

Enactment of Humanising Mathematics: Mathematics Teacher Educators' Positionalities and Theoretical Stances

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This paper presents a self-study by five mathematics teacher educators (MTEs) at a minority-serving institution in the United States. We examined how our positionalities and theoretical stances shape the enactment of humanising mathematics for prospective teachers (PSTs). We explored how our diverse racial, cultural, and professional backgrounds influenced our teaching. Using narrative inquiry, we wrote and analysed key episodes from our pedagogical experiences, connecting them to our respective theoretical perspectives. Through this work, we present counter-narratives that empower PSTs, particularly those historically marginalised in mathematics learning spaces. Our narratives revealed how attention to identity, privilege, and experience informs not only our approach to teaching but also how we present mathematics in ways that support PSTs to foster inclusive and socially responsive classrooms. We highlight tensions that emerged in this work and describe how these have shaped our teaching, prompting us to be intentional, reflective, and transparent about our practices. These findings underscore the importance of creating spaces for collective inquiry, modelling vulnerability, and offering critical support to PSTs as they learn to enact humanising mathematics in their own classrooms contributing to the theorising of MTEs' work.

Keywords • mathematics teacher education research • humanising mathematics • narrative inquiry • culturally responsive mathematics

Introduction

We are five mathematics teacher educators (MTEs) at a United States university designated as a minority-serving institution. Our students are culturally and linguistically diverse, with many from historically underrepresented groups in mathematics and many who are first-generation tertiary students. This diversity plays a crucial role in shaping the mathematics education work we do at our institution. Our collaboration grew from informal conversations about our teaching, our students, and ways to make mathematics education more meaningful and inclusive. As we shared pedagogical experiences, we began to examine how our own personal and professional backgrounds and histories influence the ways we teach mathematics. The first three authors had worked together previously on a project about humanising mathematics (Naresh et al., 2022), and two others joined to expand and enrich the work. Though we teach different courses including mathematics content, mathematics methods, STEM methods, and graduate STEM, we share a common goal: preparing prospective teachers (PSTs) to see mathematics as human and creative, and to create mathematics classrooms where all learners are valued, supported, and inspired to grow in their mathematical thinking.

This article presents collaborative self-study of how our positionalities shape our engagement with humanising mathematics. We position this work as a counter-narrative to portrayals of mathematics as neutral, culture-free, and disconnected from human activity. We view humanising mathematics not as



a singular definition but a collection of practices, values, and orientations that are situated within and evolve according to specific contexts. Humanising mathematics involves creating learning spaces that affirm learners' identities, draw on their lived experiences, and expand opportunities for meaningful participation (e.g., A. J. Bishop, 1990; D'Ambrosio, 1985; Gay, 2000;).

As MTEs preparing PSTs to work within these realities, we have found that when we share the commitment to humanising mathematics, we continue to question and refine what this work may look like in practice, whose knowledge is centred, and how our positionalities shape the opportunities we create for PSTs. In a teacher education program where mathematics teacher preparation spans multiple departments, it is particularly important to reflect critically on our work with PSTs because the contexts we teach in, our positionalities, and past learning and teaching experiences can unintentionally create tensions or inequities. Through engaging in self-study, we aim to illuminate the contradictions and unintended consequences that arise in our practice. We see the inherent complexity of this work as an essential site for ongoing reflection and growth among MTEs. These reflections inform the opportunities we provide PSTs, helping them enter K–12 classrooms with increased awareness, resources, and strategies for humanising mathematics. By surfacing the complexities, we challenge assumptions about what humanising mathematics entails and support a collective, critically reflective approach to teacher education.

In this article, we specifically focus on our work with PSTs, as we seek to prepare them to enact humanising practices in their future classrooms. Our guiding question is:

In what ways do MTE positionalities and experiences influence perceptions and enactment of a humanising approach to teaching mathematics for prospective teachers?

Theoretical Orientation

Mathematics has often been portrayed as a universal and objective discipline, one that demands learners set aside their lived experiences to succeed in an academic setting (Paris & Alim, 2017). Schools reinforce this through standardised curricula, high-stakes testing, and rigid definitions of success (Fasheh, 2012). Such systems privilege certain ways of thinking, use mathematics as a gatekeeping tool that limits opportunity, and reinforce societal inequalities (Aguirre et al., 2013; Frankenstein, 1983; Gutstein, 2003; Skovsmose, 1985). This privileging has sidelined forms of reasoning that differ from Eurocentric traditions (D'Ambrosio, 2007; Joseph, 1987) but have also contributed to the erosion of local knowledge systems, particularly in communities shaped by colonial histories (Joseph, 1987; McCarty & Lee, 2014;). Many learners are thus alienated from engaging with mathematics in deeper, more personal ways (Civil, 2007; Marshman & Brown, 2014).

