

Mathematics Teacher Educators: Theories, Methodologies and Teaching Practices

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In this special issue we explore the theories, methodologies, and teaching practices of mathematics teacher educators (MTEs). MTEs may be those university-based or tertiary-based educators who teach prospective teachers during initial teacher education or deliver professional learning to in-service teachers of mathematics. MTEs may also be teachers in schools who mentor prospective teachers during their initial teacher education, or who facilitate professional development for their colleagues. Alternatively, MTEs may be facilitators from government agencies or other organisations who deliver professional development to teachers of mathematics.

This issue exemplifies the diverse nature of teacher preparation and development, including variations in terminology, roles, and professional profiles of MTEs, and approaches to teacher learning. This issue also reflects differences in teacher education programs, and various pedagogical approaches teacher educators work with and use to support teachers in different educational contexts. A strength of this special issue is the international perspectives given with authors from Australia, Austria, Brazil, Canada, Chile, England, Germany, Israel, Norway, United States, and Uruguay.

Study of MTE work can build from the diversity of the MTE community by valuing and communicating the contextual details that shape this work. One such detail are ways government mandates enable and constrain what and how MTEs teach mathematics teaching. Across the globe the impact of such mandates on MTEs and their work differs. Outlining the socio-political landscape in which MTEs work and which they must navigate provides important context for understanding the complexity of their work and interpreting their practices. In addition, including this context provides a historical record of the field by documenting how MTEs lived and worked, as well as how they experienced, interpreted, and understood their professional worlds. The articles in this special issue illustrate several dimensions of MTE identity and practice. The special issue editors call for research reports to broaden the scope of what is shared, to illustrate further the complexity of learning and teaching the discipline of mathematics teaching.

Articles in this special issue further highlight broad dimensions of MTE work, knowledge, and expertise describing the complex nature of their practice. MTE are involved in activities that involve a variety of areas of expertise and knowledge including but not limited to: preparing MTEs, engaging with schools and communities, conducting and presenting research, and writing scholarly journal articles and conference papers. These activities require different knowledge and expertise. As research about MTEs and their MTE work continues to develop, we advocate for the continued attention on descriptions of phenomena and syntheses of existing findings. Together these approaches can create a research landscape that reflects the complexity and breadth of the research field. One example in this special issue is offered by Zehetmeier, Borko, Friedrich-Pöhler, Karensky, Rojas, and Rösken-Winter.



Such a landscape enables researchers to situate their research within the broader field while attending to relationships among context, activities, uses of knowledge (Chapman, 2021), and expertise (Goos, 2025).

In the following section, brief descriptions of the articles in the special issue provide the reader with a structure to consider relationships among the articles. Readers will notice that some articles appear in more than one section, highlighting the view that the research reported contribute in multiple ways to the field.

Engaging with Theoretical Questions

For this special issue, theoretical articles are interpreted as those that engage with theoretical questions by drawing on and extending concepts and frameworks from the research literature on the study of MTEs. The development of theory specific to MTEs has advanced understanding of the knowledge and knowledge domains of MTEs (Beswick & Goos, 2018), with more recent focus on MTE expertise (Chorney et al., 2025; Goos, 2025). Responding to Chapman's (2021) call to examine how MTEs use knowledge in practice, scholars have continued to develop and refine theory in this field. Whilst all articles in this special issue are grounded in existing theory, particular attention is given to those for which extending, refining, or building theory is a central contribution.

In the first article, Barbosa builds on Wenger's (1998) theoretical framework to develop the construct of *reference practices*. Barbosa draws on empirical evidence to illustrate how MTEs mobilise and articulate the reference practice of both academic and school mathematics in their interactions with teachers, highlighting how these practices shape and inform their work. Mamolo and Zazkis develop theory by extending the notion of tensions to the specific work of MTEs, conceptualising tensions as disruptive forces that MTEs navigate when mathematics goals compete with pedagogical concerns, societal issues, or digital technology/AI.

Gomes, Ponte, Quaresma, and Martins build from the resources, orientations, goals, and identity (ROGI) framework (Karsenty et al., 2023) to describe the development of a novice lesson study facilitator. Of particular interest are adjustments to the categories in ROGI framework for the context of lesson study that highlight the importance of professional development context and facilitator history in relation to the focus of the professional development. Marshman and Anson extend Akkerman and Bakker's (2011) learning-at-the-boundary framework to examine MTEs' work as critical friends. They show how this role supports reciprocal learning among teachers and MTEs and can generate hybrid knowledge that connects classroom practice with educational research.

