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Research Article

Reflective Practice and Emotional Engagement in Mathematics Education: A Case-Based Study of Situated Teacher Development in Latin America

Keila Chacón-Rivadeneira¹, Orlando García-Marimón², Luisa Morales-Maure³, Agustín Torres Rodríguez⁴

1. University of Barcelona, Spain

2. University of Panama, Panama City

3. University of Panama, Panama City

4. Atitalaquia Technological Institute, Mexico

Corresponding Author, Email: luisa.morales@up.ac.pa (Luisa Morales-Maure)



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Abstract. Introduction: In-service teacher training that explicitly addresses metacognitive and socio-emotional dimensions is essential for reimagining mathematics teaching in the 21st century. This multiple case study examines how a situated professional development program in mathematics education fosters reflective practice, emotional engagement, and didactic-mathematical competencies in two primary school teachers working in rural and semi-urban schools in Panama. Methods: Within the framework of the EDEM diploma program, based on the Didactic-Mathematical Knowledge and Competencies Model (DMKC) and the Onto-Semiotic Approach, we implemented a qualitative multiple case study design. Data included written responses to pedagogical tasks in four modules, reflective essays, video presentations of each teacher's final project, and institutional feedback. A

deductive coding scheme based on the six dimensions of the DMKC (epistemic, cognitive, affective, interactive, mediational, and ecological) was combined with an inductive thematic analysis of metacognitive regulation (planning, monitoring, and evaluation) and socio-emotional practices (empathy, resilience, and classroom climate). Three researchers independently coded the corpus and achieved inter-rater reliability (Cohen's kappa > 0.85). The study received approval from institutional ethics committees and the Panamanian Ministry of Education. Results: Both teachers showed development in epistemic, cognitive, and affective dimensions, with more modest progress in the mediational and ecological dimensions. They increasingly articulated self-regulated teaching cycles by planning lessons aligned with learning objectives, monitoring student thinking, and evaluating their pedagogical decisions. Socio-emotional evidence indicated greater empathy, concern for students' emotional safety, and resilience in the face of infrastructural and curricular barriers. The cross-case analysis revealed distinct DMKC profiles: one teacher excelled in maintaining classroom dialogue and developing strong relationships with students, while the other showed more pronounced progress in the cognitive and mediational dimensions, particularly in lesson design and the strategic use of teaching resources. Discussion: These findings suggest that professional development experiences based on daily practice and theory can jointly strengthen metacognitive self-regulation and socio-emotional competence in mathematics teachers. This growth appears to strengthen teachers' sense of empowerment and emotional commitment to their work. The study illustrates how contextualized programs like EDEM can foster systematic reflection on teaching and offer an analytical and humanizing process through which teachers examine their decisions, emotions, and interactions to strengthen their professional capacity and improve student learning experiences.

Keywords: Reflective Practice, Emotional Engagement, Teacher Development, Teaching Practice, Mathematics Teachers.

الملخص

المقدمة: تُعدّ برامج التنمية المهنية أثناء الخدمة التي تتناول صراحةً الأبعاد ما وراء المعرفية والاجتماعية-الانفعالية — ضرورةً لإعادة تصور تدريس الرياضيات بما ينسجم مع متطلبات القرن الحادي والعشرين. تهدف هذه الدراسة بوصفها دراسة حالات متعددة — إلى فحص كيفية إسهام برنامج تنمية مهنية متموضع في تعليم الرياضيات في تعزيز الممارسة التأملية، والانخراط الوجداني، والكفايات اليداكتيكية-الرياضية لدى معلمتين في المرحلة الأساسية تعملان المرتكز إلى نموذج المعرفة، EDEM في مدارس ريفية وشبه حضرية في بنما. المنهجية: أُجريت الدراسة ضمن برنامج دبلوم والمقاربة الأنطوسيميائية. وتم اعتماد تصميم نوعي لدراسة حالات (DMKC) والكفايات اليداكتيكية-الرياضية متعددة. شملت البيانات: إجابات كتابية عن مهام تربوية ضمن أربعة محاور/وحدات، ومقالات تأملية، وعروضاً مرئية (فيديو) (المشاريع الخارج لكل معلمة، إضافة إلى تغذية راجعة مؤسسية. وُجّع بين الترميز الاستنباطي القائم على (الإبستيمي، والمعرفي، والوجداني، والتفاعلي، والوسائطي، والبيئي) والتحليل الموضوعي DMKC الأبعاد الستة لنموذج الاستقرار الذي ركّز على التنظيم ما وراء المعرفي (التخطيط، والمراقبة، والتقويم) (الممارسات الاجتماعية-الانفعالية بصورة مستقلة، وبلغت موثوقية الترميز بين corpus (التعاطف، والمرونة، ومناخ الصف. (وقام ثلاثة باحثين بترميز المقيمين مستوى مرتفعاً) معامل كابا لكوهين > 0.85. (كما حصلت الدراسة على موافقات لجان الأخلاقيات المؤسسية ووزارة التربية في بنما. النتائج: أظهرت المعلمتان نموًا ملحوظًا في الأبعاد الإبستيمية والمعرفية والوجدانية، في حين كان التقدم أكثر تواضعًا في البعدين الوسائطي والبيئي. ومع تطور المشاركة في البرنامج، عبّرت المعلمتان بصورة أوضح عن دورات تدريس ذات تنظيم ذاتي من خلال التخطيط للدروس بما يتسق مع أهداف التعلم، ومراقبة تفكير التلاميذ وتقويم قراراتهما التدريسية. كما كشفت الأدلة الاجتماعية-الانفعالية عن ازدياد التعاطف والاهتمام بسلامة التلاميذ الانفعالية وارتفاع مستوى المرونة في مواجهة عوائق البنية التحتية والقيود المنهجية. وأظهر التحليل المقارن بين

؛ إذ تميّزت إحدى المعلمتين في إدارة الحوار الصفّي وبناء علاقات قوية مع التلاميذ DMKC الحالتين تبايناً في ملفات بينما برزت الأخرى في البعدين المعرفي والوسائطي، ولا سيما في تصميم الدروس والاستخدام الاستراتيجي لموارد التدريس. المناقشة: تشير النتائج إلى أن خبرات التنمية المهنية المرتكزة إلى الممارسة اليومية والمسنودة بإطار نظري يمكن أن تعزز التنظيم الذاتي ما وراء المعرفي والكفاية الاجتماعية-الانفعالية لدى معلمي الرياضيات. ويبدو أن هذا النمو يدعم فاعلية المعلمين المهنية والتزامهم الوجداني تجاه عملهم. وتوضح الدراسة كيف يمكن لبرامج سياقية مثل أن ترسخ التأمل المنهجي عبر عملية تحليلية وإنسانية يفحص فيها المعلمون قراراتهم وانفعالاتهم وتفاعلاتهم EDEM بما يسهم في تعزيز كفاءتهم المهنية وتحسين خبرات تعلم التلاميذ

كلمات المفتاحية: الممارسة التأملية، الكفايات الاجتماعية-الانفعالية؛ التنظيم ما وراء المعرفي، التنمية المهنية للمعلمين، تعليم الرياضيات

INTRODUCTION

Educational research in recent years emphasized the need to reconceptualise teacher preparation; that metacognitive and socioemotional development are fundamental aspects of professional learning, not mere sidebars (Morales-López, Breda, & Font, 2025; Pochulu & Moll, 2025). In mathematics education, growing evidence indicates that systematic reflection and persistent emotional awareness are a foundation for reshaping classroom contexts and deepening initiatives toward equitable teaching. It is pertinent in Latin America because significant differences in territory with heterogeneous school settings highlight the need for approaches to teacher education as being explicitly situated and as being responsive to local realities (Rodríguez-Nieto et al., 2025; Olivero-Acuña et al., 2025).