To counter deficit framings, scholars propose humanising mathematics that positions mathematics within students' lived experiences, cultural knowledge, and community (A. J. Bishop, 1990; D'Ambrosio, 1985). Humanising mathematics recognises that mathematics is shaped by the identities and experiences of those who engage with it (Gutstein, 2003; Skovsmose, 1994). It seeks to transform learning environments where students see themselves as capable, valued participants, while also addressing the power structures that regulate access and belonging (Yeh & Otis, 2019). Our orientation towards humanising mathematics is informed by insights from ethnomathematics and critical mathematics education.

Ethnomathematics and Critical Mathematics Education

Ethnomathematics and critical mathematics education both critique universalist accounts of mathematics and situate mathematical knowledge within the broader social, cultural and political contexts. These perspectives emerge from distinct intellectual traditions and foreground different questions for research and practice (Francois & Stathopoulou, 2012).

Ethnomathematics centres the epistemological plurality of mathematics and focuses on how people's cultural practices, experiences, and knowledge systems shape the mathematics they use and



value (A. J. Bishop, 1990; D'Ambrosio, 2007). Research on strands of ethnomathematics such as everyday mathematics (e.g., Magajna & Monaghan, 2003; Millroy, 1991; Naresh, 2008), culturally responsive mathematics education (Gay, 2000; Gerdes, 1998; Zavala & Aguirre, 2024), and non-European traditions (e.g., Ascher, 1991; Joseph, 2000; Raju, 2007) have disrupted the universalist narrative of mathematics. Researchers have extended this line of research to illustrate how principles of ethnomathematics are enacted in teaching mathematics. For instance, weaving patterns have been used to explore geometry concepts (Arribay, 2025) and traditional architecture has provided a context for studying proportions and spatial visualisation (Ramadhani et al., 2023). Ancestral Andean mathematical elements link mathematical reasoning to Indigenous cosmologies (Villota et al., 2025), while African knowledge systems, particularly in the context of gold mining in colonial Brazil, reveal the technical expertise of enslaved people and contribute to decolonising mathematical knowledge (Orey et al., 2025).

Critical mathematics education, however, foregrounds the sociopolitical dimensions of mathematics, interrogating how mathematics knowledge and schooling structures reproduce or challenge inequities (Frankenstein, 1983; Skovsmose, 1994). It asks how mathematics functions within systems of power, who benefits, who is excluded, whose mathematical knowledge is foregrounded and whose is excluded or marginalised (Aguirre et al., 2013). Mathematics, thus, can act as a gatekeeper that maintains the status quo of inequity or as a powerful tool for promoting critical citizenship when used to challenge unjust structures (Skovsmose, 1994; Volmink, 1994). Proponents of critical mathematics education have demonstrated how mathematics teaching can confront racism, classism, and other forms of oppression (Frankenstein, 1983;) and can enable mathematics learners to “read and write the world”, investigating issues that impact their communities (Gutstein, 2006, p. 4).

From ethnomathematics, we draw attention to how mathematical activity is rooted in cultural practices, histories, and knowledge systems that extend beyond school mathematics. From critical mathematics education, we foreground that mathematics shapes and is shaped by sociopolitical relations that influence access, participation, and agency. Humanising mathematics draws from both traditions but places particular emphasis on how learners experience dignity, agency, and belonging within mathematical activity, and how classroom interactions can actively affirm or diminish these experiences. In this view, humanising mathematics involves integrating diverse knowledge systems while also developing learners' abilities to critique how mathematics operates in contexts of power and decision-making. We interpret this process as placing particular emphasis on preserving and restoring dignity in mathematical learning spaces.

Humanising Mathematics in Teacher Education

MTEs have engaged in research and practice to exemplify humanising mathematics. Many embrace self-study approaches to examine, through their identities and positionalities, systemic inequities, and model new possibilities for mathematics teaching and learning. MTEs have used theoretical lenses-such as critical ethnomathematics curriculum (Mukhopadhyay et al., 2009), racialised social systems (Martin, 2009), culturally relevant and responsive (mathematics) teaching, (Gay & Kirkland, 2003; Ladson-Billings, 1995; Zavala & Aguirre, 2024), and rehumanising mathematics to attend to the political, social, and historical factors that shape learners' experiences (Gutiérrez, 2018). In doing so, they help foster learning spaces that honour the intersectional identities of learners and affirm students as whole human beings.

