, Camarines Sur, whose reality includes multi-grade adaptability, resource shortages (i.e. classroom supplies, promotion of the school), and community-based teaching, within these variables, being a teacher is challenging. All of these

teachers represent an identified pattern of service to the Philippines' Foundation for Universal Education (UN-Habitat, 2). Regardless of the subject area or the grade for which they are trained, they have been reassigned to teach science and mathematics due to teacher shortages and the desire to support the community where the teacher is required. For example, Teacher A has been involved in the WINS and is a coordinator for Gulayan, Teacher B has received recognition from the municipality for being an outstanding teacher, while providing services through the school clinic, Teacher C has been involved in feeding programs and learning camps on an ongoing basis, Teacher D is the LIS-BEIS/Reading Coordinator and have served for over 20 years in this capacity, and Teacher E serves as both the Science and Reading Coordinator. The graduate work of each of these teachers in the area of Administration and Supervision was obtained at the following institutions: University of Northeastern Philippines, Naga College Foundation Inc., and Central Bicol State University. These teachers are living proof of real teachers navigating the complexities that arise from multigrade, multi-program, and multi-subject situations. A teacher who has been labeled as a "science teacher" represents only a small part of each teacher's overall experiences. True leadership arises from a daily decision to continue to adapt to the need for teachers and provide for the educational and community needs of the students they serve.

The narrative displays five parallel teacher lives as a purposeful tapestry, woven to show one shared truth from many separate pieces. The piece contains many different layers of rhetorical structure. Initially provides a panoramic synthesis of all five teachers combined into one paragraph of shared experience and struggle. Second used a shrink to each teacher's individual context including school names, grade levels, program coordinator positions and graduate units thereby contextualizing the collective at very detailed levels. Thirdly an epiphany naming their each teacher's own experience of quiet epiphanies as they transitioned from their respective external lives (biography) to internal awareness. Fourthly provide an authenticating paragraph that situates the entire narrative in actual realities of public (DepED) education as an assurance that no one could interpret this narrative as purely fictitious. What is produced through this non-linear sequence is a multi-layered portrait of (5 teachers, 1 story), 1st - completed Forescape (forest), 2nd individual Forescape (trees), 3rd connected to the teacher's Foredream (roots), 4th Sorel (soil) DepED context for these narratives. This multi-layered structure is quite similar to the same kinds of journeys that all teachers experience; beginning with different areas of specialization, converging through science teaching, and ultimately creating greater coherence through their responses to additional needs surrounding them. Therefore, the text reflects the adaptation, layering, and quiet powers of covering individual struggles to create a larger more powerful shared continuing narrative.

These five teacher's stories contain the essence of research in that they do not engage in the objective collection of data; rather, they represent the ongoing process of systematically observing lived educational realities, particularly with regard to patterns and practices associated with specialization, acquiring graduate units, coordinating multiple DepEd programs, and adapting to classroom settings for many years—all of which provide their primary source of actionable knowledge. As such, the essence of research in this case is not in making discoveries but rather in the intentional

documentation of how (1) Teacher A has integrated both WINS and Gulayan sa Paaralan into their science instruction; (2) Teacher B has transformed their recognition as an outstanding teacher into practices to replicate in their clinic management; (3) Teacher C has determined the effects of feeding programs and Brigada Pagbasa on learners' readiness for school; (4) Teacher D, via their dual role as LIS-BEIS and Reading coordinator, generates school-level data to continuously improve; and (5) Teacher E has discovered that the intersection of science and reading coordinatorships creates opportunities to link literacy to scientific thought. Therefore, these teachers are not simply research subjects. In fact, they are each conducting research on a daily basis as Program implementors by collecting data, documenting student progress across grade levels, pursuing master's degrees in Administration and Supervision as practical ways to address community-based issues in rural areas, and demonstrating that the true essence of educational research comes from the community upwards and from the teacher who realizes that his/her student's hunger may impact the student's performance in science, the coordinator who conducts a daily attendance review of students enrolled in Summer Learning Camps, and the veteran teacher who compares student's enrollment data with their reading levels to assist them. Thus, the essence of research in this case is participatory, contextualized, and fundamentally human; it finds its roots in the classrooms of Calabanga and has been tested over countless years, and its purpose is not to provide general knowledge but rather to provide careful and patient improvement to one school, one program, and one learner at a time.

Through these data and the in-depth interview conducted the researcher come up with the Teaching strategies in handling Science subject despite of mismatch qualification. The presentation detailed how OOF teachers managed this discrepancy.

Teaching Strategies of Out-of-Field Elementary Science Teachers

This chapter highlights the results and discussion of the qualitative analysis conducted on the teaching strategies used by OOF science teachers within the Calabanga West District, as outlined in Table 2. Based on narrative data obtained from the participants, the results have been arranged according to themes that were developed from the experiences of these educators. The range of strategies employed include compensatory methods, which focus more on the teacher, and facilitative strategies that involve the learner. This paper analyses each theme, giving specific excerpts to illustrate each one in the context of Pedagogical Content Knowledge, self-efficacy, and Constructivist Learning theory.

Reciprocal Teaching refers to a teaching method that involves the use of four main reading strategies, namely predicting, questioning, clarifying, and summarizing in order to enhance the understanding of texts by students. As a learning approach in science education, Reciprocal Teaching aims at facilitating the comprehension of expository scientific texts through the generation of hypotheses about scientific content, asking questions related to causality and answering them by using key vocabularies.

Reciprocal Teaching

Each of the five elementary science teachers teaching out of field had their own set of problems in the implementation of Reciprocal Teaching strategy. Teacher A gave excessive importance to the storytelling part of "Clarifying" and "Summarizing," regarding scientific texts as stories, thereby ignoring essential elements of the subject of science. Teacher B asked only literal comprehension-based questions in "Questioning," but failed

Table 2
Summary Results of the Core Strategies of the OOF Teachers in Teaching Science

Core Strategy	Teacher Examples & Specialization-Informed Variations	Primary Adaptive Function / Mechanism
Reciprocal Teaching	<p>Teacher A (Filipino): Concerned with narrative coherence during "Clarifying" and "Summarizing," using the science text as a story instead of as a concept.</p> <p>Teacher B (Filipino): Asked literal questions about comprehension instead of inquiry questions about scientific concepts.</p> <p>Teacher C (Mathematics): Found difficulty with "Predicting" due to his preoccupation with getting accurate answers rather than speculating about possibilities.</p> <p>Teacher D (EPP): Skipped technical language during "Clarifying," and was not willing to define scientific concepts.</p> <p>Teacher E (English): Provided a grammatically perfect yet scientifically meaningless summary, paying attention only to correct usage of language.</p>	<p>Epistemological Filtering: The teachers used their native discipline's conception of text (storytelling, procedure, or language), thereby disregarding the hypothesis-generating and concept-building approach of scientific text.</p>
5E Instructional Model	<p>Teacher A (Filipino): Found difficulty in creating practical "Explore" activities; was unable to relate the topic to real-world events in "Elaborate."</p> <p>Teacher B (Filipino): Introduced terms prior to the "Explore" phase, inhibiting students from exploring the activity independently.</p> <p>Teacher C (Mathematics): Hasted the "Explore" stage to focus on analyzing data.</p> <p>Teacher D (EPP): Excelling in hands-on "Elaborate," but unable to articulate the scientific concepts behind them.</p>	<p>Learning Cycle Transfer: The teachers' interpretation of the 5 E's model aligned with their own disciplinary process of learning—storytelling structures, vocabulary exercises, mathematics procedures, or hands-on activities—instead of scientific inquiry.</p>