In Panama and across Latin America, the need for situated professional development is sharpened by persistent inequalities in mathematics learning and by the uneven conditions under which schools operate, particularly in rural and semi-urban territories. Large-scale assessments report performance gaps and highlight the importance of strengthening teachers' capacity to interpret students' thinking, to adapt instruction to local constraints, and to cultivate classroom climates that sustain motivation and belonging. These contextual challenges make it timely to examine professional learning models that explicitly integrate metacognitive self-regulation with socio-emotional competence. (OECD, 2023; UNESCO/OREALC, 2021).

This article reports a comparative multiple-case study of two in-service primary mathematics teachers who participated in EDEM (Estrategias Didácticas para la Educación Matemática), a situated professional development diploma designed by the GIEM21 research group in Panama. Grounded in the Didactic-Mathematical Knowledge and Competence model (DMKC) and the OntoSemiotic Approach to mathematics education, the programme supports teachers in analysing and redesigning instruction across six interrelated dimensions: epistemic, cognitive, affective, interactivational, mediational and ecological (Godino et al., 2015; Morales, 2023; Font et al., 2024). We examine how participation in EDEM promotes (a) teachers' metacognitive self-regulation planning, monitoring and evaluation of

instruction and (b) socio-emotional engagement, empathy, resilience and the intentional construction of a psychologically safe classroom climate as these are expressed through reflective practice and emotionally committed teaching. Accordingly, the guiding research question is: What role does a contextualized professional development programme (EDEM) play in shaping mathematics teachers' metacognitive self-regulation and socio-emotional engagement, and how are these changes reflected across DMKC dimensions in two contrasting school contexts?

The thought processes that play in and out on the pathways of the teachers are aligned with the metacognitive regulation that has been theorized as critical for the enhancement of teaching, planning, control, and evaluation of one's teaching (Zimmerman, 2002). At the same time, teachers' emotional responses to student needs, institutional limitations, and ongoing curricular changes highlight their socioemotional resilience (Nuñez-Gutierrez et al., 2025; Ledezma et al., 2024). The Latin American region provides a particularly resourceful setting in which to explore situated professional learning. Most rural and semi-urban schools also have few resources, yet teachers often show extraordinary initiative, creativity, and a sense of commitment to their students (Rodríguez-Nieto et al., 2025; Cantillo-Rudas et al., 2024). With the professional journeys of two teachers, Teacher A and Teacher B, serving as guiding frameworks, the analysis examines the ways that their emotional investments and reflective practices intersect and develop within their positions as mathematics educators.

Their stories, classroom artifacts and stories of practice empirically support the importance of foregrounding the socioemotional and metacognitive contexts in teacher education (Morales-López & Font, 2024). Developed by the GIEM21 research group in Panama, the EDEM program is one of the first efforts in Latin America to prioritize theoretical rigor and reflective pedagogy in mathematics teachers' continuing education. Following the DMKC model, EDEM focuses on designing contextualized tasks, structured research of classroom teaching experiences as well as peer discussion to develop metacognitive cognition.

Recent work in Panama (Morales-Maure et al., 2025) has begun to document teacher development across extended implementations of mathematics professional development, including multi-year analyses of EDEM cohorts and program redesign cycles that provide population-level indicators of perceived growth and program impact. However, large-scale or longer-horizon evidence does not fully capture the micro-processes through which individual teachers regulate instruction, negotiate socio-emotional demands, and recontextualize didactic decisions in specific school settings. The present multiple-case qualitative study therefore complements these broader longitudinal mappings by offering an in-depth, practice-based account of how metacognitive self-regulation and socio-emotional engagement are enacted and transformed in two contrasting contexts.

Its ability to establish mathematics-neuro-mathematical connections has attracted attention in recent studies (Rodríguez-Nieto et al., 2024) and assists teachers in designing teaching activities that are didactic uses of artificial intelligence tools (Pochulu & Moll, 2025). From this point of view, EDEM can be seen as the junction of theoretical and socially responsive pedagogical practices. In this respect,

the study's guiding question is: What role does a contextualized professional development programme play in shaping metacognitive and socioemotional development of mathematics teachers? Using a qualitative case study model informed through extensive documentation reflective tasks, institutional feedback and classroom-based contexts, this article aims to contribute to the debates around redefining teacher education for the 21st century. The results seek to support regional policy and contribute in further international debates on how teacher education models might be designed which are grounded in context, emotionally activated and pedagogically sensible.

Background

International organizations like the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the Organization for Economic Co-operation and Development (OECD) have argued since the 1990s that human development is not only an interplay of cognitive skills but also socio-emotional competencies (Lozano-Peña et al., 2022; Lozano-Peña, Sáez-Delgado, & López-Angulo, 2021).

The climate in the classroom improves and socio-emotional and academic outcomes are better when teachers can cultivate these competencies in students (Jennings et al., 2017). Several studies in recent years attempted to quantify or predict the various facets of socio-emotional competence, and several exemplary cases are given below. Aldrup et al. (2020) utilized the Test of Regulation and Understanding of Social Situations in Teaching (TRUST) to measure concepts as emotional regulation and relationship management, which are well-known as core aspects of socio-emotional competence.

Brown et al. (2020) combined rich semi-structured interviews and an emotional competence questionnaire to explore factors such as self-management, relationship management, self-awareness and awareness of others, and responsible decision-making. Chica et al. (2020), using Edgar Morin's complexity theory, employed field journals and open-ended questionnaires to examine different levels of emotional competence. Similarly, Knigge et al. (2019) examined variables including behavioral affective attitudes, the learning of affective attitudes, empathic concern, and student-teacher relationships through Jennings and Greenberg's (2009) prosocial classroom model. Together with more recent contributions affirming instruments specifically created for teacher socio-emotional skills (Sáez-Delgado, Mella-Norambuena, & López-Angulo, 2024), these studies highlight the importance of robust, contextually relevant measures to help guide teacher education.

Research on emotional competencies has relied upon several methodological approaches qualitative, quantitative, and mixed, and across studies results consistently demonstrate that the development of socio-emotional competencies has traditionally been less studied than cognitive capabilities. The evidence also indicates that these skills need to be bolstered through explicit teacher preparation so educators can design their own education plans promoting these competencies appropriately in their own classroom (Lozano-Peña et al., 2022; Lozano-Peña, Sáez-Delgado, & López-Angulo, 2023; Sáez-Delgado, Mella-Norambuena, López-Angulo, Hartley, & Sepúlveda, 2023).