MTEs have also attended to humanising mathematics by broadening the scope of mathematics beyond traditional boundaries. Examples include connecting mathematics with computational thinking (Perez, 2018), computer programming (Kudaisi & Leonas-Cabrera, 2025), social studies (Kudaisi et al., 2025), societal issues (e.g., Gutstein, 2006; Sears & Kudaisi, 2021), or emphasising socially just pedagogy in mathematics teaching (e.g., Garii & Appova, 2013; Morton, 2024). Although these expansions open meaningful possibilities for connecting mathematics to students' experiences, they also raise questions about what counts as mathematics and how such integrations are framed in



practice. Similarly, by engaging PSTs in “mathematics in many voices,” MTEs foreground the polysemic nature of ethnomathematics and resist reducing non-western practices to mere tools for western concepts (Chahine & Naresh, 2025, p. 1).

MTEs’ attention to humanising mathematics also involves a critical reflection on their positionality and how it influences their instructional decisions. For example, examining one’s racial/ethnic identity in relation to those of their students, MTEs can prompt purposeful actions towards humanising mathematics by identifying barriers and drivers to implementation (DiAngelo, 2018; Kalinec-Craig & Bonner, 2016). This can also be done through an ongoing examination of facets of their positionality (e.g., knowledge bearers, experts) that privilege MTEs as instructors of PSTs, professional development providers for in-service teachers, and as researchers disseminating findings (Gutiérrez, 2016a).

Finally, humanising mathematics requires consideration for the affective and communal aspects of students’ lives. Specifically, it is necessary to model with PSTs the need to prioritise deep understanding of students’ socioemotional well-being (Cochran-Smith, 2010; Kokka, 2022; Mahdi, 2025). This is important given that larger societal structures and inequities greatly impact students’ mathematics learning opportunities and outcomes (e.g., mathematics identity and efficacy) especially those of historically marginalised students (Kokka, 2022). Furthermore, doing this well requires the cultivation of relationships within the mathematics classroom and beyond the classroom with families and community members. A key part of this relationship building involves MTEs being advocates for PSTs, which models for PSTs how to advocate for their future students and their families and communities (Cochran-Smith, 2009).

A role of MTEs is to provide knowledge, tools, and reflective spaces that help PSTs see mathematics as creative, relational and relevant. By integrating research with practice, MTEs aim to support them in designing mathematics learning experiences that are rigorous, accessible and humanising for their future students.

Methodology

Research Design

The study employs a collaborative self-study methodology guided by three characteristics – collaborative inquiry, contextual knowledge, and a commitment for improving practice (Lovin et al., 2012). These characteristics align with our goals as MTEs: to critically examine our teaching, to consider the unique contexts of our students and institution, and to use our reflection to enhance our practice. As MTEs teaching at the same university, we met regularly to discuss and make decisions on our respective mathematics content and methods courses. During these meetings, we shared resources (e.g., course syllabus, class activities, practitioner and research articles) and discussed our experiences as MTEs. One outcome of this collaborative work was a self-study that documents our journeys toward humanising mathematics for PSTs and their future students. We used narrative inquiry to engage in the process of telling, retelling, living, and reliving our experiences (Clandinin & Caine, 2013) through key episodes that illustrate how our positionalities inform our teaching. Our collaborative process involved writing our individual stories (telling) and sharing them with one another for feedback, revisiting and revising those stories after considering that feedback (retelling), reflecting over our prior experiences while continuing our work as MTEs (living), and exploring how our initial ideas or concepts may have evolved following our discussions and reflective process (reliving).

Participants

We are five female MTEs who differ in race, nationality, ethnic identity and career stage (see Table 1). We acknowledge our roles and social positions carry various forms of privilege that shape how we engage with our students and the broader field. One such form of privilege is embedded in the act of teaching mathematics itself, which is often perceived as a gatekeeping subject (Aguirre et al., 2013). We

hold influence over how others experience and come to understand mathematics, which carries both power and responsibility. As MTEs, we have opportunities to exercise professional and pedagogical agency to design transformative and responsive mathematics learning experiences (Bjerke & Nolan, 2026). Additionally, institutional privilege grants us access to professional networks, research opportunities, and the authority associated with academic titles. As we continue to grapple with the implications of these privileges, we recognise their impact on our capacity to shape the field and engage in humanising mathematics.

