

# Special Issue Introduction: Critical Perspectives on Mathematics Teacher Education

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## 1. Introduction

Nowadays, the field of mathematics education research is more diverse than ever. A quick look at recently published articles in different venues suggests that research topics encompass not only purely cognitive but also cultural, social, and political issues. It can be argued that these last three issues form a unified entity, one that Planas and Valero [1] call the “socio-cultural-political axis” of mathematics education. Attempting to distinguish between them is neither possible nor productive [2]. For this reason, in this Special Issue, we use the term *critical* as a unifying label to address this axis. In doing so, we are fully aware of the diverse understandings and uses of the term *critical* in the literature [3]. Nevertheless, we refer to the notion from a Freirean point of view, aiming toward inspiring learners and educators of all levels to understand, analyze, and critique social, cultural, and political power structures and patterns of inequality through the cultivation of sociopolitical awareness [4]. To us, *critical* serves as an umbrella under which different philosophical/epistemological approaches intersect, embracing, among other things, discussions on equity, social justice, inclusion, culturally responsive pedagogy, Indigenous education, ethnomathematics, and language diversity [5]. Furthermore, by teacher education, we refer to both initial teacher education (prospective teachers) and continuous professional development (practicing teachers) at all school levels (early years, primary, secondary) [6].

This Special Issue covers a range of critical perspectives in mathematics teacher education. Our initial call for articles was intentionally broad to allow authors to communicate a variety of critical issues, without being restricted to specific frames. Nonetheless, the thirteen contributions to this issue can be organized into three sections. The first section focuses on research being conducted through coursework in initial teacher education with prospective (pre-service) teachers. The second section examines issues of continuous professional development of practicing (in-service) teachers. Finally, the third section comprises theoretical contributions based on authors’ reflections on their own research and practices as mathematics teacher educators.

## 2. Focus on Coursework with Prospective (Pre-Service) Teachers in Initial Teacher Education

As the authors of articles in this section of the Special Issue will attest, explicit critical work with prospective teachers (PTs) in their initial teacher education courses provides PTs with early-career insights and opportunities not otherwise possible once they begin life as a teacher. In fact, “insights” is the focus of the first article in this Special Issue. In their paper titled “*The role of insights in becoming a culturally responsive mathematics teacher*” (<https://doi.org/10.3390/educsci13101028>), Kathleen Nolan and Constantinos Xenofontos extend their previous work focused on studying the growth and development of PTs’ culturally responsive pedagogy (CRP) by discussing the implementation of their COFRI



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framework. An acronym standing for challenges, opportunities, fears, resistance, and insights, COFRI offers a way to gauge PTs' understandings of CRP as various points during a course on CRP and mathematics. While their focus is on PTs' insights and understandings, Nolan and Xenofontos also discuss the work of MTEs with regard to modeling CRP and designing courses with the COFRI components and their inter-relationships in mind.

In the second article in this section, the work of MTEs in designing and facilitating mathematics teacher education courses is front and center in the featured research. In *"Integrating societal issues with mathematical modelling in pre-service teacher education"* (<https://doi.org/10.3390/educsci13070721>), Lisa Steffensen and Georgia Kasari draw on theoretical perspectives from the field of sociocritical modeling to feature a case study of one MTE who introduces specific problem-posing modeling activities focused on societal issues in courses with pre-service teachers (PTs). Their findings point to the success of integrating these critical-issue mathematical modeling activities in teacher education as one way to move beyond superficial mathematizing problems. Steffensen and Kasari recommend that MTEs work in informal learning communities to support each other as they work to support PTs toward including sociocritical issues in mathematics classrooms.

Also focused on the topic of addressing societal issues in mathematics teacher education courses is the article by Magnus Ödmo, Anna Chronaki, and Lisa Bjorklund Boistrup, titled *"Bringing critical mathematics education and actor-network theory to a statistics course in mathematics teacher education: Actants for articulating complexity in student teachers' foregrounds"* (<https://doi.org/10.3390/educsci13121201>). In this case, the societal issue being highlighted is climate change, with the context being a required statistics course for student (pre-service) teachers. In the study, student teachers are interviewed about how they see their future selves as teachers in the field of critical mathematics education. By drawing on two theories (critical mathematics education, and actor network theory), the authors illustrate the complex network (actants and connections) encountered by the student teachers when a more traditional statistics course is transformed into a course based on critical perspectives around the context of climate change. In the end, these authors recommend that teacher education programs should deal more explicitly with the complex nature of bringing critical mathematics education practices into mathematics classrooms.