Theoretical Framework

In The framework we utilize in this study is the Didactic–Mathematical Knowledge and Competence Model (DMKC), which explains teacher expertise in six intertwined dimensions or dimensions that are epistemic, cognitive, affective, interactivational, mediational, and ecological (Godino et al., 2015). Taken together, these dimensions form the complete framework for understanding how teachers design and execute the instructional process and how teachers subsequently reinterpret or revise their classroom practices. DMKC has developed into a well-established resource for measuring instruction appropriateness and for professional development, both pre-service and in-service settings (Morales-López et al., 2025).

The DMKC is based on the Ontosemiotic Approach (OSA) and extends analysis by interpreting teaching and learning as semiotic and institutional practices influenced by sociocultural and cognitive limitations. From an ontosemiotic perspective, the classroom constitutes a lively context where representations, practices, and meanings interrelate and change over time (Font et al., 2024; Morales, 2023).

To frame the school as an ecological and didactic setting in the Onto-Semiotic Approach, we adopt a systemic view that connects the system of practices, the onto-semiotic configuration of mathematical objects and meanings, the didactic trajectory enacted in instruction, and the normative dimension that regulates decisions and expectations. These components interact with curriculum, epistemology, tools and applications, providing an analytic lens for interpreting how teachers mobilize disciplinary knowledge, methodological skills and culturally relevant planning when designing learning environments that foster logical, critical and creative thinking. These analytical components are summarized in figure above (1).

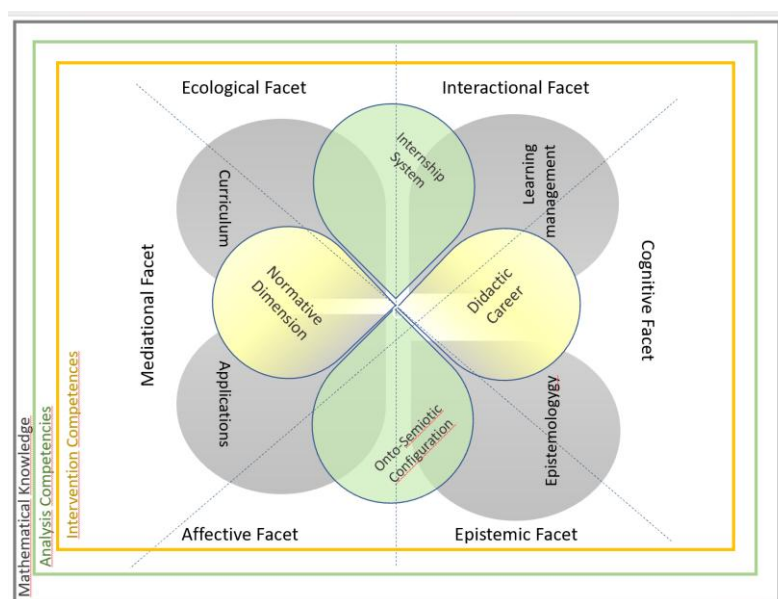


Figure 1. The School in the Onto-Semiotic Context: analytical components linking practices, onto-semiotic configuration, didactic trajectory, and normative dimension.

This point is especially relevant in areas that are diverse in culture and that experience ongoing social inequality, such as much of Latin America (Olivero-Acuña et al., 2025). Metacognition is a second key construct in this work. Effective teaching, as well as effective instructional strategy, relies heavily on teachers' self-regulation of their own instructional practice, informed by Zimmerman's (2002) argument through careful planning, ongoing monitoring, and follow-up evaluations of practice following instruction, which can be the key to teaching well! Indeed, these processes are intentionally woven throughout the construction of the EDEM program: teachers are challenged to clarify learning goals, predict students' possible reactions to the questions, and self-reflect on when and how they could impact their teaching decisions (Ledezma et al., 2024; Morales-López & Font, 2024).

This metacognitive dimension is supplemented by socioemotional competence. Which includes skills ranging from emotional regulation, empathy and resilience, and accumulating evidence indicates that teachers who build these skills are more capable of creating inclusive, supportive, equitable classroom spaces (Nuñez-Gutierrez et al., 2025; Cantillo-Rudas et al., 2024). As in the DMKC, these aspects are reflected primarily in the affective and interactional dimensions, all of which make emotional engagement and relational strategies intrinsic elements to teaching quality. Our theoretical framework integrates these constructs and enables us to examine how metacognitive reflection and socioemotional awareness develop in line and simultaneously within situated and culturally responsive design of the EDEM program. This dual perspective enriches prevailing debates and contributes to theoretical debates and provides empirical recommendations for enhancing mathematics teacher professional development in different educational settings.

Operationally, we use the term reflective practice to denote teachers' systematic analysis of instruction before, during and after classroom activity, grounded in evidence from tasks, student responses and teacher reasoning. Emotional engagement refers to teachers' explicit attention to affect in teaching recognising and regulating their own emotions, responding empathically to students, and intentionally cultivating a supportive classroom climate. In the analysis, metacognitive regulation is identified through traces of planning (goal setting and anticipation), monitoring (in-the-moment noticing and adjustment) and evaluation (post-lesson appraisal and redesign), while socio-emotional competence is identified through evidence of empathy, resilience and relational strategies that sustain students' participation.

MATERIALS AND METHODS

The development of this study took the form of a qualitative multiple-case study, an approach that allowed us to follow the process of professional learning in authentic school settings. This design was particularly appropriate given the situated nature of the EDEM diploma and its emphasis on classroom-based reflection and practice. Two participants, identified as Teacher A and Teacher B to preserve anonymity, were purposively sampled from the EDEM cohort during the study process. Eligibility criteria included complete participation in all four modules of the

program, successful completion of the final classroom-based project, and the availability of substantial written and audiovisual reflective materials. In line with qualitative case study methodology, the intent of the study is analytical rather than statistical generalization. This section details the research design, data sources, analytical procedures, and validation strategies employed in the study (see Table 1 for an overview).

Table 1. *Methodological Overview of the Study*

Methodological component	Description
Research approach	Qualitative, interpretive multiple-case study focused on teachers’ professional learning processes in authentic classroom contexts; analytical rather than statistical generalization.
Study context	EDEM continuing professional development diploma for in-service mathematics teachers; participants were required to be actively teaching in their own classrooms and to implement program tasks within regular instruction.
Participants	Two in-service mathematics teachers (Teacher A and Teacher B), purposively selected from the EDEM cohort based on full participation in all four modules, completion of the final classroom-based project, and availability of rich reflective data.
Data sources	(a) Written responses to pedagogical and mathematical tasks across the four EDEM modules; (b) reflective essays and classroom video recordings linked to the final project; (c) institutional feedback from school leaders and program evaluators.
Data collection principles	Naturalistic inquiry emphasizing ecological validity, preservation of teachers’ voices, and sensitivity to local classroom conditions (Lincoln & Guba, 1985).
Analytical framework (deductive)	Didactic–Mathematical Knowledge and Competences (DMKC) model: epistemic, cognitive, affective, interactivational, mediational, and ecological dimensions.
Analytical procedure (inductive)	Thematic analysis identifying patterns of metacognitive regulation (planning, monitoring, evaluation) and socioemotional practices (e.g., resilience, empathy, student engagement).
Analytical tools	NVivo qualitative analysis software used for data organization, coding, and retrieval.
Validation strategies	Data triangulation; independent coding by three researchers; iterative refinement of the codebook; audit trail; member checking with participating teachers.