Table 1
Participants

Participants	Years in Education	Years as an MTE	Race
Nirmala	25	21	South Asian
Karisma	26	16	Black/Afro-Caribbean
Colleen	32	23	White
Fardowsa	15	3	African American
Queshonda	11	6	African American

Researcher positionalities

Nirmala is a South Asian brown woman, who was raised in a formerly colonised nation, learning mathematics in English through a Eurocentric curriculum that ignored the rich, contextual mathematical knowledge of her local community. For her, humanising mathematics means embracing the view that mathematics is not an abstract, culture-free construct, but a deeply human creation shaped by history, language, and lived experience.

Karisma is an Afro-Caribbean woman, mother, and former high school mathematics teacher in a school serving predominantly Black and Brown students from low-income households. For her, humanising mathematics means affirming learners' identities, disrupting harmful narratives, and positioning all students, especially those historically marginalised, as capable doers of mathematics.

Colleen is a White female mathematics educator whose early learning was shaped by growing up in a non-Christian home, raised by a single mother. Diagnosed with dyslexia at age three, she was often seated at the back of the classroom, unheard. For her, humanising mathematics means creating learning spaces where all students are seen, supported, and valued for their potential, and where mathematics is presented as something to understand deeply, not just memorised.

Fardowsa is a Black African Muslim woman, mother of four, and mathematics educator whose learning and teaching journey has spanned East Africa, South Asia, and North America. For her, humanising mathematics means acknowledging that mathematics is not neutral, centring cultural context, fostering critical awareness, and helping learners see mathematics as a tool for empowerment and social justice.

Queshonda is a Black woman, Christian, mother, former mathematics teacher and instructional mathematics coach, who has navigated educational spaces that often failed to affirm the brilliance of historically marginalised learners. For her, humanising mathematics means co-creating learning that centres students' voices, cultures, and lived experiences, positioning them as capable sense-makers and reconnecting mathematics to our shared human experiences.

Data Sources

The primary source of data used for this study is a set of key episodes. Each researcher's key episodes were developed through the lens of selected theoretical frameworks, including ethnomathematics (D'Ambrosio, 1985), teaching mathematics for social justice (Gutstein, 2006), and culturally relevant and responsive pedagogy (Ladson-Billings, 1995; Gay, 2000). Additionally, the key episodes illustrate



pivotal pedagogical experiences shaping the development of our identities as MTEs who are committed to humanising mathematics.

The process of developing and selecting the two episodes in this study began with each researcher reflecting on their social and cultural identities, educational journeys, initial beliefs about mathematics teaching and learning, positionality in the field, the theoretical or conceptual foundations of their teaching practice, and how theory informed their teaching. Each researcher initially identified and described several key episodes that met the following criteria:

1. Describes transformational experiences that led to a shift in the way we view mathematics (education).
2. Identifies tensions that we experienced in promoting humanising pedagogies.
3. Acknowledges strengths and weaknesses impacting our practice.

In this reflection process, we drew from data sources that span several semesters of teaching (e.g., teaching artefacts, author reflections rooted in students' artifacts, required annual peer observations, narratives, stimulated recall, research literature) as well as memories from our time as classroom teachers. These sources supported researcher reflections, helped contextualise the experiences, and enriched the construction of the key episodes. From these initial episodes, two episodes that most clearly represented the focal experiences and themes of the study were selected and further refined through the collaborative process defined in the next section.

Data Analysis

We used narrative inquiry to analyse and interpret the data (Clandinin & Caine, 2013). In our first stage of analysis, we served as critical friends (Ragoonaden & Bullock, 2016) by reading through each other's key episodes, asking probing and clarifying questions and providing constructive feedback. We then revised the episodes in response to these discussions. Specifically, we included additional details, provided clarifications, and strengthened connections between experiences and interpretations. These collaboratively refined episodes served as the primary data set for subsequent analysis.

In the second stage of analysis, each author read through all episodes to identify intersecting identities and experiences to develop preliminary patterns that impacted our work as MTEs. In the third stage, we categorised the episodes into themes that reflected common patterns related to our educational journeys (e.g., identity development, theoretical orientations, transformative experiences, and strengths and assets that informed our practice). This involved reviewing margin notes, questions, and comments generated during the critical-friend process on each other's episodes, and then meeting collectively to discuss, refine, and consolidate themes. In the fourth stage, we focused on experiences within the episodes that were most significant in shaping our identities and practice. We engaged in several iterative rounds of analysis and revisited the episodes, margin notes, questions, and comments until saturation was reached (Rahimi, 2024). The identities and experiences that emerged as most prominent are provided in the following section.

