

Exploring Filipino Science Teachers' Meta-Strategic Knowledge In Differentiating Instruction In International Classrooms

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Abstract

This phenomenological study explored Filipino science teachers' experiences in applying meta-strategic knowledge in international classrooms, its significance in differentiation, the contextual factors influencing its application, and their reflective insights. Utilizing a qualitative phenomenological approach, data were gathered through semi-structured interviews with six Filipino science teachers teaching in international or multicultural settings in New Mexico, USA. Data were analyzed using thematic analysis guided by Moustakas' framework, including horizontalization, clustering of meanings, and synthesis of themes. Findings revealed that teachers experience meta-strategic knowledge as a dynamic, self-regulatory, and context-sensitive instructional competence that guides planning, decision-making, adaptation, and reflection. Teachers described designing differentiated lessons with multiple access points, selecting strategies based on evidence of student learning, and adapting instruction in real time when students show confusion or misconceptions. Meta-strategic knowledge was also viewed as essential for inclusive differentiation, enabling teachers to support diverse learners and ensure access to rigorous content. Its enactment was influenced by contextual factors such as learner diversity, institutional expectations, curriculum requirements, and resource availability. Teachers further reported that meta-strategic knowledge develops through professional experience and reflective practice, becoming internalized as guiding principles shaping their professional identity. Based on these findings, the study proposes the Meta-Strategic Knowledge for Differentiated Teaching in International Classrooms (MSK-DTIC) Framework, a four-domain cyclical process consisting of Intentional Design, Evidence-Based Decision Making, Responsive Adaptation, and Reflective Reconstruction, with implications for teacher education and professional development.

Keywords: differentiated instruction, Filipino teachers, international classrooms, meta-strategic knowledge, phenomenological study, teacher decision-making

1. Introduction

The global education sector continued to face a pressing need for qualified science teachers, especially in STEM (Science, Technology, Engineering, and Mathematics) subjects. Many countries responded to this shortage by hiring international teachers who brought both subject expertise and instructional flexibility. Among these educators, Filipino teachers were increasingly sought after for their strong academic backgrounds, English proficiency, and ability to work effectively in multicultural environments. Their migration to international schools, especially in countries such as the United States, the United Arab Emirates, China, and other parts of Asia, reflected a growing reliance on globally mobile teaching professionals to meet the demands of science education. International classrooms, however, presented unique challenges. Teachers were expected to engage students from diverse linguistic, cultural, and academic backgrounds. These classrooms often included learners with varying degrees of English language proficiency, differing prior knowledge, and diverse learning preferences. Such diversity required educators to move beyond a one-size-fits-all approach and embrace teaching methods that responded to individual student needs.

Despite the growing body of literature on metacognition and differentiated instruction, there remained a limited understanding of how meta-strategic knowledge was enacted by Filipino science teachers in international and culturally diverse classrooms. Existing studies had largely focused on Western or local educational contexts and had paid insufficient attention to how teachers consciously regulated, adapted, and reflected on their instructional decisions while responding to linguistic diversity, varying student readiness levels, and unfamiliar educational systems. Furthermore, there was a lack of experience-based and context-specific frameworks that explained how meta-strategic knowledge operated in actual classroom practice rather than in theory.

Differentiated instruction (DI) is essential in this context, encouraging teachers to adjust content, processes, and outcomes based on student readiness and learning profiles through flexible, real-time instructional decisions. The success of DI depends on teachers' meta-strategic knowledge (MSK), defined as a component of metacognition involving awareness and regulation of teaching strategies to evaluate instructional effectiveness and support diverse learners. While general metacognition has been studied, limited research has explored MSK specifically among Filipino science teachers abroad implementing DI. This study addresses this gap by examining their lived experiences, offering insights to inform teacher education, professional development, and educational policies.

This study was grounded in a combination of metacognitive theory, differentiated instruction principles, and constructivist and cognitive learning theories, which together provided a lens for understanding how Filipino science teachers used meta-strategic knowledge to inform their instructional decisions in international classrooms. At the core of this study was the concept of meta-strategic knowledge (MSK), a key dimension of metacognition. Metacognition referred to the knowledge and regulation of one's cognitive processes and involved not only knowing

how to learn but also knowing when and why to use certain strategies (Schraw & Moshman, 2023). Building on this, meta-strategic knowledge was described as the ability to evaluate, monitor, and adjust strategies to fit specific learning situations (Dinsmore & Fryer, 2022). For teachers, MSK involved consciously choosing and adapting instructional strategies to students' needs, classroom dynamics, and learning objectives, making it a crucial component of reflective and responsive teaching.