Methodological component	Description
Intercoder reliability	Pairwise Cohen’s kappa calculated on overlapping coded segments; minimum kappa > .85; discrepancies resolved through consensus.
Use of visualizations	Descriptive qualitative visualizations derived from coded data; evidence synthesized into 1–5 qualitative ratings to support cross-case comparison (non-inferential).
Ethical considerations	Written informed consent obtained; anonymization of data; approval by the Comité de Bioética de la Universidad de Santander (CBI-USantander-M-045-2025).
Funding endorsement	and Funded by the Ministry of Education of Panama (VIEEX-1636-EDM) and endorsed by the Dirección Nacional de Formación y Perfeccionamiento Profesional (DNFPP).
Scope limitations	and Focus on teachers’ learning processes; validation using student achievement measures was beyond the scope of the study and is proposed for future research.

Nota. *The table summarizes the key methodological components of the study to support transparency and replicability.*

Centering these two cases provided the context for an in-depth exploration of a situated professional development program in mathematics education and its potential to foster metacognitive and socioemotional competences. The empirical corpus drew on three main sources of material: (1) written responses to pedagogical and mathematical tasks produced across the four EDM modules; (2) reflective essays and video recordings associated with each teacher’s final project, documenting classroom implementation and subsequent reflection; and (3) comments and evaluations from institutional actors, such as school leaders, who were familiar with the teachers’ instructional practices. Interweaving these materials enabled the reconstruction of each teacher’s professional trajectory and the articulation of contrasting perspectives on instructional decision-making. Data collection and organization followed the principles of naturalistic inquiry, with particular attention to preserving the specificity of teachers’ voices and the local conditions of their classrooms (Lincoln & Guba, 1985).

The analytical plan was carried out in two phases. First, a deductive coding scheme was constructed based on the six dimensions of the Didactic–Mathematical Knowledge and Competences (DMKC) model: epistemic, cognitive, affective, interactional, mediational, and ecological, which was applied systematically to the entire dataset. In the second phase, an inductive thematic analysis was conducted to identify recurring patterns related to metacognitive regulation (planning, monitoring, and evaluation) and socioemotional practices, including resilience, empathy, and strategies for student engagement. NVivo software was used to organize the materials and to support systematic coding across the full corpus.

To strengthen credibility, multiple validation strategies were applied. Three researchers from the GIEM21 research group independently coded overlapping portions of the corpus and compared interpretations in analytic meetings, leading to iterative refinement of the codebook. Intercoder agreement was examined on a shared subset of units of analysis; because three coders participated, Cohen's kappa was computed pairwise, and the minimum pairwise kappa exceeded 0.85. Remaining discrepancies were resolved through consensus, and an audit trail of coding decisions was maintained. A condensed version of the codebook and illustrative coding examples are provided in the Supplementary Material to enhance transparency and support replication. While EDEM has generated multi-year implementation evidence of scale, the present manuscript is intentionally bound to an intensive, in-program qualitative window focused on mechanisms of change rather than post-program sustainability.

To complement the narrative results, descriptive visualizations were produced from the qualitative coding. For Figures 2 and 5, the research team synthesized the coded evidence within each DMKC dimension into a 1–5 qualitative rating for each teacher (1 = emerging evidence; 5 = consolidated and consistent evidence across data sources). These ratings are intended to facilitate cross-case comparison and should not be interpreted as inferential statistics. For Figure 3, the same 1–5 qualitative rating approach was applied to recurring socioemotional themes across the four EDEM modules, drawing on all artefacts from both cases. Figure 3 presents a descriptive word-frequency visualization of socioemotional keywords extracted from coded segments after the removal of common stop-words.

Because the initial coding scheme was directly derived from an established theoretical framework (DMKC) and from prior research on metacognitive regulation and socioemotional competence, no separate content-validity study with an external expert panel was conducted, and coefficients such as Aiken's V were not computed. Future research that develops new instruments or evaluative rubrics within the EDEM program could incorporate larger expert panels and complementary indices of content validity alongside intercoder agreement measures.

Ethical considerations were addressed throughout the research process. Participants were informed of the study's objectives and provided written consent authorizing the use of their anonymized materials for research purposes. The study was approved by the Comité de Bioética de la Universidad de Santander (CBI-USantander, CBI-USantander-M-045-2025). Previous phases of the broader research project received approval under CBUP/448/2021, CBUP/279/2021, and CBUP/298/2019. The study was funded by the Ministry of Education of Panama (VIE-X-1636-EDEM) and endorsed by the Dirección Nacional de Formación y Perfeccionamiento Profesional (DNFPP, 267PC-2022-EDEM).

EDEM is a continuing professional development diploma designed for in-service mathematics teachers who are required to be actively teaching in their own classrooms throughout the duration of the program. It combines theoretical tools specifically the DMKC framework and the OntoSemiotic Approach with a cycle of situated task design, classroom implementation, and structured reflection grounded in teachers' own instructional practice. The diploma is organized into four

modules that progressively guide participants from (i) analyzing mathematical tasks to (iv) evaluating instructional decisions and producing a final classroom-based project. A central component of EDEM is systematic reflection on classroom experience, which supports the reinterpretation and refinement of teaching practices.

In line with this theoretical orientation, the methodological design sought not only to document observable instructional practices but also to elucidate the cognitive transformations and affective processes reported by teachers as they reflected on their classroom work. The structured artefacts generated within the EDEM program provided a particularly rich lens for examining how reflective and socioemotional dimensions of professional development emerge within situated, culturally responsive learning spaces. The methodological coherence between research design, analytical framework, and validation strategies is synthesized in Table 2.

RESULTS

Results by DMKC Dimension

The analyses of coded material showed different developmental pathways on the six DMKC axes. Improvements in epistemic, cognitive, and affective domains were the most strikingly evident for both Teacher A and Teacher B. At an epistemic level, teachers increasingly presented mathematical conceptions with greater clarity and were more explicit about the pedagogical reasons for tasks. In the cognitive domain, they enhanced their ability to recognize misconceptions students held and modified explanations, questions, or representations in response.

There were also changes in the affective dimension, with both teachers having more positive feelings attached to their teaching mathematics, and feeling more confident as mathematics teachers, more pleasant and engaged with the mathematics teaching content. The result of these changes was a more welcoming and comforting classroom environment. By contrast, development on mediational and ecological dimensions was uneven. While technological tools were employed to try to include and localize tasks, these efforts were less consistent.