Key Episodes

In the following key episodes, we expand further on our positionalities and our varied experiences and the influence these have had on how we each perceive and enact a humanising approach to teaching mathematics for PSTs. Our key episodes foreground moments of growth and possibilities. At the same time, we engage in ongoing sensemaking around the tensions and contradictions present in our practice and acknowledge that our experiences are situated within broader structural and institutional and social contexts.

Nirmala's Episodes

Episode 1: Formative teaching experiences in a linguistically diverse context

My first teaching position in higher education was at a four-year college in my home country. The institution served a linguistically diverse student population—many like me, had learned mathematics in English, a non-native language. The college had not previously had a stable mathematics faculty, so I was hired to help build the department and support student success. Students needed help to succeed in a tightly sequenced curriculum that included topics in engineering mathematics. The responsibility felt both urgent and demanding.

My teaching followed the established norms of the time in that context. I wrote detailed daily lessons, outlining which topics to teach and which problems to work out. During each class session and out of class tutoring sessions, I made sure that students took diligent notes, solved ample practice problems, and checked their own work. When the end of the semester exam results came, the student success rate was phenomenal and the public appreciation I received from the administrators was deeply affirming.

Yet, even within those moments of success, I now recognise complexities I did not fully see at the time. As English was the official language of instruction, during class and tutoring sessions, I encouraged students to speak and communicate their mathematical thinking in English. In practice though, I noticed that students frequently engaged in mathematical conversations in their native language. I could not always follow these conversations, but I could see that these interactions often helped students reason more effectively. In retrospect, this revealed a persistent gap between what I believed about mathematics and how learning unfolded in the classroom. I believed mathematics could transcend language, yet classroom learning was deeply shaped by it. At the same time, I was enforcing the institutional expectation that students communicate only in English. Years later, as a graduate student in a foreign country among native English speakers, I began to understand what it might have felt like for my students—the challenge of expressing complex ideas in a language that is not one's own. Did requiring English unintentionally limit their participation? Whose ideas and what reasoning were left unspoken because of this strict expectation?

Another tension concerned the curriculum. At the time, I had not yet questioned the nature of mathematics itself. The curriculum emphasised abstraction, procedural fluency, and disembodied reasoning, often disconnected from socio-cultural contexts or historical knowledge (Joseph, 1987;). It did not always reflect students' lived experiences, but it served as a gateway to professional opportunities and determined who advanced and who did not. In that context, success in those examinations carried very real consequence for students and their families. Teaching it felt necessary to support students' immediate success, but it also reinforced the system's narrow definition of mathematics and of my own early assumptions about mathematics teaching. Yet I wonder what might have happened had I challenged those structures. Would introducing alternative mathematics histories or culturally grounded mathematics enriched students' understanding? Or would it have taken time away from preparing for high-stakes examinations that determined their futures? I also think about those who struggled within these structures. Could different approaches have supported them better?

Nearly a decade later, graduate study in a new setting offered me frameworks to revisit these questions and rethink mathematics, language, and culture. Theoretical perspectives (e.g., ethnomathematics) highlighted how mathematics is embedded in culture, history, and power. These ideas stayed with me as I returned to teaching, particularly in my work with teachers.

Episode 2: Humanising statistics education through critical and cultural relevance

As an MTE in a mathematics department, my work has consistently focused on teaching mathematics content courses for teachers. A pivotal moment came when I taught a course on the teaching and learning of statistics for in-service teachers. It was my first intentional effort to align statistical content with social justice themes across an entire semester. I drew from the domains of statistics education



(e.g., Franklin et al., 2007; Gould & Peck, 2004;) and critical pedagogy (Freire, 1998; Gutstein, 2006; Lesser, 2007) to design the course.

From a disciplinary perspective, I structured the course to expand the boundaries of statistical knowledge making space for critique, interpretation, and cultural connection. Pedagogically, I centred collaborative inquiry, reflective dialogue (Naresh et al., 2022), and opportunities for teachers to author and adapt their own lessons. Coursework was designed to encourage teachers to see mathematics as a human activity: contextual, interpretive, and socially meaningful. I hoped that by modelling such a course and sharing the materials with the teachers, I could offer tangible examples for use in their classrooms.