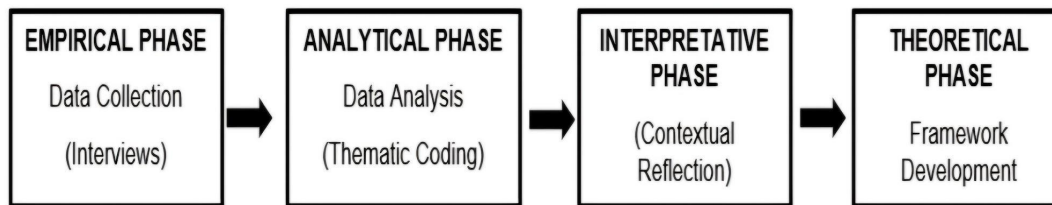


Figure 1: Theoretical Lens

The study also drew on Carol Ann Tomlinson's model of Differentiated Instruction, which emphasized that effective teaching required adjusting the content, process, product, and learning environment to meet learners' diverse needs. In addition, this research was informed by constructivist learning theories, particularly those advanced by Jean Piaget and Lev Vygotsky, which posited that learners actively constructed knowledge through experiences and interactions. Contemporary constructivist research continued to affirm that teachers served as facilitators who created meaningful learning opportunities tailored to students' backgrounds and needs (Khalil & Elkhider, 2021; Järvelä et al., 2023). Cognitive learning theories, such as those stemming from information-processing models, also highlighted the importance of the mental processes involved in learning, reinforcing the value of teachers' strategic awareness in choosing appropriate instructional methods (Mayer, 2022).

Statement of the Problem

Specifically, this study aimed to explore how Filipino science teachers working abroad used their meta-strategic knowledge to differentiate instruction in culturally and linguistically diverse classrooms, addressing the following corollary questions:

- How do Filipino science teachers describe their experiences in applying meta-strategic knowledge in international classrooms?
- What significance do Filipino science teachers attribute to their meta-strategic knowledge in the context of differentiation in teaching?
- What contextual factors influence the application of meta-strategic knowledge by Filipino science teachers in international classrooms?

- Based on the findings of the study, what meta-strategic knowledge framework may be proposed?

This study focused on exploring the meta-strategic knowledge of Filipino science teachers in the context of differentiated instruction (DI) within international classrooms. Specifically, it investigated how these teachers made conscious instructional decisions, adjusted teaching strategies, and responded to the diverse cultural and linguistic needs of their students. The research sought to understand the reflective practices and strategic thinking that guided their differentiation of science instruction.

2. Materials and Methods

This study adopted a qualitative phenomenological research design, aiming to explore and understand the lived experiences of Filipino science teachers working abroad. The phenomenological approach was suitable because it emphasized capturing the depth and richness of participants' personal insights regarding their application of meta-strategic knowledge in diverse classroom settings (Smith & Nystrom, 2021; Van Manen, 2021). This design facilitated an in-depth exploration of how teachers perceived, interpreted, and utilized their metacognitive strategies to differentiate instruction, aligning with the study's goal of uncovering nuanced thematic patterns in their instructional practices (Moustakas, 2021; Gallagher & Zahavi, 2021). The research employed a phenomenological framework that identified common themes across participants' narratives, providing insight into shared experiences and individual variations. This approach enabled a comprehensive understanding of the contextual and personal factors influencing their instructional decision-making.

The interviews were conducted online via video conferencing platforms and audio-recorded with the participants' permission. Each interview lasted approximately 30 to 45 minutes, during which the researcher asked open-ended questions and used probes to elicit rich, detailed responses. The interviews were transcribed verbatim, and participants were given the opportunity to review their transcripts for accuracy and to clarify or expand upon their responses if desired.