The interactivational dimension was more differentiated; Teacher A used question tactics on dialogic interaction and promoted group action. Figure 2 summarizes these tendencies, with a comparative bar chart, and shows the relative strength of the EDEM program for promoting epistemic and affective development and suggests that mediational and ecological development could find stronger support and design refinement.

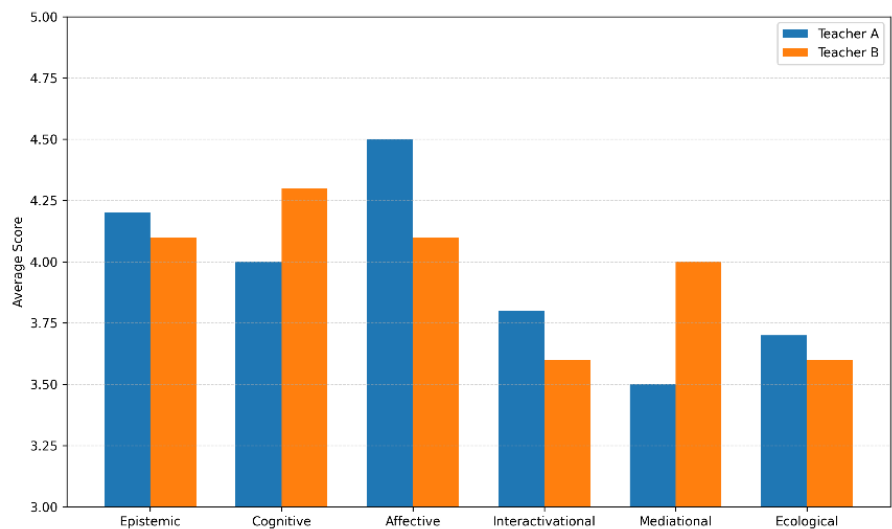


Figure 2: Descriptive DMKC profile by dimension for each case

Evidence of Metacognitive Development

Metacognitive growth was evident in both cases. As time passed, teachers started to plan tasks with a greater knowledge of what they were working at, expect student problems, and critically evaluate the efficacy of their teaching. This development is reflected in their journal entries and project reports, where they explained more the reasons why particular strategies were chosen, how lessons progressed, and what changes they decided to make to their approaches afterwards.

Teacher A, for instance, described cycles during which she developed a set of geometrical activities, tried them in the classroom and then made some focused adaptations after seeing points of confusion. Teacher B demonstrated a comparable scenario when editing a lesson focused on proportionality, customizing examples and explanations to integrate with student prior knowledge and everyday experiences. And in this process, such iterative changes reflect a growing ability to govern one’s teaching through the process of planning, supervising, and appraising.

Table 1. Chronological matrix of metacognitive regulation across EDEM modules for Teacher A and Teacher B

Modu le	Planning (Teacher A)	Monitoring (Teacher A)	Evaluatio n (Teacher A)	Planning (Teacher B)	Monitori ng (Teacher B)	Evaluati on (Teache r B)
Modul e 1	Identified student needs	Observed misconcepti ons	Reflected on student outcomes	Analyzed curriculum fit	Monitore d group work	Compare d results to goals
Modul e 2	Outlined learning goals	Collected student feedback	Discussed with peers	Designed context- based problems	Took anecdotal records	Student self- assessme nt

Module 3	Prepared visual aids	Adjusted pace	Reformulated activities	Selected manipulatives	Tracked task completion	Teacher journal entry
Module 4	Revised instructional materials	Noted engagement patterns	Confirmed strategy success	Aligned with assessment goals	Noted emotional responses	Presented summary video
Module	Planning (Teacher A)	Monitoring (Teacher A)	Evaluation (Teacher A)	Planning (Teacher B)	Monitoring (Teacher B)	Evaluation (Teacher B)

These processes are synthesized in Table 2, which outlines a chronological matrix of metacognitive action for each teacher (initial intentions, classroom events, and revisions followed).

Evidence of Socio-emotional Competencies

The socio-emotional component of teaching was also evident in the participants' reflections. Both teachers commonly said they cared for students' emotional health during mathematics lessons and described attempts to sustain motivation and create a sense of safety. Teacher A described game and small group work as helpful elements to de-stress and increase engagement. Teacher B identified attentive listening and deliberate exchanges of ideas as ways to develop trust with the students.

Table 3. Qualitative indicators by DMKC dimension for each case

DMKC Dimension	Teacher A	Teacher B
Epistemic	Strong conceptual focus	Consistent conceptual clarity
Cognitive	Student misconceptions addressed	Lesson structure improved
Affective	Empathy and motivation visible	Positive rapport
Interactivational	Dialogical strategies	Less dialogic interaction
Mediational	Moderate use of tech	Strong material use
Ecological	Limited contextual adaptation	Some ecological links

Table 3 presents qualitative excerpts from the teaching records, organized by DMKC dimension. This presentation highlights commonalities and differences in emphasis, as well as specific expressions of didactic-mathematical competencies in different contexts.

The patterns that emerge display interplay and overlap. Teacher A appears to have exceptional influence on the affective and interactivational dimensions, for instance when the relational dynamics and emotional support of the learning environment is part of the curriculum. Teacher B, by contrast, displays enhanced stability in the mediational and ecological dimensions and draws on material choices and tries to bring mathematics to the context of the students’ real lives. Despite strong epistemic and cognitive underpinnings, the reflections and enactment of the DMKC are dissimilar in focusing on different aspects to demonstrate how the DMKC framework provides for multiple levels of development within a common framework.



Figure 3: Most frequent socio-emotional keywords in the reflective corpus

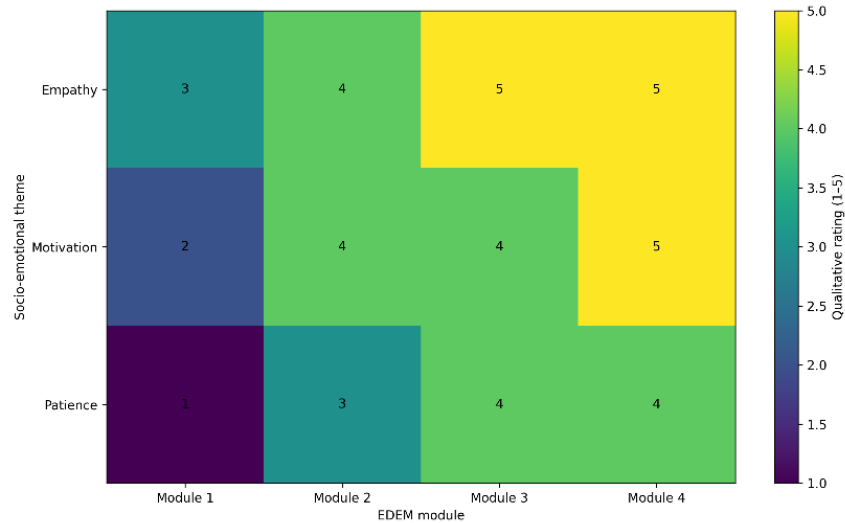


Figure 4: Module-by-module intensity of three recurrent socio-emotional themes across the combined dataset

Re-expression of resilience was also a common finding, especially on the days when teachers reported that they worked under constrained conditions, including with a lack of educational resources and also with the issues of remote teaching. They called for patience, calm and continued emotional presence in the absence of support from the institution. The reflective prompts and peer-discussions on EDEM also supported this understanding and created opportunities to explore what it is that we

were noticing that emotional experiences should be considered. This tendency is visualized in a word cloud with terms associated with emotion or relation issues (Figure 3) and in Figure 4, which shows a heatmap depicting socio-emotional engagement among program modules increases as compared with the modules implemented throughout the program.