The next article in this section also shares rich stories from interviews with pre-service/student teachers as they engaged with specific teacher education courses. In *"Storylines in voices of frustration: Implications for mathematics teacher education in changing times"* (<https://doi.org/10.3390/educsci13080816>), Annica Andersson, Trine Foyn, Anita Movik Simensen, and David Wagner interview preservice teachers about their teacher education experiences regarding inclusive teaching, asking, for example, what they have learned within the teacher education program about mathematics pedagogy for minoritized and indigenous students. In their aim to better understand the implications these experiences have for teacher education courses and preparation for teaching in diverse classrooms and schools, the authors use storylines as their theoretical construct. The three key storylines constructed out of the data (concerning language, method rigidity, and invisibility) draw attention to important implications for teacher education programs, including creating spaces for deeper and more critical conversations which prepare prospective teachers to challenge and transform current inclusive practices in mathematics classrooms.

The final article in this section on initial teacher education is also focused on the learning of mathematics by students with diverse needs, though this research text shifts our attention from the design side of teacher education courses to approaches to assessment. Specifically, in *"Addressing language diversity in early years mathematics: Proposed classroom practices through a Live Brief Assessment"* (<https://doi.org/10.3390/educsci13101025>), authors Sinem Hizli Alkan and Derya Sahin Ipek work with Live Brief assessments to address language diversity with Year-1 early years mathematics PTs. After analyzing their data through the lens of Moschkovich's perspectives on the relation between language and pedagogy in mathematics, the authors conclude that within the three pedagogical practice

themes (vocabulary teaching, scaffolding, and multi-sensory approaches), the situated sociocultural perspective was under-emphasized. The authors offer critical reflections on the student teachers' proposed practices for addressing language diversity and suggest an important role for teacher education programs to challenge and disrupt student teachers' current thinking on language diversity toward gaining more critical perspectives in the teaching and learning of mathematics.

### 3. Focus on Professional Development of Practicing (In-Service) Teachers

The articles in the second section of this Special Issue concern practicing teachers and their engagement in opportunities for continuous professional development. For instance, in their paper titled *"Exploring the interplay between conceptualizing and realizing inquiry—The case of one mathematics teacher's trajectory"* (<https://doi.org/10.3390/educsci13080843>), Marte Bråtalien, Margrethe Naalsund, and Elisabeta Eriksen focus on how teachers negotiate the interplay between theory and practice regarding inquiry-based teaching. In this work, inquiry is seen as an approach that challenges traditional teaching structures and authority, and places whole-class discussions (as a key practice for equity and pupil empowerment) at the center of mathematics lessons. This study follows the journey of Alex, an experienced high school mathematics teacher who lacked expertise in inquiry-based teaching. By enrolling in a one-semester professional development program Alex's trajectory emphasizes the significance of continuous professional development in teachers' understandings of inquiry. It also highlights how these understandings impact the realization of inquiry-based lessons and how carrying out these lessons can, in turn, shape teachers' conceptions of inquiry.

Angeliki Stylianidou's and Elena Nardi's article *"Overcoming obstacles for the inclusion of visually impaired learners through teacher-researcher collaborative design and implementation"* (<https://doi.org/10.3390/educsci13100973>) explores the collaboration between teachers and researchers in designing and implementing mathematics lessons that address the needs of visually impaired learners. In the first phase of the study, the authors used classroom observations, focus group interviews, and individual interviews to document teachers' current practices, while in the second phase, teachers and researchers used data from the previous phase to co-design and implement more inclusive lessons. In closing their article, the authors discuss implications for mathematics teacher education, arguing that ongoing collaboration and professional development are essential for creating inclusive math classrooms sustainably. The article highlights the necessity for mathematics teachers to be better prepared to address and think more critically about the needs of children with disabilities.