Still, end of the course evaluations showed an unexpected misalignment between my intentions and teachers' perceptions. Many participants resisted the social themes and a few expressed discomfort. Some felt that they had not learned meaningful statistics that they could take back to their classrooms. I found this feedback difficult to process. I had designed the course carefully to integrate statistical reasoning with socially meaningful contexts. I believed that this approach would strengthen both rigor and relevance. Teacher feedback, however, reminded me that well-intentioned changes require attention to learners' readiness, expectations, and professional realities. What I intended as support felt unfamiliar or risky to teachers. In these moments, I recognised echoes of my own earlier teaching; the constant struggle to balance supporting learners' immediate success with challenging assumptions about mathematics and its teaching.

Karisma's Episodes

Episode 1: Initial attempts at modelling culturally relevant mathematics teaching with prospective elementary teachers

As a post-doctoral scholar, I started teaching an elementary mathematics methods course to PSTs seeking early childhood through 6th grade certification. My interest in elementary mathematics education emerged when my oldest child started kindergarten. At this time, my identities as a mother and a researcher converged. My research focused on identifying racial inequity in mathematics learning opportunities (Morton & Rieggle-Crumb, 2019, 2020), and I was especially concerned about the mathematics learning trajectory of my son who was entering the public school system that in many ways marginalises and dehumanises Black boys (Ladson-Billings, 2011). As such, I became increasingly interested in supporting elementary PSTs to teach in culturally relevant ways.

I faced several challenges in teaching this course. First, the students in my course were predominantly white middle-class young women who attended K–12 schools with little racial or ethnic diversity. As a Black woman, it was difficult to connect to my students in meaningful ways. Consequently, it was especially challenging to model culturally relevant pedagogy for them. This became evident at the end of that semester. I learned through student feedback on the course evaluation that even though I was prioritising preparing PSTs to teach mathematics in culturally relevant ways, the students reported feeling disconnected from what they were learning and as such, did not feel prepared to teach mathematics well. Given that I was at the start of my career as an MTE, I internalised much of their feedback, and I made a conscious decision to seek out resources (e.g., Aguirre et al., 2013; Drake et al., 2015) and used them to redesign the course. However, in retrospect, I recognise that I held positions of both privilege and oppression in that space—as a professor and as a Black woman, respectively (Collins, 1990)—and there remain questions about that experience that I continue to ponder. Was my students' lack of receptiveness to my instruction due to a deficiency in my own teaching or some other factors such as my race and/or gender? Was the legitimacy of what I tried to teach undermined by implicit biases held by my students or myself?

Episode 2: Rethinking operationalizing humanising mathematics with elementary PSTs

I transitioned to a Hispanic and Minority serving institution and I became increasingly more committed to utilizing humanising practices in my teaching of elementary mathematics methods. I continued to



tinker with learning activities and assignments to better attend to the needs of my students, many of whom were from racially minoritised populations in the US (see Morton, 2024). One trend that I noticed was that many of my students had developed a debilitating fear of engaging in mathematics activities and believed the common narrative that mathematics ability was reserved for a select few (Aguirre et al., 2013; Drake et al., 2015; Martin, 2009). They expressed concern about teaching a subject that they did not feel competent with as a learner. Considering that this fear would be a hindrance to their preparation as elementary mathematics teachers, I decided to make space for PSTs to be able to share the mathematics learning experiences that may have contributed to these feelings of fear and apprehension through the writing and unpacking of their mathematics autobiography (Aguirre et al., 2013; Drake et al., 2015). Once they reflected on those experiences, I asked PSTs to reflect over their experiences in relation to their classmates' experiences by engaging in a series of in class activities. I designed the activities to give PSTs the opportunity to utilise windows, mirrors, and sliding glass doors (R. S. Bishop, 1990; Gutiérrez, 2018). PSTs who were more mathematics anxious reported feeling that their mathematics learning experiences were validated, and those who were not mathematics anxious, were able to learn more about experiences that were different from theirs thus also giving them a better understanding of the importance of teachers in fostering positive learning experiences for mathematics learners.

However, in more recent years this same activity has had the opposite effect in my PSTs. I started noticing that recounting those experiences with their peers in some cases seemed to reinforce some students' perceptions of their mathematics ability rather than confront them. Conversations with peers with similar experiences resulted in a confirmation that they were either in the group of students who were mathematics capable or not. This was particularly damaging for students with mathematics anxiety. How had an activity that had been so impactful before have such negative impacts now? In my quest to humanising mathematics did I cause harm to my students and inadvertently reinforce the idea of hierarchies in mathematics ability?