Jeon, Brown, Herbst, and Savuran draw from practical rationality (Herbst & Chazan, 2011) extending this theory to the work of professional development facilitators. Findings reveal that facilitators recognised disciplinary, interpersonal, individual, and institutional obligations as relevant to their work, but the obligation they treated as the anchor in moments of uncertainty differed.

Methodological Contributions to Mathematics Teacher Educator Practice

Several contributions to this special issue broaden what counts as a methodological contribution to the study of MTEs' work and professional development. Methodological articles are considered those that offer theory-informed tools, resources, models, perspectives, tasks, and sequence design, routines, and approaches that can be adapted by other MTEs in their teaching, research professional learning, or the design of professional development programmes. Building on existing theory, these articles develop practical and transferable methodological advances that support prospective teacher learning, strengthen professional development practice, and inform research on MTEs.

One set of articles locates the methodological contribution within MTEs' teaching practices in mathematics teacher education. Focusing on pedagogical communication, Barbosa illustrates how MTEs can engage rigorously with mathematical content while recontextualising it for the work of teaching mathematics. In this way, the article offers alternative approaches for integrating



mathematical rigour with pedagogical purpose in teacher education. Addressing the relationship between advanced and school mathematics, Molino demonstrates how learning sequences can be designed to make these relationships explicit and meaningful for prospective teachers. Through the detailed analysis of one MTE's work linking algebraic structures to equation solving, the article illustrates how these sequences can support the integration of mathematical connections into teacher education practice. Considering the purposes for and tasks used by MTEs in mathematics methods courses, Ochoviet makes visible formative aims that go beyond preparation for classroom practice, positioning prospective teachers as intellectuals in the making, capable of constructing a personal and collective educational project. Within an *Illustration of Practice*, Lischka examines her assessment practice as an MTE to show how relational constructivist theory informs alternative assessment.

Another area of contribution concerns the tools and approaches available to MTEs to examine and improve their practice. Schwarts and Nieman show how representations of practice can serve as productive tools for MTEs' professional learning, while also offering principles for selecting and designing tools oriented towards MTEs' professional growth. In their enactivist approach to becoming an MTE, Helliwell, Reid, Brown, and Coles provide a methodology for learning through the work of being an MTE. The authors conceptualise research, learning, and teaching as interrelated dimensions of professional growth. They propose five actions that guide reflection on practice, dialogue among colleagues, and the development of new insights. Thus, MTE learning is conceived as a continuous process, grounded in experience and oriented towards expanding what it is possible to observe, understand, and do in mathematics teacher education.

A third area of contribution addresses the methodological design of professional learning and collaboration among MTEs. Drawing on professional learning routines and curriculum materials, Gibbons, McKie, and Hiebert present a replicable model through which MTEs can systematically foster productive instructional conversations. Beyond offering a way to examine professional learning through the quality of instructional conversations, the report also provides a way of examining learning opportunities through the quality of the conversations. Götze Holzäpfel, Rösken-Winter, Selter, and Prediger focus on facilitator professional development, showing how theory-informed and research-based activity sequences can be designed to prepare facilitators for key aspects of their work, including moderating discussions, adapting materials, drawing on teachers' classroom experiences, and supporting school-based collaboration. Addressing collaboration between MTEs and mentor teachers, Scorza, Parodi, and Pages identify hybrid practices such as joint planning, co-teaching, and shared examination panels, as productive structures for bridging institutional boundaries creating meaningful professional dialogue.

Research Methodologies

Authors identified research methodologies as tools for building knowledge of MTEs' work, encouraging researchers to adopt new approaches to its study. Zehetmeier, Borko, Friedrich-Pöhler, Karensky, Rojas, and Rösken-Winter discuss the core theoretical frameworks and empirical methodologies used in MTE studies, key findings, and emergent issues. The analysis of Congress of the European Society for Research in Mathematics Education (CERME) proceedings from 2021-2025 is used to support MTEs as they continue to build knowledge about MTE work.