	Teacher E (English): Proficient in "Engage," yet incompetent in conducting "Explore"; inclined towards presentation rather than science during "Evaluate."	
Lead-Learner Role	<p>Teacher A (Filipino): Viewed student ideas as stories in need of correction and did not encourage the testing of ideas.</p> <p>Teacher B (Filipino): Favored narrative aesthetics over scientific processes and had lead-learners simply narrate the story.</p> <p>Teacher C (Mathematics): Made lead-learners strictly adhere to scripted steps and made them data recorders concerned with results.</p> <p>Teacher D (EPP): Restricted lead-learners from being scientific discussants and limited them to just managing materials.</p> <p>Teacher E (English): Obsessed too much with proper language over scientific thinking.</p>	Delegation of Authority Frame: The teachers used their own areas of knowledge—storytelling, computation, management, or grammar—to make peer inquiry a teacher-centered process.
Inquiry-based Learning	<p>Teacher A (Filipino): Could not help students go past descriptive stories to determine the experimental variables.</p> <p>Teacher B (Filipino): Focused on correct grammar instead of encouraging students to engage with the scientific misunderstandings.</p> <p>Teacher C (Mathematics): Overdosed on data computation, preferring calculations over discussion of the concepts.</p> <p>Teacher D (EPP): Was excellent in doing hands-on experiments but could not help the students discuss the theoretical "Explain" step.</p> <p>Teacher E (English): Confused correct vocabulary with proper understanding of the concept.</p>	Scientific Inquiry Reduced to Epistemology: Teachers translated scientific inquiry into something they know better—constructing narratives, computations, performing procedures, or acquiring vocabularies—skipping the important scientific processes of experimentation and explanations.
Think-Pair-Share	<p>Teacher A (Filipino): Hurried the individual "Think" stage because of time pressure.</p> <p>Teacher B (Filipino): Over-emphasized translation and grammar in "Pair" discussion, resulting in conversations that were irrelevant.</p>	Misalignment in Procedure: Teachers implemented the procedural steps of Think-Pair-Share but not the epistemological basis

	<p>Teacher C (Mathematics): Looked for only one right answer, making it impossible to engage in discussions.</p> <p>Teacher D (EPP): Confused the "Think" process with silent worksheet doing; "Pair" became comparison of answers rather than discussion of concepts.</p> <p>Teacher E (English): Over-valued eloquence in "Share"; emphasized grammar rather than conceptual learning.</p>	<p>in science: using social interaction for conceptual learning.</p>
Different Simulation Activities	<p>Teacher A (Filipino): Developed engaging simulations with character dialogue that deeply engaged students.</p> <p>Teacher B (Filipino): Was adept at building discussions to facilitate qualitative observation.</p> <p>Teacher C (Mathematics): Constructed simulations with outstanding logical structure and defined parameters.</p> <p>Teacher D (EPP): Was skilled at hands-on manipulation of materials for concrete experiences.</p> <p>Teacher E (English): Directed descriptive discussions to articulate observations accurately.</p>	<p>Assets-Based Transfer: Science teachers effectively transferred skills from their home disciplines through productive transfer of narrative engagement, discussion facilitation, logical structuring, hands-on construction, and descriptive precision in "Engage," "Explore," and "Elaborate."</p>
Mirroring Strategy	<p>Teacher A (Filipino): Emphasized grammar, reiterated, and restructured student answers to use excessively formal sentences, obscuring scientific language.</p> <p>Teacher B (Filipino): Valued linguistic structures over scientific content.</p> <p>Teacher C (Mathematics): Prematurely transformed student responses into symbolic representations without establishing their validity through language.</p> <p>Teacher D (EPP): Implemented mirroring formally, verifying the procedure but not the principle.</p> <p>Teacher E (English): Elevated student discourse by using sophisticated vocabulary, distorting its meaning.</p>	<p>Framing of Discourse: Mirroring was employed by teachers to verify disciplinary practices within their respective disciplines—grammar, symbolism, procedure, or eloquence—instead of scientific discourse.</p>
Hands-on Learning & Experiments	<p>Teacher A (Filipino): Experiments were hurried because of worries regarding classroom management; students did not understand key ideas.</p>	<p>Avoiding Inquiry: The teachers treated their science activities as distinct tasks to complete</p>

Teacher B (Filipino): No safety instructions given; no connection made between experiment and theory.	(hurrying, over-directing, following steps) rather than engaging
Teacher C (Mathematics): Unable to come up with relevant assignments; gave too much help, leaving little room for discovery.	experiences through which children would make meaning.
Teacher D (EPP): Miscalculated time required; lacked supplies; could not integrate information.	
Teacher E (English): Lacked the assurance to use scientific tools properly; could not adjust procedures when experiments led to unforeseen outcomes.	

to frame any questions in relation to scientific concepts. Teacher C displayed reluctance towards the use of the "Predicting" strategy, insisting on accurate answers and unable to perform predictions concerning the subject of science. Teacher D glossed over complex scientific terminologies during "Clarifying" phase due to a lack of proper theoretical knowledge about science. Teacher E prepared empty scientifically speaking but grammatically correct summaries during the "Summarizing" phase.

“The first teacher says, ‘I kept looking for characters and plot in my science book, therefore, I got the wrong details. The second teacher says, ‘The pressure of making sure they get the vocabulary on their papers made me forget to ask them why the procedure works like this.’ The third teacher says, ‘Since there is only one right answer in my math lessons, it was hard for me to tell them that they could be speculative about the result of the experiment.’ The fourth teacher says that each time a scientific term was brought up, she just scanned through the definitions hoping the children would not ask for further clarification. The fifth teacher says that her concern about grammar made her blind to the fact that the children did not get the lesson’s message”

The data revealed a pattern wherein each teacher's field of specialization acted as a filter of how they understood and implemented Reciprocal Teaching in science. Language-oriented specialization backgrounds (Filipino, English) translated their strong literacy-based pedagogy into narrative comprehension with emphasis on grammar, failing to address the analytical demands of scientific literacy. Mathematical specialization caused aversion towards the unpredictable nature of Reciprocal Teaching in science as this field emphasizes precision and exactitude of procedures. Process-oriented specialization background (EPP) caused discomfort in tackling vocabulary-heavy theoretical science discourses as this specialization relies heavily on experiential, material-based instruction. This revealed that out-of-field teachers do not come into a science classroom with an open mind, but rather apply their field-specialization background of pedagogy that contradicts with the epistemological demands of processing

science texts.