Colleen's Episodes

Episode 1: The first 10 years as a mathematics teacher educator

Early on in my career as an MTE, I had the opportunity through funded projects to support algebra and geometry teachers to develop their ability to support student learning. I did this primarily through lesson study (Pratt & Eddy, 2020) alongside other professors committed to reflecting on our practice of teaching elementary mathematics methods courses (Cooper et al., 2011; Lewis, 2002; Meyer & Wilkerson, 2011). While lesson study supported my goal of working with teachers to improve our mathematics instruction in those initial years, I was not considering my intersecting identities or those of my PSTs and their future students.

In my early years leading professional development (PD) sessions with in-service teachers, I provided opportunities for teachers to select the purpose and content for improving their instruction which disrupted hierarchies of mathematics expertise and redistributed power (Gutiérrez, 2018). However, the PDs did not consider humanising mathematics. My focus at that time was being inclusive, but I needed to push further. Soon thereafter, I attended a session at a regional conference about equity in a middle grades mathematics content course (Dibbs & Beene, 2017) and I was introduced to the use of culturally relevant pedagogy (Ladson-Billings, 1995) in mathematics teacher education. I realised that one crucial step in this pedagogy is seeking to know preservice and in-service teachers and their prior experiences in mathematics, and how this impacts their teaching of mathematics (Aguirre et al, 2013).

Episode 2: A journey to transformation

My first attempt to centre PSTs' identity and support their agency as teachers was adding an autobiography assignment (Dibbs & Beene, 2017) into a secondary STEM methods course. As PSTs shared about themselves and their mathematics and science learning experiences I began to see them



in new ways. Their autobiographies, which they also shared with their classmates, allowed us all to see each other as humans, sympathise with experiences different from our own and consider how this impacts our teaching. This foundation helped me to delve into other discussions about multiculturalism and why it matters in the classroom. However, I struggled with doing this work alone without being able to debrief with colleagues doing similar work. Therefore, I sought to attend research conference sessions where there were conversations about humanising mathematics so I could continue to learn.

During this time, I became aware of the lens I used to view my students and teaching. While previously I sought to instil instructional mathematics and science practices that promoted pedagogical content knowledge (Ball et al., 2008) such as productive discussions (Smith & Stein, 1998, 2018), I now understood the importance of educators knowing their students and considering the life experiences they have in the mathematics classroom. I had also come to realise that I was a member of several dominant groups in the United States (i.e., white, heterosexual, and follower of Jesus) that afforded me privilege that some of my colleagues and my students did not have. I also realised that I held colour-blind beliefs (McIntosh, 1988). As a result, I hungered to know more about the experiences of my colleagues and students who were different than me. I sought to create a space in my classes where students could bring their whole selves and support their agency as teachers and their students' agency as STEM learners. Some of my PSTs, however, did not value this aspect of the course, with several stating that more emphasis should be placed on the STEM content.

Most recently, I taught a new STEM elective course for elementary teachers focused on a commitment to all learners (Losoya & Eddy, 2026). One of the goals of the course was for PSTs to understand the importance of identity development, lived experiences, activism, and participation as key constructs for STEAM disciplines in K–12 classrooms. One of the course assignments, Identity Development as STEAM Activists, had three components: reflect on experiences in STEM in grades PK–12 and outside of school; investigate a STEAM activist, individual or an organisation; and reflect on two components that support them as a future STEM teacher. This assignment, much like the autobiography, gave the PSTs and me a mirror and window into PSTs' lived experiences (R. S. Bishop, 1990).

Fardowsa's Episodes

Episode 1: From interdisciplinary roots, constrained environment to modelling teaching mathematics for social justice with prospective teachers

My teaching career began in an international school, teaching middle and high school mathematics in West Africa. As a beginning teacher, I faced challenges that included teaching multiple grades in a classroom, and students that needed various accommodations. I was, however, able to overcome those challenges through support from colleague teachers. I learned to humanise mathematics by centring students' experiences and community concerns (e.g., student-led inquiry into global poverty). For example, collaborating across science, social studies, and language arts affirmed mathematics as meaningful and culturally relevant (; Gutstein, 2006; Ladson-Billings, 1995).