Cross-Case Comparison (Teacher A vs. Teacher B)

Although both two participants showed growth in all of their DMKC dimensions, their developmental profiles differed. Teacher A exhibited significant gains in the affective and interactivational dimensions, including dialogic exchanges, questioning strategies, and emotionally responsive interaction. Teacher B, on the other hand, had more focus on the cognitive and mediational dimensions, where detailed planning and deliberate selection and adaptation of instructional resources were identified.

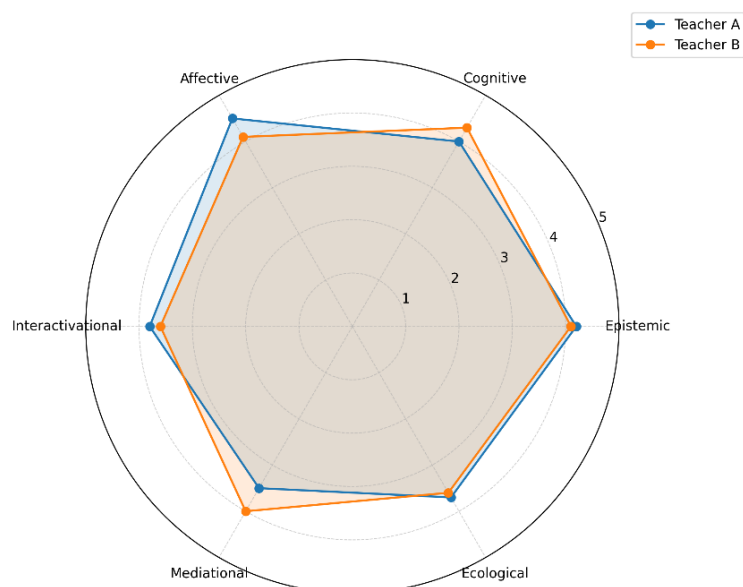


Figure 5: Radar representation of the descriptive DMKC profile for Teachers A and B.

These comparisons reflect the role of personal histories and teaching circumstances in the construction of professional learning. Such an implementation would also have, in their opinion, been supported by the fact that the EDEM program provides ample teachers' flexibility to tailor the structure to their own circumstances. Comparison of the side-by-side profiles is presented in Figure 5, a radar chart, allowing these tendencies to be brought to the surface. The visualization is complemented by qualitative indicators that are presented in Table 3 for each dimension.

A) Mediatonal + socio-emotional classroom design (Teacher A). Teacher A connected the mediational dimension to the use of diverse, "potentially meaningful" resources linked to students' prior knowledge and interests. In classroom management, Teacher A emphasized autonomy (individual and group

work) and collaboration as a bridge from individual effort to cooperative learning toward shared goals, proposing differentiated grouping and roles to accommodate heterogeneous learning rhythms.

- B) Metacognitive regulation through problem solving (Teacher A). In the classic “chickens and rabbits” task, Teacher A documented an initial attempt, recognized its insufficiency (“it becomes difficult... I desist”) and designed an alternative procedure that led to a correct solution. This pattern reflects monitoring, evaluation and strategic regulation, consistent with the reflective-practice focus promoted by EDEM.
- C) Epistemic-affective framing and cultural anchoring (Teacher A). Teacher A differentiated error, difficulty and obstacle, linking them to cognitive and methodological factors in mathematics learning, and explicitly incorporated affective variables (e.g., anxiety, motivation, attitude) as conditions shaping mathematical engagement. Teacher A also mobilized cultural and historical references (e.g., Mayan and Incan contributions) to connect mathematics with broader human practices, reinforcing the ecological dimension of the didactic analysis.
- D) Cognitive structuring and mediational design through resources (Teacher B). Teacher B foregrounded analysis of students’ numerical reasoning and anticipated procedural difficulties. This cognitive emphasis translated into systematic mediational decisions: sequencing, selection of supports and representational adjustments to increase conceptual clarity and accessibility.
- E) Metacognition as calibration of certainty (Teacher B). In everyday inquiry tasks, Teacher B contrasted intuitive approximations with verifiable methods, privileging strategies that increase certainty before deciding on a final procedure. This evidence monitoring and evaluation of available evidence, followed by regulation toward a more reliable method.
- F) Socio-emotional orientation: reducing fear and sustaining interest (Teacher B). Teacher B explicitly framed didactic improvement as a means for students to learn more easily and “not be afraid,” reinforcing interest, attention and enjoyment. This orientation helps interpret why mediational choices are repeatedly tied to sustaining motivation and participation.

Comparative synthesis. Overall, Teacher A illustrates a development pathway centred on interaction and socio-emotional engagement, articulated with epistemic-ecological connections; Teacher B illustrates a pathway centred on cognitive structuring and mediational design, explicitly oriented toward reducing fear and strengthening confidence. These complementary profiles support the claim that EDEM can foster multiple trajectories of professional improvement within a shared analytical framework (DMKC).

DISCUSSION

Our findings indicate that the EDEM program can be helpful as an accelerant to improve the didactic-mathematical competence of in-service teachers, especially on the level of epistemic, cognitive, and affective dimensions. This aligns with prior work that demonstrates systematic professional development as a facilitator for the

development of reflective teaching practices (Morales-López et al., 2025; Morales-Maure & García-Marimón, 2023). The increasing gains in the epistemic and cognitive domains suggest not only a deeper understanding of the mathematical content but also greater attention to students' ways of thinking, consistent with reported trends in Godino et al. (2017) and Rodríguez-Nieto et al. (2024).

The metacognitive trajectories found in this study teachers planning with clear intentions, following what occurs during instructional experiences, and recalibrating their strategies are directly compatible with Zimmerman's (2002) model of self-regulated learning. Such behaviours reinforced teacher autonomy and professional agency consistent with findings of Sala-Sebastià, Breda, and Font (2025) in early childhood education settings. Socio-emotionally, the participants' responses are aligned with research emphasizing empathy and resilience as key pieces of effective teaching (Nuñez-Gutierrez et al., 2025; Cantillo-Rudas et al., 2024).