From the data collected, it can be seen that out-of-field teachers' difficulty in implementing Reciprocal Teaching in science is not necessarily a result of lack of content knowledge but more of a mismatch between their field specialization assumptions of how to teach and the nature of science text interpretation. From the data collected, Filipino and English teachers' challenges showed that they perceived science text reading in terms of literary comprehension and ignored the importance of understanding empirical concepts and causal relationships. On the other hand, the Mathematics specialist had trouble predicting and making sense of what will happen next as this was based on his perspective of certainty and predictability, which was contrary to the tentative hypotheses in science. Similarly, the EPP specialist avoided dealing with theoretical science concepts because she preferred hands-on, practical teaching. It can therefore be concluded that the implementation of Reciprocal Teaching in elementary science among out-of-field teachers requires a different approach towards science text reading.

This finding ties with the theoretical framework set forth, namely pedagogical content knowledge (PCK). This theory posits that a teacher needs not only pedagogical skills but also the capacity to transform particular content knowledge into a form that would be cognitively understandable by the learner. Out-of-field teachers' failure to execute Reciprocal Teaching roles such as summarizing, clarifying, and predicting showed that the teachers failed to develop their PCK in science due to their underdeveloped pedagogical approach to specific content area. Moreover, this finding corroborates the situated learning theory posited by Lave and Wenger (1991), wherein an individual's understanding and execution of a new task is influenced by professional identity and community of practice. For the language specialists, whose professional community revolved around language-based instructions, it is inevitable for them to use language-based techniques in teaching science. This current study thus provides additional evidence to previous research conducted on out-of-field teaching difficulties. First, regarding translation of science content into understandable instruction were confirmed by all five out-of-field teachers in this study. Second, the observations by Feille (2021) regarding how teachers with low content confidence revert to their familiar pedagogical practices were supported in this study. Third, Hobbs and Porsch (2022)'s observation on how teachers' instructional decisions are influenced by professional identities is echoed in the present study as specialization background filters out-of-field teacher implementation of Reciprocal Teaching. Lastly, the Filipino teachers need content-specific training especially on complex topics are validated by teachers A, B, and E's struggles in processing scientific texts. However, the present study uniquely shows that difficulties in executing Reciprocal Teaching were specialization-specific, thereby extending the study by du Plessis (2021).

It is recommended that professional development programs should be organized targeting the difficulties experienced by out-of-field teachers in applying Reciprocal Teaching strategy in elementary science. In order to address the specific problems associated with specialization backgrounds, separate training series should be developed for each specialization. Language teachers should receive workshops on how to

differentiate between narrative comprehension and scientific text analysis. For the mathematics specialist, trainings on embracing uncertainty and hypothesis formation in science should be made available. Lastly, to address the theoretical-science vocabulary challenge of EPP teacher, workshops using hands-on conceptual modeling should be held. Partnerships should be formed between each out-of-field teacher and their in-field mentor for on-the-spot coaching when implementing Reciprocal Teaching in science classes. Lastly, school administrators should give opportunities for collaborative planning sessions wherein out-of-field teachers learn lesson construction alongside science specialists.

5 E's Instructional Model

An extensive assessment on how each of the teachers implemented the 5Es model in science classes identified the weaknesses associated with their specialization. For instance, Teacher A, whose specialty was Filipino, found it hard to provide investigation activities during "Explore" and also failed to relate lessons with practical phenomena during "Elaborate." Teacher B, a teacher with reading as his or her main specialization, did a lot of front loading of new vocabulary words, which delayed students' inquiry process. Teacher C taught science in a mathematical way by being in a rush to analyze data during "Explore," leaving students with no time to develop meaning in science. Teacher D who specialized in EPP performed well when it came to carrying out hands-on tasks during "Elaborate" but could not account for the scientific concepts involved. Lastly, Teacher E, with English as his or her primary specialization, performed better during "Engage" but was weak in providing hands-on activities during "Explore."

"Teacher A said, "I felt comfortable conducting the discussion, but at the Explore phase, I did not know what to do in order to guide them to experiment because I am used to letting them read the story." Teacher B told how she taught, saying, "It was so important to make sure that they understand the big words that I noticed that I have answered their questions before they even formulated them." Teacher C reflected, "We are used to valuing the way the students reached the right answer in math class, thus in science class, I was guiding them to find the solution without giving them enough time to explore the problem." Teacher D expressed her confusion, saying, "I knew how to guide them in building the circuit in order for the light bulb to turn on, but I couldn't explain why." Teacher E confessed, "I spent too much time teaching them how to deliver the report well, but I forgot to ensure the scientific accuracy of the findings."

The identified deficits were clearly intentional rather than accidental since they correlated with the particular field each of the teachers specialized in before becoming a science educator, showing the transfer of instructional approaches specific to their original areas into the science classroom. Teacher A's focus on narrative and Teacher E's concentration on presentation skills showed an adherence to the principles of teaching humanities where form is prioritized above everything else, yet failing in science where inquiry-based learning is crucial. Teacher B's emphasis on front-loading vocabulary demonstrated a borrowing of techniques used in reading comprehension lessons without

realizing the purpose of the "Explore" phase. Teacher C's focus on quick data analysis and procedure showed an excessive preoccupation with numbers typical of mathematics but alien to the nature of science. Teacher D's inability to facilitate transition from manipulations with objects to abstract reasoning indicated her practical bias stemming from EPP studies. Thus, these out-of-field teachers seemed to revert to teaching methods typical of their specialties without regard for the epistemological and pedagogical specifics of science, showing a need for intervention in the area.

One may conclude that the core challenge faced by these out-of-field teachers was a deficit of discipline-specific pedagogical content knowledge. On the one hand, they knew how to interact with children, organize group work, and carry out simple experiments, showing sufficient generic teaching skills. However, on the other hand, they were ignorant of how to present science knowledge to students and engage them in meaningful discovery. In other words, the deficiency in out-of-field teachers' pedagogical content knowledge manifested itself through an emphasis on form rather than substance, resulting in their failure to promote scientific literacy. Thus, being out-of-field was seen as a failure in understanding how science should be taught rather than ignorance of its factual content.

These observations can be explained by Lortie's (1975) apprenticeship of observation theory according to which teachers use what was learned during their years as students as a basis for their pedagogy even when teaching subjects they specialize in; thus, out-of-field teachers reverted to familiar methods regardless of misalignment. Thirdly, such behavior patterns can be attributed to Bandura's (1977) theory of self-efficacy which holds that low teaching confidence forces teachers to choose less risky and predictable teaching methods such as lecture delivery. Overall, this research enriches the theoretical base of pedagogical content knowledge theory and adds to our understanding of how self-efficacy affects pedagogy. These conclusions align well with the existing literature on out-of-field teaching. Specifically, the teachers' difficulty with pedagogical content knowledge found in this research was discussed extensively by Tijap et al. (2022); the latter authors emphasized how the psychological pressure associated with teaching out-of-field affects teaching practices. Similarly, the teachers' tendency to apply familiar but incorrect instructional techniques is well-supported by du Plessis (2021) who described them as psychologically conservative due to their unfamiliarity with the subject matter. Also, avoidance of inquiry-based phases of the lesson and over-reliance on rote memorization were mentioned by Maseko and Khoza (2021) among other characteristics of out-of-field teachers. Overall, this research is consistent with this literature in describing the specific ways out-of-field teaching manifests itself in practice.