Data analysis followed Moustakas' (1994) phenomenological procedures, beginning with horizontalization, in which significant statements related to the experience of applying meta-strategic knowledge were identified and treated with equal value. These significant statements were then clustered into meaning units through coding and thematic grouping. The researcher examined patterns across participants' descriptions, organizing related meanings into thematic categories that reflected shared experiences. Both textural descriptions (what participants experienced) and structural descriptions (how they experienced it within their contexts) were developed. Through this process, themes emerged that captured how Filipino science teachers understood, enacted, monitored, and reflected upon meta-strategic knowledge in differentiating

instruction. The final step involved synthesizing these textural and structural descriptions to articulate the essence of the phenomenon.

3. Results

The demographic profile of the six co-participants revealed that they were Filipino science teachers employed in international schools in New Mexico, USA, with ages ranging from 30 to 40 years and teaching experience spanning 7 to 17 years. All participants held master's degrees and possessed multiple teaching licenses from various states or countries. They taught science at the fourth, fifth, sixth, and twelfth grade levels, representing diverse teaching contexts and experiences.

Analysis of participants' narratives regarding their experiences in applying meta-strategic knowledge (Corollary Question 1) revealed that teachers described meta-strategic teaching as an intentional, evidence-driven, and adaptive practice. Teachers consistently reported designing differentiated lessons with multiple access points, including visuals, sentence frames, vocabulary supports, guided notes, tiered tasks, and flexible grouping arrangements based on student readiness and language needs. Strategy selection was described as a deliberate process grounded in multiple sources of evidence, including student assessment data, learning objectives, language proficiency levels, prior performance, and real-time classroom observations. Teachers further described making immediate instructional adaptations when students demonstrated confusion or difficulty, including pausing lessons, remodeling concepts, shifting to hands-on activities, adding visuals, simplifying explanations, chunking tasks, reorganizing students into small groups, or providing more explicit modeling and support. These adjustments were consistently framed as strategic and deliberate responses to emerging learner needs rather than reactive or unplanned changes.

Regarding the significance of meta-strategic knowledge in differentiation (Corollary Question 2), teachers attributed strong importance to meta-strategic knowledge as a foundation for inclusive and intentional instruction. Participants described meta-strategic knowledge as enabling them to support diverse learners by matching strategies to readiness levels, language proficiencies, and learning needs. Teachers emphasized that meta-strategic knowledge supported intentional instructional decision-making, allowing them to purposefully choose and justify differentiation strategies rather than relying on routine or habit. They further viewed meta-strategic knowledge as enabling instructional flexibility and responsiveness, allowing them to anticipate challenges and adjust instruction based on student responses. Teachers also believed that meta-strategic knowledge helped ensure access and engagement for all students, allowing them to maintain rigorous expectations while providing differentiated support. Meta-strategic knowledge was therefore perceived not merely as a cognitive skill but as a form of professional

empowerment that connected intentional pedagogical thinking with responsive instructional action.

Concerning contextual factors influencing the application of meta-strategic knowledge (Corollary Question 3), teachers consistently identified learner-centered influences as the primary drivers of strategy modification. Student understanding, performance, engagement, language needs, and feedback served as the main sources of information signaling when instructional changes were necessary. Teachers described continuous monitoring of student responses and using this evidence to determine whether current approaches were effective. However, teachers also articulated significant challenges in enacting meta-strategic knowledge, including balancing diverse learning levels and language abilities, meeting lesson objectives while addressing individual needs, and managing constraints related to time, class size, and instructional resources. Institutional expectations, including curriculum standards, pacing guides, and administrative requirements, were described as both guiding and constraining instructional decisions. Teachers reported navigating these conditions by adjusting activities rather than changing entire lessons, prioritizing key concepts, making small modifications that aligned with standards, and exercising professional judgment within existing constraints.

Based on these findings, the proposed Meta-Strategic Knowledge for Differentiated Teaching in International Classrooms (MSK-DTIC) Framework (Corollary Question 4) conceptualized meta-strategic knowledge as a cyclical and self-regulatory instructional process consisting of four interconnected domains: Intentional Design, Evidence-Based Decision Making, Responsive Adaptation, and Reflective Reconstruction. Intentional Design captured how teachers planned instruction with awareness of learner variability, ensuring multiple access points through scaffolds, visuals, and tiered tasks. Evidence-Based Decision Making represented how teachers selected instructional strategies based on student data, learning objectives, and observed classroom responses. Responsive Adaptation captured how teachers monitored student understanding during instruction and adjusted strategies in real time by modifying explanations, representations, or grouping structures. Reflective Reconstruction represented how teachers evaluated the effectiveness of their instructional practices, identified gaps in learning, and refined future instruction through continuous reflection. These domains operated as a continuous cycle in which each phase informed and strengthened the next, with contextual factors including learner diversity, language and culture, curriculum requirements, and resource availability shaping the enactment of the framework.