The use of emotional vocabulary in their written and audiovisual productions provides evidence for the idea that socio-emotional competence was intentionally cultivated in the program rather than an incidental factor. Teacher A's increased fluency in dialogic and emotionally responsive practices is consistent with work from Font et al. (2023), whereas Teacher B's emphasis on mediational planning is consistent with research on the adaptability of instruction in a low-resource community (Pochulu & Moll, 2025). The contrast between those two cases also underlines the adaptability of the DMKC framework where numerous developmental pathways affected by situational and personal elements are included (Morales, 2023; Olivero-Acuña et al., 2025).

This view has recently made connections with conversations on ethnomathematics and on cognitive and emotional aspects of teaching. Integrating a visual with qualitative evidence, our analysis highlights how cognitive and affective processes shift and/or change through situated professional development, deepening our understanding of the contextual dimension of these processes. Hence, the discussion reveals that the EDEM program based in the Ontosemiotic Approach and in practice through the DMKC model enables significant, contextualized, and personalized changes in teaching practice. In doing so, it adds to larger conversations about the most demanding yet equitable teacher education programs as well as the most emotionally attuned that must be provided programs that balance rigor, a commitment to equity and an intentional focus on emotional intelligence, especially in Latin America and in other historically underrepresented settings. This study is designed as a qualitative multiple-case analysis with two information-rich cases... Transferability depends on the degree of contextual similarity and on the availability of 'thick description. A second limitation is the absence of longitudinal follow-up beyond the duration of the Diploma program future work should examine whether these shifts are sustained over time and how they relate to classroom dynamics and student learning.

Although our evidence captures change during the diploma, we did not conduct post-program follow-up observations, which limit claims about the durability of the reported shifts. This is a substantive limitation because sustainability is central to professional development impact. Complementary studies demonstrate that follow-

up designs are feasible and informative: for example, post-training evaluations conducted six months after program completion have documented continued peer collaboration and sustained use of analytic tools beyond the intervention period. In the Panamanian context, multi-year analyses of EDEM cohorts and redesign cycles have also provided longer-horizon indicators that can be used to contextualize case-based findings. Building on this emerging evidence, future research should adopt a qualitative-longitudinal design (e.g., 3-, 6-, and 12-month waves) combining classroom observations, teacher interviews, and artefacts of practice, and when feasible linking these trajectories to student participation and learning indicators.

CONCLUSION

Using the example of in-service mathematics teachers in rural and semi-urban schools in Panama, this study investigated how a situated professional development program, EDEM, can lead to metacognitive and socioemotional development. We saw significant shifts in both cognitive and emotional aspects of teaching by examining written reflections, task productions, and project materials. Throughout the course of the program, the participating teachers developed deeper understandings of mathematical content; they focused more closely on students' ways of thinking; and they reported greater emotional commitment to their instructional roles.

The combination of the DMKC model, and with contextually responsive, reflective practices, made EDEM a space in which teachers could enter into cycles of self-regulated learning and foster resilience based on the realities of their schools. Through repeated opportunities to plan, monitor, and evaluate their own practice, teachers were able to interpret classroom evidence, adjust their decisions, and narrate their learning in metacognitive terms. These results support global discussions about teacher autonomy, emotional intelligence, and collaboration within practice-based models of professional learning and offer empirical support from a Latin American experience where structural constraints frequently limit creative pedagogies.

These disparate yet related paths of Teacher A and Teacher B illustrate that personalised professional paths often play out within a common theoretical and institutional context. But though both worked to solidify their epistemic and cognitive foundations, one had risen more prominently in affective and interactivational dimensions, while the other advanced in mediational and ecological ones. This variation suggests that theoretically supported flexible programs such as EDEM can be developed to fit various profiles of teachers and still aim to address the goals of metacognitive regulation, socioemotional competence, and didactic-mathematical quality. At the same time, they also seem to emphasize that explicitly incorporating socioemotional work into one's professional development is a non-negotiable, rather than optional, practice in systems in which territorial and socioeconomic inequalities condition the ways in which teachers' everyday work is done.

These insights suggest the possibility of a second translation and localization of the EDEM model across other regions, and stress importance for the rigorous and humanizing education of teachers to recognize that cultural and territorial differences are equally important. Possible future research work would involve

following teachers longitudinally to determine how those changes made here are maintained and reflected in classroom dynamics and student learning. There would be value here in investigating how digital reflective tools: AI feedback systems, learning analytics, and so on, could become a tool for tailoring and reinforcing professional development pathways. Developments like this can also assist in shaping policy interventions and institutional choices that lead to the development of better mathematics teacher education opportunities for the 21st century that are inclusive, responsive, and high quality.

Data availability statement

The datasets generated and analyzed for this study consist of written pedagogical tasks, reflective essays, and classroom-related project materials produced by two in-service teachers, as well as anonymized institutional feedback. Due to the small number of participants and the contextual richness of the materials, full datasets cannot be made publicly available without risking identification of the teachers and their schools. Anonymized excerpts supporting the conclusions are included in the article and its Supplementary Material. Additional de-identified materials will be made available by the corresponding author upon reasonable request and subject to institutional and ethical restrictions.

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Ethics statement

The studies involving human participants were reviewed and approved by the Bioethics Committee of the University of Panama (protocols CBUP/298/2019, CBUP/279/2021, and CBUP/448/2021). Oversight for the 2025 analytical extension of the project was transferred to the Bioethics Committee of the Universidad de Santander (CBI-USantander; protocol CBI-USantander-M-087-2025, under review at the time of analysis). All procedures complied with national regulations and institutional requirements. Participation was voluntary, informed consent was obtained from all participants, and data were anonymized and reported in aggregate form to protect confidentiality.

Author contributions

KCh-R: Conceptualization, Methodology, Data curation, Investigation, Visualization, Writing- original draft, Writing-review & editing. OG-M: Conceptualization, Methodology, Formal analysis, Investigation, Visualization,

Writing- original draft, Writing-review & editing. LM-M: Conceptualization, Project administration, Resources, Supervision, Validation, Writing- original draft, Writing-review & editing. AT-R: Data curation, Software, Formal analysis, Validation, Visualization, Writing- review & editing.