Thus, it is recommended that any efforts made to support out-of-field teachers in the district should go beyond generic science content training. Professional development and targeted interventions are necessary to help teachers unlearn wrong methods of teaching that are characteristic of their specialty and master pedagogical content knowledge in the domain of science.

Lead- Learners' Role

In the case of out-of-field teachers adopting a peer-led learning approach, it was found that the original areas of specialization of these teachers greatly influenced how the teachers assigned scientific authority to the learners. The first teacher, who was Filipino, regarded the inputs made by the learners as a narrative that had to be corrected instead of as hypotheses to be validated. The second teacher, who was also a Filipino, preferred the aspect of good storytelling aesthetics, and this reduced the learner-lead to mere script readers. The third teacher, who specialized in Mathematics, coerced the learner-lead into following a strict procedure and therefore reduced him to a mere data recorder with a view to achieving expected results.

“Teacher A said, “When the lead-learner made a statement not in line with the book, I promptly intervened to correct their grammar rather than asking other members of the group what they thought about it.” Teacher B thought about what her main priorities were at that time, saying, “I made sure that the lead-learner made their explanation colorful and expressive; I did not realize they were ignoring some of the steps in our procedures.” Teacher C stated his expectations of the lesson as follows: “I gave them a list of steps to follow, and instructed them strictly to do everything by the book.” Teacher D described how she limited herself when delegating tasks to her learners, saying, “I have done a good job training them to pass out the material and set up the equipment; however, I failed to inform them that they should also lead the discussion of its purpose.” Teacher E mentioned that she was too critical of the students, saying, “I often had to interrupt them to explain their mistakes in pronouncing the word photosynthesis.”

In the current case, it became clear that there was an organized transfer of PCK from the teachers' original disciplines into the science classes, thus contradicting the aims of inquiry-based learning. Teachers A and B (the Filipino specialists) brought a humanities perspective into the experiment, paying attention to how things should be said rather than how to make a discovery, thus taking control over the discourse rather than helping to discover. Teacher C (the Mathematics specialist) provided a procedure-focused approach, turning the experiment into the problem of solving the equation. Teacher D (the EPP specialist) took on the task of management, making students separate doing science from thinking about science. Finally, Teacher E (the English specialist) focused on the accuracy of terms rather than scientific concepts in the context of science. All in all, the teacher-specific approaches made it impossible for students to become independent scientists in any possible way.

Thus, it can be concluded that out-of-field teachers' major weakness lies not only in their lack of science-related information but also in their lack of pedagogical content knowledge that makes them fail at facilitating the process of inquiry. Their practices reveal how they perceive the role of a lead-learner – through their own discipline-specific lens as storytellers, calculators, managers, or grammarians. Therefore, the process of peer interaction was not aimed at developing scientific habits of mind, leading to the fact that

student-centered approach turned into a teacher-centered one where the lead learner became another medium for the teacher.

Out-of-field science teaching in South Africa, coming to the conclusion that teachers with inadequate pedagogical content knowledge tend to teach using low-risk activities guided by textbooks. At the same time, Rebolledo & Calimag (2025) interviewed 40 educators working in public schools, noting that such teachers experience knowledge gap, diminished confidence, and have to resort to collaborative and self-directed learning. Moreover, international variation in out-of-field science teaching based on TIMSS 2023 data and concluded that it had both cognitive and non-cognitive effects. Some studies conducted longitudinal research of physical science teachers in their early careers, discovering that out-of-field teachers were characterized by underdeveloped enacted pedagogical content knowledge and inconsistency in their practices. In the Philippine context, social studies teachers who were teaching out of field, finding gaps in subject mastery, higher level of preparation, stress, but also some resilience due to peer collaboration and professional development. Co et al. (2021) concentrated on science teachers who were teaching out of specialization, while Bugwak (2021) addressed out-of-field teachers in general. Additionally, Wong (2025) researched out-of-field Chinese history teachers in Hong Kong, stating the need for professional development addressing out-of-field teachers' lack of content knowledge and pedagogical content knowledge. Moreover, there was a critical gap between the need for such development and existing training programs. Finally, it explored out-of-field non-government basic education teachers, and analyzed senior high school mathematics teachers teaching out of their specialization.

Therefore, the authors propose to design professional development initiatives aiming at addressing these specific discipline-related pedagogical issues. On the one hand, it may involve science content training. On the other hand, reflective practices and mentoring may be used to ensure out-of-field teachers' awareness of how their specialization influences their teaching of science. Moreover, some targeted interventions should help such teachers learn how to facilitate students' inquiries, i.e., how to model open-ended questions and hypothesis testing.

Inquiry Based Learning

In applying the IBL approach in class, each teacher displayed his/her own weakness according to her original specialization. Teachers A and B, whose field is Filipino, were unable to adhere to the scientific approach; Teacher A was unable to progress beyond the narration level to determine scientific variables while Teacher B emphasized the correctness of grammar rather than letting the students confront scientific misconceptions. The teacher whose specialty is mathematics, Teacher C, focused more on numerical computation rather than explaining the scientific principles behind such problems through formulaic computation. Teacher D, who specializes in EPP, was very good at conducting hands-on activities in class but was weak in facilitating scientific theories during the "explain" stage. Finally, Teacher E, who is an English specialist, equated vocabulary proficiency with scientific understanding, which led her to accept

complicated terms as signs of learning without considering application to the context.

"Teacher A considered her students' answers, saying, "I felt happy that they wrote me lengthy paragraphs about the volcano, but after some time, I understood that nobody had ever mentioned the variable responsible for causing the eruption." Teacher B explained her intuitive response, saying, "I kept marking all their spelling mistakes while reviewing the observation sheet during the investigation rather than focusing on whether their theories about sinking and floating made sense." Teacher C clarified his instruction, saying, "They were working on average and percentages calculations from their observations for the whole lesson, and I came to know later that we never discussed the reason behind slowing down the pendulum." Teacher D talked about her sequence of instructions, saying, "We made an electromagnet, and it worked. I decided to take up another task without thinking that it was essential to explain the scientific reasons behind its function." Teacher E mentioned her initial happiness, saying, "I marked their presentation full of marks because they used the term 'osmosis' perfectly. However, they could not answer my question regarding the reaction of a raisin in water."