In the third article of this section, *"Teacher learning towards equitable mathematics classrooms: Reframing problems of practice"* (<https://doi.org/10.3390/educsci13090960>), Yvette Solomon, Elisabeta Eriksen, and Annette Hessen Bjerke discuss findings from a year-long professional development program as part of a wider project on inclusive mathematics teaching. The study draws on data from 16 practicing teachers who enrolled in the course. Solomon et al. discuss how teachers' engagement with the program shifted assumptions about mathematics teaching and learning, and participants' professional practice as critical mathematics educators. The authors pinpoint four mechanisms contributing to teachers' enriched conceptions and conclude by articulating the need for future research and professional development to unpack these mechanisms further.

In the last article of this section, *"Teacher development for equitable mathematics classrooms: Reflecting on experience in the context of performativity"* (<https://doi.org/10.3390/educsci13100993>), Sue Hough and Yvette Solomon follow and discuss the journey of the first author during her development from a teacher who emphasized children's understanding to a teacher with deeper critical understandings of mathematics education. The article highlights the pivotal role of realistic mathematics education (RME) as the theoretical lens that enabled the teacher-researcher to reconceptualize her own pedagogical practice,

especially within the challenges set by a wider climate of performativity and tangible measurement of outcomes.

#### 4. Theoretical, Reflective, and/or Sociopolitical Contributions

Four articles approach the topic of the Special Issue from theoretical perspectives and/or comprise authors' reflections on their own work as critical mathematics teacher educators. For example, Marrielle Myers, Kari Kokka, and Rochelle Gutiérrez use braiding as an analogy to introduce a framework with four strands for facilitating the development of candidate teachers' political consciousness. In their article "*Maintaining tensions: Braiding as an analogy for mathematics teacher educators' political work*" (<https://doi.org/10.3390/educsci13111100>), the authors draw on their work as mathematics teacher educators to illustrate examples of what each strand can look like and to highlight the necessity for colleagues to braid the four strands together.

In their article "*Pedagogical imagination in mathematics teacher education*" (<https://doi.org/10.3390/educsci13101059>), Ole Skovsmose, Priscila Lima, and Miriam Godoy Penteado build on their previous research focused on the theoretical idea of pedagogical imagination, a concept which was initially developed by their team in post-Apartheid South Africa. The authors deliberately choose not to limit the definition of pedagogical imagination and instead explore its connection to five other broad concepts: dialogue, social justice, mathematics, hope, and sociological imagination. To illustrate these connections, the authors share episodes from discussions between the second author and four prospective teachers in Brazil. The article highlights the adaptability of pedagogical imagination as a theoretical concept that can be applied across different cultural contexts.

Kay Owens draws on her extensive research experiences in the context of Papua New Guinea to discuss the vital role of pre- and in-service mathematics teacher education in illuminating the impact of neocolonialism on mathematics teaching and learning, as well as the need for mathematics education to focus more explicitly on culturally relevant approaches. In doing so, her article, titled "*The role of mathematics teacher education in overcoming narrow neocolonial views of mathematics*" (<https://doi.org/10.3390/educsci13090868>), uses a variety of data sources to exemplify the impacts of colonization, post-colonial aid and globalization on mathematics education. In light of the impact of First Nations' colonization, and multiculturalism in certain areas, there is a growing importance for teacher education programs to include Ethnomathematics as a mandatory subject. Owens strongly advocates for this viewpoint, suggesting its importance in ensuring a more comprehensive and inclusive mathematics education.

In the last article, "*The Fascists are coming! Teacher education for when right-wing activism micro-governs classroom practice*" (<https://doi.org/10.3390/educsci13090883>), Peter Appelbaum uses the US context as an example of how research-informed policies and practices based on liberal multiculturalism have fallen short of realizing their promise. In highlighting the fascistization of many so-called Western societies, Appelbaum uses the Currere methodology and its four phases of inquiry to stress the need for mathematics teacher educators to reconsider the content and processes of teacher education so as to better prepare teachers to recognize and address right-wing narratives.

**Conflicts of Interest:** The authors declare no conflict of interest.

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