Opheim draws from the history of action research and her action research projects to examine how the methodology connects research and practice in mathematics teacher education. The author discusses challenges in publishing action research and offers reflections to support MTEs in responding to and resolving such challenges. Helliwell, Reid, Brown, and Coles introduce enactivism as both a theory and a methodology. They illustrate how their framework: using dissonance, staying with the detail, finding conviction, making it real, and going meta can guide MTEs' work across three interconnected domains of researching, learning, and teaching. The methodology emphasises deep engagement with experience, reflective practice, and iterative learning, supporting MTE development, whilst also informing the learning of prospective teachers. Through an *Illustration of Practice*, the authors



demonstrate how these actions can help MTEs make sense of teaching experiences and develop new understandings of their work.

Teaching Practices

Authors shared findings from explorations of MTEs teaching practices that highlights the complexity of their work. Bjeke and Nolan investigate how MTEs in Canada and Norway support prospective teachers' transition from practicum back to university settings. Focusing on disruptive pedagogy, they found that MTEs often avoid challenging specific beliefs or practices because prospective teachers' may be unfamiliar with theoretical discourse, MTEs want to reduce the pressure on prospective teachers and avoid reinforcing the dominant time discourse. Additionally, some MTEs were unaware that pre- and post-field practices might need to differ. This article addresses what may be a universal challenge in MTE practice, maintaining a focus on disruptive pedagogy when prospective teachers transition to classroom practice. Naresh, Morton, Eddy, Mahdi, and Kudaisi use narrative inquiry to analyse their teaching experiences to demonstrate how attention to race, culture, identity, and privilege can support more inclusive and empowering approaches for prospective teachers.

Götze, Holzäpfel, Rösken-Winter, Selter, and Prediger explored how within their large-scale facilitator professional development (PD) program facilitators were supported to adapt the teacher PD to the school context where the PD would be delivered. Their QuaMath program has developed a *Learning to Facilitate Framework*, which includes leveraging teachers' ideas as they launch and moderate teacher PD (TPD) activity, considering their teachers and the teachers' context to adapt TPD resources, utilising the teachers' classroom experiences, and fostering school cooperation.

In an *Illustration of Practice*, Qiu, Rasmussen, Fortune, Carney, Santos, Ponce, Jacome, and Stewart describe their teaching practices in an upper-level university course, Inquiry-oriented Dynamical Systems and Modelling, and how they make connections between mathematics in the course and secondary school mathematics that their prospective teachers will most likely be teaching.

The Role of Mathematics

Authors shared findings that highlight how the structures and practices of the discipline of mathematics inform MTEs' work. To inform their teaching, MTEs draw on research in mathematics learning, teaching, and curriculum. Central to this work is recognising that MTE work differs from that of classroom teachers, requiring meta-knowledge about teachers' knowledge and practice (Beswick & Goos, 2018). In this special issue authors demonstrate how research informs their work as MTEs and offers tools and approaches for connecting research to their teaching.

Ochoviet's paper draws from the work of Zaslavsky and Sullivan (2011) exploring how MTEs in Uruguay select and use tasks when teaching the didactics of mathematics in initial teacher education. These tasks, potentially useful in secondary school classrooms, were chosen to help prospective teachers make choices about what and how to teach mathematics effectively. Findings showed how tasks served multiple purposes in teacher education, yet there was relatively little emphasis on tasks designed to challenge or develop prospective teachers' beliefs about mathematics and its teaching.

Barbosa's article provides a tool that MTEs might use to consider their use of reference practices in communicating with teachers. There is the potential for MTEs to use Barbosa's tool to investigate objects, epistemic values, and validation they use in their pedagogical communication. Findings reveal how MTEs use the reference practices of academic and school mathematics.

Prospective teachers often struggle to connect the mathematics they study in university with the mathematics they are expected to teach in schools (Marshman, 2021). Wasserman (2018) offered important insights into addressing this challenge in abstract algebra. Further research, however, is needed to strengthen these connections and improve mathematics teaching and learning at all levels (Zazkis, 2020). Molfino investigated how one MTE who participated in workshops about designing learning sequences for prospective teachers, implemented the sequences. Her analysis describes how



this MTE's work with algebraic structures, and equation solving enabled them to integrate a range of mathematical connections among tertiary and secondary concepts into their teaching. Through their inquiry-oriented approach to teaching a higher-level Dynamical Systems and Modelling course, Qiu, Rasmussen, Fortune, Carney, Santos, Ponce, Jacome, and Stewart encourage the prospective teachers to engage with the mathematical practices (National Governors Association Center for Best Practices, & Council of Chief State School Officers, 2010), to see the connections between university mathematics and school mathematics, and to take responsibility for their learning in teacher preparation.

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