The observed inadequacies indicated the presence of a definite pattern of educational transfer, where each specialist attempted to apply the logical principles of his/her respective discipline to teach science and thus inevitably created the fundamental mismatch with the aims of scientific inquiry. The Filipino specialists (Teachers A and B) treated the subject matter as an exercise in Language Arts, favoring storytelling skills and grammatical correctness over the process of hypothesis formation and conceptual revision. The Mathematics specialist (Teacher C) perceived scientific inquiry as a mathematical operation, placing undue emphasis on numerical results and failing to recognize the importance of scientific sense-making and building explanatory models. The EPP specialist (Teacher D) regarded science as a hands-on subject without an abstract, conceptual component, overlooking the crucial step of deriving abstractions from concrete experience. The English specialist (Teacher E) equated scientific literacy with knowing scientific vocabulary, thus mistaking memorization for problem-solving.

From this analysis, one may infer that, contrary to what may appear at the surface level, the underlying issue for the teachers under study was neither a lack of content knowledge nor lack of motivation but a profound mismatch between their field-specific epistemologies and the nature of science itself. Having fully-developed pedagogical content knowledge (PCK) within the framework of their respective disciplines, the teachers automatically applied it to interpret and deliver science instruction. As a result, the focus shifted to the features of a science lesson that seemed to match teachers' experience and comfort zone (storytelling, neat numbers, technical vocabulary, etc.), with all other, more important components being ignored completely. Thus, the process of inquiry was either interrupted mid-way or completely distorted.

The findings of this paper can be corroborated and expanded by several recent

scholarly works published between 2021 and 2026. The international collection of papers compiled by Hobbs and Porsch (2022) confirmed and elaborated the finding, showing that teachers with OOF certification used conservative instructional practices due to their insufficient subject matter knowledge. However, the same research also indicated that professional learning context, including mentoring programs and collaborative networks, played a significant role in helping teachers develop adaptive expertise beyond basic survivalism. Preservice teachers are well-aware of the negative impact of out-of-field teaching on their professional experience, which includes teacher turnover, burnout, and job dissatisfaction, with important practical implications for initial teacher education and policy making. In the meantime, a 2025 paper presented at the Australian Association for Research in Education Conference revealed the specific profile of out-of-field teaching in the field of mathematics. The participants described their out-of-field assignments as highly stressful experiences characterized by a low level of curriculum knowledge, limited confidence, and an overwhelming need for rote learning methods instead of deep approaches, with mixed feelings of fear and enjoyment associated. Moreover, out-of-field work was concentrated in small schools in low socio-economic areas. Collectively, these studies demonstrate a consistent international trend, while emphasizing the importance of certain systemic and contextual variables in overcoming pedagogical gaps.

It is recommended that professional development opportunities offered to teachers in the studied district should be revised with a view to helping the participants identify and remedy the described issues with discipline-specific pedagogical content knowledge. Specialized workshops and collaborative lesson planning could prove beneficial for that goal.

Think-Pair-Share

In particular, each of the teachers was found to have used the Think-Pair-Share method with some deficits based on their own original specialties. First of all, Teacher A and Teacher B, being both Filipinos, always abused this method in such a way that Teacher A was hurrying with the "Think" part of the lesson, whereas Teacher B paid too much attention to translation and grammar when working with the "Pair" part and consequently distracted students from scientific topics, which prevented any sharing of students' ideas. Teacher C was guided by a mathematical approach and wanted to get only one correct answer for the whole lesson, which made any meaningful conversation impossible. Teacher D, coming from an EPP specialty, mistook the "Think" period for silence and thus transformed "Pair" cooperation into mere work on producing results and not thinking about them. As for Teacher E who is a linguist in general and English specialist specifically, he/she paid too much attention to fluent language production, forgetting that science topics should be understood first.

"Teacher A confessed, 'I became so preoccupied with time that I instructed them to turn to their partner straight away without giving it too much thought.' Teacher B revealed the reason she had intervened while students worked with their partners. She said, 'I kept moving around making sure they properly translated the scientific terminology into the Filipino language

without realizing that they had stopped discussing the concept at all.' Teacher C revealed his expectations, saying, 'I informed them that there was only one answer to discover; instead of coming up with ideas, they simply sat down waiting for the genius child to tell them the answer.' Teacher D revealed her misconception, saying, 'I believed 'Think' time meant that they needed to complete the worksheets quietly, and thus, upon pairing off, they ended up comparing their responses rather than discussing the science involved.' Teacher E revealed her priorities, confessing, 'I was quite happy to hear them exchange their answers using perfectly structured sentences without realizing whether or not they had understood what they were saying.'

However, the shortcomings mentioned above were not coincidental but resulted from the pedagogical transfer from the field of each teacher's major into science instruction. Specifically, being specialists in humanities, Teachers A and B tended to focus on language mechanics and narration rather than on thinking and making sense of scientific ideas through prolonged cognitive processing. Teacher C, being oriented towards mathematics, sought empirical certainty which contradicted the exploratory and discursive nature of "Think-Pair-Share". Teacher D, having experience in EPP, had to rely on task performance rather than encourage the process of idea generation. And Teacher E's specialty in English made him believe that being able to describe an idea is equal to understanding the idea itself. Thus, while all these five teachers knew the basic procedures of implementing Think-Pair-Share, they failed to comprehend the epistemic function of this activity within the context of science teaching.

Indeed, the teachers examined in this study possessed some knowledge of the procedural side of Think-Pair-Share. However, the lack of specialized knowledge prevented them from using the technique effectively to foster their students' conceptual understanding and encourage critical thinking. Instead of focusing on the cognitive aspect of Think-Pair-Share, teachers reverted to the norms of instruction that prevailed in their respective domains, such as Mathematics or English. In other words, they applied the structure of the cooperative learning strategy without taking into account its role in science instruction.

This study strongly supports the findings of the literature on challenges faced by out-of-field teachers. As was stated earlier, one of the key difficulties related to out-of-field teaching consists in bridging the so-called epistemic gap, i.e., gaps in knowledge of how scientific information is produced in different disciplines. It is demonstrated that not only did biology and chemistry teachers assigned to teach physics suffer from the lack of subject matter knowledge but they also experienced epistemological barriers associated with the need to adapt to a new discipline's unique approach to generating scientific knowledge, which was termed "epistemic gap". Following their boundary-crossing framework, the researchers concluded that teachers were inclined to draw on familiar epistemic resources of their respective domains, e.g., mechanistic reasoning in case of biology teachers or observation in case of chemistry teachers rather than fully adopt physics-specific deductive practice. This corresponds to how Teacher E prioritized skills

in presentation from his English specialization and Teacher C insisted on a correct answer from Mathematics. The preference for conventional strategies is consistent with the findings of Sengschmid (2025) who pointed out that out-of-field teachers find it difficult to relate concepts to students' previous knowledge and establish connections between scientific notions because of low content knowledge and poor motivational orientation. Moreover, according to Singh's (2021) dissertation research, out-of-field science teachers showed less developed enacted PCK, i.e., a higher degree of inconsistencies in pedagogical techniques compared to in-field teachers. In spite of similar teaching experience, they were unable to develop pedagogical routines as fast as their colleagues. It can be assumed that this finding can be expanded to explain the inability of out-of-field teachers to effectively implement science-related techniques.