4. Discussion

The findings of this study demonstrate that Filipino science teachers in international classrooms experience meta-strategic knowledge as a dynamic and adaptive instructional process that operates across both planning and enactment, aligning with Dinsmore and Fryer's (2022) characterization of meta-strategic knowledge as the deliberate selection, evaluation, and modification of strategies according to contextual demands. Teachers' descriptions of designing

lessons with multiple access points, selecting strategies based on evidence of student learning, and adapting instruction in real time when students showed confusion or misconceptions extend Zepeda et al.'s (2022) emphasis that metacognitive regulation enables reflective instructional decisions and responsive adaptations that address learner diversity. The finding that teachers viewed meta-strategic knowledge as enabling them to anticipate challenges, maintain flexibility, and ensure access to learning reinforces the work of Ituma (2025) and Morales-Doyle and Childs (2024), who emphasized that culturally responsive science teaching depended on teachers' abilities to connect instruction to students' backgrounds and continuously adjust learning experiences. Teachers' emphasis on maintaining common learning objectives while varying forms of support suggests that meta-strategic knowledge operated as a mechanism for equitable differentiation, supporting Nketsia's (2025) finding that inclusive teaching practices were strengthened when teachers intentionally modified instructional processes according to learners' varied needs while preserving academic rigor.

The influence of contextual factors on the enactment of meta-strategic knowledge confirms that instructional decision-making in international classrooms is shaped by the interplay of learner, institutional, and environmental conditions, consistent with Chen et al. (2022), UNESCO (2022), and Santoro et al. (2023). Teachers' descriptions of balancing diverse learning levels, managing time constraints, and navigating institutional expectations while maintaining instructional responsiveness illustrate that meta-strategic knowledge functions as a context-sensitive competence requiring continuous negotiation between instructional intentions and contextual possibilities. The proposed Meta-Strategic Knowledge for Differentiated Teaching in International Classrooms (MSK-DTIC) Framework contributes to the literature by providing a context-specific and experience-based model grounded in participants' lived experiences, extending Dinsmore and Fryer (2022) and Meutstee et al. (2023) by positioning meta-strategic knowledge as a cyclical process of Intentional Design, Evidence-Based Decision Making, Responsive Adaptation, and Reflective Reconstruction. This framework addresses the gap identified in existing scholarship where limited empirical research had examined how Filipino teachers consciously regulated, evaluated, and adapted their instructional strategies through meta-strategic knowledge while implementing differentiated instruction in multicultural science classrooms.

5. Conclusion

This study concluded that Filipino science teachers in international classrooms experience meta-strategic knowledge as a dynamic, self-regulatory, and context-sensitive instructional competence. MSK operates across a continuous cycle of planning, decision-making, adaptation, and reflection, enabling teachers to address learner diversity, language barriers, and multicultural classroom dynamics effectively. Teachers attribute profound significance to MSK as a foundation for inclusive differentiation, ensuring equitable access to rigorous science

content. Although enactment is influenced by learner needs, curriculum standards, and resource constraints, teachers successfully exercise professional judgment and adaptability.

The study established the Meta-Strategic Knowledge for Differentiated Teaching in International Classrooms (MSK-DTIC) Framework, comprising four interconnected domains: Intentional Design, Evidence-Based Decision Making, Responsive Adaptation, and Reflective Reconstruction. Based on these findings, it is recommended that teacher education programs explicitly integrate meta-strategic thinking, formative assessment literacy, and adaptive teaching into pre-service curricula; that school leaders provide supportive organizational conditions, collaborative planning time, and flexible pacing; and that professional development initiatives focus on cultivating teachers' meta-strategic capacity through coaching and professional learning communities rather than isolated workshops.

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