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Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

REFERENCES

- Aldrup, K., Carstensen, B., Köller, M., & Klusmann, U. (2020). Measuring teachers' social-emotional competence: development and validation of a situational judgment test. *Frontiers in Psychology*, 11(892), 1–20. <https://doi.org/10.3389/fpsyg.2020.00892>
- Blanco, A., Morales, L., & Font, V. (2022). Reflexiones socioemocionales en la formación docente en matemáticas. *Paradigma*, 45(2).
- Brown, E. L., Valenti, M., Sweet, T., Mahatmya, D., Celedonia, K., & Bethea, C. (2020). How Social and Emotional Competencies Inform Special Educators' Social Networks. *Education and Treatment of Children*, 43(3), 295–311. <https://doi.org/10.1007/s43494-020-00022-2>.
- Cantillo-Rudas, B. M., Rodríguez-Nieto, C. A., Moll, V. F., & Schnorr, C. E. (2024). Mathematical and neuro-mathematical connections activated by a teacher and his student in the geometric problems-solving. *Eurasia Journal of Mathematics, Science and Technology Education*, 20(10), em2522.
- Chica, O., Sánchez, J., & Pacheco, A. (2020). A look at teacher training in Colombia: the utopia of emotional training. *Utopía y Praxis Latinoamericana*, 25(4), 283–296. <https://doi.org/10.5281/zenodo.3931081>
- Font, V., Breda, A., & Sala-Sebastià, G. (2024). Future teachers' reflections on mathematical errors made in their teaching practice. *ZDM–Mathematics Education*, 1–13.
- Font, V., Breda, A., & Sala-Sebastià, G. (2025). Characterising computational and geometric thinking in pre-service Early Childhood Education teachers by playing with MatataLab. *Education and Information Technologies*, 1–25.
- Godino, J. D., Batanero, C., & Font, V. (2015). Teoría ontosemiótica del conocimiento y la instrucción matemática: Avances y perspectivas. *Revista EMA*, 20(2), 7–38.
- Godino, J. D., Batanero, C., & Font, V. (2017). Fundamentos de la idoneidad didáctica en educación matemática. *Educación Matemática*, 29(2), 5–38.

- Jennings, P., & Greenberg, M. (2009). The prosocial classroom: teacher social and emotional competence in relation to student and classroom outcomes. *Review of Educational Research*, 79(1), 491–525. <https://doi.org/10.3102/0034654308325693>
- Jennings, P., Brown, J., Frank, J., Doyle, S., Oh, Y., Davis, R., Rasheed, D., Deweese, A., Demauro, A., Cham, H., & Greenberg, M. (2017). Impacts of the CARE for teachers' program on teachers' social and emotional competence and classroom interactions. *Journal of Educational Psychology*, 109(7), 1010–1028. <http://dx.doi.org/10.1037/edu0000187>.
- Knigge, M., Krauskopf, K., & Wagner, S. (2019). Improving socio-emotional competencies using a staged video-based learning program? Results of two experimental studies. *Frontiers in Education*, 4(142), 1–12. <https://doi.org/10.3389/feduc.2019.00142>
- Ledezma, C., Morales, L., & Font, V. (2024). Experiencia educativa en modelización para docentes de matemática en Panamá. *Alteridad*, 19(1), 58–70.
- Ledezma, C., Sánchez Brualla, A., Breda, A., & Font, V. (2024). Prospective Teachers' Reflection on the Inclusion of Mathematical Modelling. *Caminhos da Educação Matemática em Revista*, 14(3), 26–43.
- Lozano-Peña, G. M., Sáez-Delgado, F., López-Angulo, Y., Mella-Norambuena, J., Contreras-Saavedra, C., & Ramos-Huenteo, V. (2023). Programas de intervención docente en competencias socioemocionales: Una revisión sistemática de la literatura. *Aula de Encuentro*, 25(2), 215–241. <https://doi.org/10.17561/ae.v25n2.7391>
- Lozano-Peña, G. M., Sáez-Delgado, F., & López-Angulo, Y. (2022). Competencias socioemocionales en docentes de primaria y secundaria: una revisión sistemática. *Páginas de Educación*, 15(1), 01–22. <https://doi.org/10.22235/pe.v15i1.2598>.
- Morales, Y. (2023). Formación reflexiva situada de docentes en matemáticas: análisis desde la idoneidad didáctica [Tesis doctoral, Universidad de Granada]. https://enfoqueontosemiotico.ugr.es/tesis/Tesis_Morales.pdf
- Morales-López, Y., & Font, V. (2024). Analysis performed by pre-service teachers in an emerging technological environment in mathematics education. *Journal of Research in Mathematics Education REDIMAT*, 13(1), 23–37. <https://doi.org/10.17583/redimat.14072>
- Morales-López, Y., Breda, A., & Font, V. (2025). Modelos TPACK y DMKC: Algunas claves para promover la reflexión docente. *Congreso de Educación Matemática de América Central y El Caribe*.
- Morales-Maure, L., García-Marimón, O., Chacón-Rivadeneira, K., Ponce, B. A., & Moll, V. F. (2025). Between the Epistemic and the Affective: Mapping Didactic Suitability in Mathematics Education from a Territorial Perspective. *Journal of Cultural Analysis and Social Change*, 10(2), 195–206. <https://doi.org/10.64753/jcasc.v10i2.1585>
- Morales-Maure, L., & García-Marimón, E. (2023). Prácticas reflexivas y desarrollo situado en formación matemática continua: Evidencia desde Panamá. *Educación Matemática*, 35(1).

- Núñez-Gutiérrez, K., Rodríguez-Nieto, C. A., Correa-Sandoval, L., & Moll, V. F. (2025). High school Colombian students' variational thinking triggered by mathematical connections. *International Electronic Journal of Mathematics Education*, 20(1).
- Olivero-Acuña, R. R., Rodríguez-Nieto, C. A., Moll, V. F., & Cantillo-Rudas, B. M. (2025). Ethnomathematical connections in cheese production. *Eurasia Journal of Mathematics, Science and Technology Education*, 21(4).
- Pochulu, M. D., & Moll, V. F. (2025). Idoneidad didáctica de tareas de matemáticas reformuladas con inteligencia artificial. *Paradigma*, 46(1).
- Rodríguez-Nieto, C. A., González, H. A. C., Arenas-Peñaloza, J., & Schnorr, C. E. (2024). Onto-semiotic analysis of mathematical connections. *Eurasia Journal of Mathematics, Science and Technology Education*, 20(5), em2438.
- Rodríguez-Nieto, C. A., Moll, V. F. (2025). Mathematical connections in multivariable calculus and vector problems. *Eurasia Journal of Mathematics, Science and Technology Education*, 21(4), em2619.
- Rodríguez-Nieto, C. A., Pabón-Navarro, M. L., Cantillo-Rudas, B. M., & Moll, V. F. (2025). The potential of ethnomathematical and mathematical connections in the pre-service mathematics teachers' meaningful learning when problem-solving about brick-making. *Infinity Journal*, 14(2), 419-444.
- Sáez-Delgado, F., López-Angulo, Y., Mella-Norambuena, J., Hartley, K., & Sepúlveda, F. (2023). Mental health in school teachers: An explanatory model with emotional intelligence and coping strategies. *Electronic Journal of Research in Education Psychology*, 21(61), 559-586. <https://doi.org/10.25115/ejrep.v21i61.8322>
- Sáez-Delgado, F., Mella-Norambuena, J., & López-Angulo, Y. (2024). Psychometric properties of the SocioEmotional Skills Instrument for Teachers (SEMS-IT) using network approach: English and Spanish version. *Frontiers in Psychology*, 15. <https://doi.org/10.3389/fpsyg.2024.1421164>
- Sala-Sebastià, G., Breda, A., & Font, V. (2025). Characterising computational and geometric thinking in pre-service Early Childhood Education teachers by playing with MatataLab. *Education and Information Technologies*, 1-25.
- Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview. *Theory Into Practice*, 41(2), 64-70.