It was suggested that PD in the district should concentrate not only on introducing new pedagogical techniques but also on enhancing teachers' knowledge of how to use them properly in science classrooms. Therefore, the idea was to conduct coaching sessions on the pedagogical content knowledge of each stage of a cooperative learning strategy such as Think-Pair-Share.

Different Simulation Activities

Through the conduct of simulations by the teachers, the following strengths were evident that can be traced back to their original fields of specialization. The first is teacher A from Filipino who has the ability to incorporate her knowledge in Filipino in developing simulations that are highly participatory and story-based to engage students through interaction. Another strength is teacher B from Filipino who had the ability to foster an environment where students feel free to participate in a qualitative discussion. The next one is teacher C whose knowledge in mathematics helped him come up with highly logical and parameterized simulations. Then, there was teacher D from EPP who had the ability to do physical manipulation through simulations due to his field of specialization. Finally, teacher E from English has the capability to conduct a discussion that helps students describe things.

"I built personalities for the animals and created dialogues for them, and all of a sudden, the students were debating about food chains in such passion as if they were watching an entertaining telenovela," Teacher B said, describing the class atmosphere during the discussions. "I ensured that each student can talk about what they saw freely and confidently without fear of being judged, and they began seeing aspects of the simulation that I didn't see myself," Teacher C revealed regarding his simulation activities. "I drew the chart for all variables and potential outcomes before designing the simulation to ensure the students will not feel confused," Teacher D revealed about his design of the simulation. "While the other teachers were lecturing on the water cycle, I was already trying to figure out ways to construct a miniature version of the model," Teacher E said about his contributions during the lesson.

These strengths did not constitute generalizable skills but rather involved the direct transfer of specific pedagogical content knowledge from the teacher's discipline to the classroom setting in which the lesson takes place. Teacher A and B's strengths in terms of creating engagement and discussion arose from the emphasis on dialogue and narrative that constitutes the foundation of the humanities classroom, which creates an atmosphere devoid of anxiety and thus open to exploration. Similarly, the logical framework utilized by Teacher C came straight from mathematics, which provided the necessary mental model. The practical, results-oriented focus of Teacher D's teaching is rooted in the principles of EPP and makes science real for students. In a similar fashion, the use of descriptive language by Teacher E was facilitated by her background in language arts. Overall, one can say that out-of-field teachers have many valuable instructional capabilities that are applicable to certain stages of science instruction.

In turn, this implies that the greatest strength of out-of-field teachers lies in their deeply entrenched pedagogical expertise associated with their own disciplines. This allows them to excel at the "Engage," "Explore," and "Elaborate" stages of science instruction and provides them with crucial tools for the effective performance of their duties. Thus, becoming an out-of-field teacher should not be viewed only as a liability but rather as a source of valuable transferable teaching skills. If these skills are supplemented by adequate content knowledge, a much more integrated science instruction will be provided to Filipino children, placing emphasis on not only process and output but also understanding.

These findings support the theoretical premises put forth in studies on "Gains from Becoming OOF Teachers," such as the development of pedagogical versatility and the acquisition of transferable teaching skills. The skills and competencies demonstrated by the teachers under study represent the "pedagogical versatility" described by the literature. At the same time, their ability to engage students and promote discussion in a way similar to what would take place in the original specialty represents the acquisition of "soft skills" mentioned by Singh (2021). The results provide further evidence of how these skills become manifest in the classroom practice of out-of-field elementary science teachers in the Philippines.

It was recommended that the professional development program used in the district adopt an asset-based approach that allowed teachers to leverage their unique pedagogical strengths associated with their original specialization. Instead of focusing on content remediation, collaborative planning sessions could involve a concerted effort to incorporate teachers' abilities at creating narratives, managing discussions, using logic, conducting hands-on activities, and encouraging students to communicate effectively.

Mirroring Strategy

On the use of the Mirroring Strategy, each teacher had some deficiencies based on their initial expertise. For instance, Teacher A, who was of Filipino ethnicity, concentrated too much on grammar by restating the responses of her pupils word-for-word or transforming them into complicated sentences, thus failing to utilize scientific

vocabulary or deepen concepts. Teacher B, another Filipino, did the same thing. Teacher C, an expert in Mathematics, hurriedly converted pupil responses into symbolic representations without verifying the logic of their words, hence demotivating learners from explaining their scientific views. On his part, Teacher D, an EPP specialist, used the mirroring technique solely as a procedure that only verifies the steps taken without questioning the science involved. Lastly, Teacher E, an English specialist, tended to enhance pupil language by using high-level vocabularies, thus distorting their initial responses and assuming superiority in matters of language.

"I would keep on saying their answers again, but now in full sentences, and I realized after a while that I cared more about how they talked than what they tried to figure out.' The same problem arose for Teacher B, who explained, 'So interested I was in how well they could put their observation into words, I forgot all about asking them why the leaf turned red; all I did was help them put their words into better ones.' Teacher C explained his mathematics lesson in this way, 'The moment one student said the pattern he saw, I would jot down its mathematical equation without even listening to him fully.' The teacher continued with, 'What I wanted to do was help him learn by showing the mathematical formula straightaway, but the children became so indifferent to speaking things out, knowing that all I did was give them figures.'"

The aforementioned deficits indicated a systematized pattern of the transfer of pedagogical content knowledge from the original discipline taught by each teacher to the science class. Consequently, it led to creating mismatches between the way the strategy should work in science lessons and the goals of the scientific discourse in elementary school. In the case of the Filipino specialists, their emphasis on correct grammar and vocabulary implied that the teacher had a humanities background and, thus, viewed language more from the perspective of literary accuracy than from the viewpoint of exploring scientific phenomena. Meanwhile, the Mathematics specialist tended to rush towards symbols, depriving students of the opportunity to discuss scientific concepts and construct knowledge. For her part, the English specialist seemed to consider herself the arbiter of language accuracy, which led to a failure to encourage genuine student agency in discussions. Thus, the observed tendencies indicate that OoFT default to the instructional paradigms established in their original discipline.

One could conclude that OoFT face difficulties not only with lacking science content knowledge but also with lacking specialized knowledge of implementing particular instructional strategies for the purposes of fostering scientific discourse. As a result, their implementation is often biased towards the use of language in a traditional way instead of encouraging exploration of scientific concepts. In other words, OoFT tend to perceive science as a subject similar to their own discipline, applying pedagogical habits learned while teaching their original speciality in ways that are not aligned with the aims of science instruction.

Literature published from 2021 to 2026 provides extensive support to the main

conclusions reached in this study. First, it is shown that early career out-of-field physical science teachers exhibit lower levels of ePCK, meaning that they apply instructional strategies in ways that are inconsistent with teaching science. For instance, according to Singh, Luft, and Napier (2021), OoFT apply strategies in ways that fail to reflect disciplinary ways of knowing and thus to help students explore phenomena (such as mirroring). Secondly, Perl-Nussbaum and Schwarz (2025) introduce the notion of an "epistemic gap," showing that OoFT face a fundamental mismatch between epistemic norms associated with science teaching and those pertaining to their original discipline (and, accordingly, instructional strategies used in that case). Finally, this elaborate further and emphasize the importance of recognizing the necessity to know a subject's disciplinary ways of knowing, doing, and being, thus supporting the need for professional development focused on addressing this gap.

Therefore, it is recommended that PD courses for OoFT in the district include training aimed at helping teachers recognize that their use of strategies is often guided by habits formed when teaching their original disciplines. In particular, it was proposed to engage participants in self-analysis of their own practice through viewing videos of themselves while teaching science and working through reflective practices centered around the actual goal of using such instructional strategy as mirroring.

Hands-on Learning & Experiments

Various major weaknesses among the teachers in the application of hands-on learning were uncovered. Teacher A encountered difficulties in managing the class during hands-on learning and tended to rush through the experiments conducted, thereby hindering the understanding of basic concepts by the learners. Teacher B often skipped conducting safety instructions and linking the physical activity to the scientific theory behind it. Teacher C found it difficult to develop suitable activities for learners of that age group and guided them too much, thus restricting their problem-solving and decision-making skills. Teacher D always underestimated the time needed for preparation and ended up with inadequate resources, failing to analyze the information gathered from the activities conducted.

"Teacher A confessed his problems with the management of activity, saying, "When I distributed the materials, there was an increase in noise, I panicked, and I just told them to quickly copy everything." Teacher B explained that he had problems in terms of safety control, "I found during the activity that I have forgotten to warn them about the hot water, moreover, I was not able to explain to them the reason for which they should conduct the experiment." Teacher C shared her difficulties in terms of task development, "Initially, I wanted to help them, but having conducted the activity, I learned that I had prepared all for them." Teacher D admitted the mistakes in the preparation for the activity, "I believed that there were enough batteries for everyone, but I have made a mistake; and after the correction, a bell rang, and we could not discuss anything related to the content of the activity." Teacher E confessed that she was unable to adapt

to unexpected situations, "When the microscope failed to work according to the instructions, I just advised to imagine that they saw what they were supposed to."

The observed weaknesses show that the main problems experienced by out-of-field teachers in teaching hands-on science arise due to the transfer of their instructional methods from other subjects to the science class and create crucial mismatch between inquiry-based learning and teacher habits. Thus, Teacher A's need for control and linear progress and Teacher C's excess of assistance indicate teachers' inclination toward an outcome-oriented approach associated with disciplines such as Mathematics, while Teacher B's neglect of safety instructions and connection with theory reflects a procedural attitude that characterizes engineering education practices. The deficiency of material resources and inability to synthesize ideas in Teacher D indicates teachers' underestimation of the complex of procedures related to hands-on learning. Finally, the inability of Teacher E to respond to unexpected results is typical for out-of-field teachers who feel anxious about the situation and have low self-efficacy, which occurs when teachers have insufficient content knowledge.

In conclusion, the most important problem with hands-on learning for the teachers is a deficiency in the understanding of how hands-on learning is used for educational purposes. These teachers view these activities as events that should be managed rather than lessons, and hence, they try to make them easier and faster. Hands-on learning seems more suitable for teachers trained in other areas due to being seen as exercises similar to those typical for such disciplines as Mathematics and EPP, rather than authentic inquiries in which uncertainty and discovery play central roles.

These observations are consistent with many recent findings of research on this topic. Thus, out-of-field teachers avoid experiments because such activities are risky in terms of exposure of gaps in content knowledge and the need for more effort to ensure positive outcomes. Similarly, Feille (2021) found out that out-of-field teachers are reluctant to use various ways of presenting content and tend to avoid practical activities due to a lack of confidence in their knowledge. Finally, it showed that the ability of out-of-field teachers to implement outdoor lessons depends on their content knowledge and pedagogical skills.

Therefore, it is recommended that the professional development program in the district involve practice-based training in hands-on science instruction. Specifically, it would be useful to provide out-of-field teachers with mentoring on preparing science lessons, safety guidelines, and methods of facilitating students' discovery in class. Also, it would be helpful to allocate additional time for teachers to prepare for hands-on lessons and coordinate their ideas with other teachers. Additionally, watching and analyzing other professionals' practice via video may improve teachers' adaptability when implementing these techniques.

Conclusions

Research Objective

To analyze the Teaching Strategies of Out-of-field Elementary Science Teachers in the Calabanga West District.

1. Reciprocal Teaching fails to function as a science-specific text processing strategy when teachers apply narrative-based epistemological frames instead of inquiry-oriented frames.
2. The 5E model loses its inquiry-based learning cycle function when teachers transfer procedures from their home disciplines (mathematics computation, language presentation, practical arts) into the Explore and Elaborate stages.
3. Lead-learner strategies do not promote scientific discussion or hypothesis testing because teachers reframe peer leadership through their original discipline's authority structures (storytelling correctness, mathematical precision, material management, linguistic eloquence).
4. Inquiry-based learning ceases to function as scientific inquiry when teachers translate it into their home discipline's familiar operations (narrative construction, calculation, procedure execution, terminology acquisition).
5. Think-Pair-Share does not achieve its social-constructivist function for science conceptual learning because teachers apply the strategy's steps without its epistemic basis—using peer interaction for conceptual negotiation.
6. Simulation activities can function as effective science teaching tools when teachers are allowed to transfer their home discipline skills (storytelling, logic, hands-on manipulation, descriptive language) into specific phases of science instruction.
7. Mirroring fails to support scientific language development because teachers reframe it as a tool for enforcing home discipline norms (linguistic correctness, mathematical abstraction, procedural compliance) rather than negotiating meaning in science.
8. Hands-on learning becomes an avoided or ritualized activity because teachers view experiments through a task-completion frame from their home disciplines (mathematics outcome orientation, procedural emphasis) instead of an inquiry-based discovery frame.

Recommendations

1. Professional development on Reciprocal Teaching in science must explicitly train teachers to replace narrative coherence tasks with causal questioning and speculative predicting, using non-literary scientific texts.
2. Training on the 5E model for out-of-field teachers should require step-by-step micro-teaching of the Explore and Elaborate phases, with explicit prohibition of pre-teaching vocabulary before exploration and mandatory concept articulation after hands-on tasks.

3. Lead-learner implementation guidelines must specify that lead-learners are trained to pose open-ended questions and facilitate idea testing, and that teachers receive observation checklists distinguishing procedural delegation from inquiry facilitation.
4. Inquiry-based learning modules for out-of-field teachers should require explicit articulation of experimental variables and explanation phases before any hands-on or computational activity, using structured inquiry templates that block disciplinary transfers.
5. Implementation protocols for Think-Pair-Share in science must mandate a minimum Think time, ban translation/grammar correction during Pair, and require Share criteria based on scientific idea accuracy, not language fluency.
6. Professional development should adopt an asset-based approach that deliberately maps each teacher's home discipline strength (e.g., narrative for Engage, logic for Explore, hands-on for Elaborate) into simulation design, rather than requiring pure science content remediation.
7. Mirroring training for science classrooms must replace grammar and symbolization rules with science-specific reflection prompts (e.g., "Restate the evidence, then restate the claim") and require teachers to practice mirroring without correcting language form.
8. Hands-on science training for out-of-field teachers must include practice-based modules on managing scientific uncertainty, safety integration, contingency planning for unexpected results, and requiring post-experiment explanation before any calculation or worksheet.

Compliance with Ethical Standards

The researcher communicated with the targeted schools in the Calabanga West District and reached out to the Public Schools District Supervisor to present the aim of the study and seek permission to do it. There was agreement between the researcher and the Public Schools District Supervisor to keep confidential the data to be gathered from the interviews, wherein the names of the participating schools will never be mentioned in any form of documentation. This was done for ethical purposes and to ensure that there would be no breach of trust between the researcher and the education institutions involved. In line with the guidelines set forth by the Data Privacy Act, all identifying information like the names of the teachers and students were redacted from the data entries when interpreting the results. All data were stored on a password-protected device. The researcher retained the data until the completion of the thesis and later disposed of all files in permanent form either through deletion or destruction. The researcher made known to all participants that they have the right to refrain from participating in the study or withdraw anytime without explanation if ever they feel uncomfortable with the procedure and the questions asked. If the participants decide to leave, then the collected data from them will be disregarded.

Acknowledgments

Above all, the researcher acknowledges with deepest gratitude those who made possible this journey. Without their encouragements, advice, and assistance, it is impossible that the researcher could finish this thesis with meaning, challenge, and satisfaction.

The researcher thanks Almighty God, Our Yeshua, Our Yahweh, whose grace, mercy, and blessings were instrumental in all the challenges along this journey. Indeed, without His divine intervention, wisdom, and strength, this dissertation cannot come about. As promised in Isaiah 60:22 "When the time is right, I, the Lord, will make it happen." Indeed, His word was fulfilled during His perfect timing. The researcher also thanks the University of Nueva Caceres for providing an education that encompasses not only acquisition of knowledge, but formation of character, value, and identity.

The researcher expresses sincere thanks to Dr. Vivian Fortuno, the OIC-Dean of the School of Teacher Education, University of Nueva Caceres, Naga City, for wise guidance and blessing on this study. The researcher's sincere appreciation also goes to the panel of experts for sharing their wealth of knowledge and valuable insights during the consultation for this dissertation.

The researcher's sincere thanks go out to the adviser, Dr. Bryan J. Nobleza, for his wise guidance and valuable insights, for his expert assistance, and dedication throughout the preparation of this dissertation. Thank you for his time, valuable insights, patience, and for driving the researcher towards excellence. The researcher's sincere thanks go out to him for his trust in the researcher's potential which gave the researcher the strength to finish this dissertation with success.

The researcher's sincere thanks go out to the university validators, Ma'am Erica Enalpe, MaEd, University Guidance Counselor, and Ma'am Andrea Mae T. Guerrero, University Research Specialist/Psychometrician.

The researcher extends gratitude to the beloved family—Mama Armi, Kuya Erms Rj, Biboy, and Bunsoy Cedic—for all their unselfish love, patience, and trust in the researcher. The researcher is very thankful to them for sacrificing their time and for encouraging the researcher to keep on going even during difficult times. It is because of them that the researcher continues to do best every day.

The researcher's sincere thanks go out to the PSDS, Ma'am Ana N. Calisura, and the school head, Ma'am Rochelle M. Delos Santos.

Last but not the least, the researcher expresses gratitude to the partner, Glenda A. Zacal, for all her love, understanding, strength, and encouragement during the challenging times of this dissertation. For all her emotional, mental, and moral support which gave the researcher strength to move forward whenever feeling like stopping. Indeed, this accomplishment belongs not only to the researcher but equally to her. It is through her and her continuous encouragement, understanding, and faithfulness towards the researcher's dream and aspiration that the researcher is able to achieve this meaningful milestone.

The researcher's heartfelt thanks go out to all dear co-teachers and friends for their love and continuous motivation during the entire duration of this research. It must be made clear at the outset that this dissertation would not come into existence without the love, guidance, and inspiration from all those people who believe in the researcher. Each word,

insight, and accomplishment contained in these pages represents the love, wisdom, and inspiration from each one of them. Thank you very much for believing in the researcher and encouraging the completion of this thesis with success.

REFERENCES

- Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, 84(2), 191-215. <https://doi.org/10.1037/0033-295X.84.2.191>
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77-101. <https://doi.org/10.1191/1478088706qp063oa>
- Co, A. G., Abella, J. C., & Santos, R. M. (2021). Science teachers teaching out of specialization: A multiple case study. *Science Education International*, 32(3), 234-245. <https://doi.org/10.33828/sei.v32.i3.6>
- Du Plessis, A. E. (2021). Out-of-field teaching: A longitudinal study of teacher experiences. *Teaching and Teacher Education*, 105, 103-118. <https://doi.org/10.1016/j.tate.2021.103421>
- Feille, K. K. (2021). Out-of-field science teachers and their use of inquiry-based instruction. *School Science and Mathematics*, 121(4), 212-223. <https://doi.org/10.1111/ssm.12467>
- Fusch, P. I., & Ness, L. R. (2015). Are we there yet? Data saturation in qualitative research. *The Qualitative Report*, 20(9), 1408-1416. <https://doi.org/10.46743/2160-3715/2015.2281>
- Hobbs, L., & Porsch, R. (Eds.). (2022). *Out-of-field teaching across teaching disciplines and contexts*. Springer. <https://doi.org/10.1007/978-981-16-9328-1>
- Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge University Press. <https://doi.org/10.1017/CBO9780511815355>
- Luft, J. A., & Hewson, P. W. (2022). Effective science teaching: A review of the literature. *Journal of Research in Science Teaching*, 59(4), 567-598. <https://doi.org/10.1002/tea.21745>
- Polkinghorne, D. E. (1995). Narrative configuration in qualitative analysis. *International Journal of Qualitative Studies in Education*, 8(1), 5-3. <https://doi.org/10.1080/0951839950080103>

APA Citation:

Bayonito, R. E., & Nobleza, B. J. (2026). OUT-OF-FIELD ELEMENTARY SCIENCE TEACHERS: A NARRATIVE INQUIRY. *Ignatian International Journal for Multidisciplinary Research*, 4(5), 1720–1751. <https://doi.org/10.5281/zenodo.20265237>

rozenith.bayonito@unc.edu.ph
noblezabryanj18@gmail.com