I faced new challenges when I returned to schools in the United States, teaching high school mathematics. For example, high-stakes testing, time pressures, and limited support for interdisciplinary work constrained those practices that I used in the past. These challenges have informed how I instruct preservice teachers to incorporate mathematics with social justice topics that are important to them and their future students, thus facilitating experiences that honour them and the social issues that are relevant to their lives. I supported PSTs to view mathematics as a tool through which learners can interrogate the world around them (Gutstein, 2006; Ladson-Billings, 1995).

I believe it is essential that PSTs understand how to teach mathematics for social justice. Facilitating the activity, "Papi's 70th Birthday?" (Aguirre & Zavala, 2013) with PSTs was a pivotal experience in my work. In this activity, the PSTs struggled to determine how three siblings might share the cost of a birthday celebration. Through the lens of social inequalities, the activity emphasised that mathematics could support critical reasoning and social analysis. As I guided PSTs through determining how three



siblings might fairly share the cost of a birthday celebration, I could see their assumptions about fairness being challenged.

Episode 2: Teaching mathematics for social justice, emotional preparedness, and caring with awareness

Teaching mathematics for social justice is challenging work that requires emotional resilience from teachers. During an interview with one beginning teacher who was a previous student in my mathematics methods course, I found the challenges I faced decades ago in the classroom continued today in her classroom. This beginning teacher described her struggle of balancing her students' diverse needs. She also explained the structural pressures, such as standardised testing and mandated curricula that heightened the challenge of teaching mathematics for social justice (Mahdi, 2025).

The experience had made it emotionally challenging for her to teach mathematics for social justice while preparing students for state-mandated assessments. More than ever, I resonated with Kokka's (2022) concept of "caring with awareness", and this conversation reinforced for me the importance of intentionally fostering emotional preparedness in teacher education. As a mathematics teacher educator, I recognise that emotional preparedness needs to be an intentional part of our preparation programs. Facilitating peer discussions, modelling emotional vulnerability, and creating room for ongoing mentorship can help future teachers manage the emotional labour of this challenging yet critical work.

Queshonda's Episodes

Episode 1: Reimagining mathematics: Teaching for justice, relevance, and joy

During my first years of teaching, I taught mathematics the way I had been taught but I had not yet questioned the deeper purpose behind what I was doing. Then I had an epiphany. I began to realise that many of my students, especially those who did not want to be in school, were not there by choice. They were being forced to attend by their parents, guardians, or the state. I started to imagine what it would feel like to be required to sit in a room for hours each day where the walls were white, the teacher spoke in a monotone voice, and the content felt irrelevant. I imagined that it would feel like a prison, like punishment, rather than an opportunity.

That realisation changed my approach to teaching. I knew I needed to offer more than procedures and practice problems. I began to explore ways to make mathematics relevant, empowering, and joyful. I started using projects from my informal STEM experiences, connecting mathematics to students' backgrounds (Ladson-Billings, 1995), and using more relevant, cognitively demanding tasks (Smith & Stein, 1998). Now, in my mathematics methods courses, I require PSTs to connect mathematics to students' experiences. They use robotic vehicles, base-ten blocks, and other hands-on materials that support student learning in ways that are engaging, relevant, and fun.

That moment in my third year of teaching didn't just change how I teach. It transformed what I believed mathematics could be. It is more than a subject. It is a way to make sense of the world, a means to advocate for justice, and a source of joy. This shift, however, did not happen without challenges. For example, one of the assignments in my methods course requires the PSTs to go on a walk in their students' communities and identify places that can be utilized to develop mathematics tasks. Initially, some PSTs are resistant and frame it as an unrealistic task for classroom teachers to engage in. PSTs have also expressed similar reactions when being asked to integrate robotics and coding into mathematics. Often, once they have gone through the process, many of them realise the value in the assignments.

Episode 2: The system was failing them: A coach's realisation

Before working at the university level, I served as a K–12 mathematics teacher educator. In this role, I supported secondary mathematics teachers by identifying instructional resources, engaging in collaborative planning, co-teaching lessons, and modelling effective instructional practices. This



experience allowed me to observe mathematics teaching across a range of classroom contexts. While many teachers demonstrated strong instructional practices and a commitment to improving their teaching, I observed that less effective instruction was more often experienced by Black and Brown students. There was one classroom where students were often clustered in small groups, talking, laughing, or sitting passively with nothing in front of them. When they did have work, it was usually worksheets disconnected from context. This deeply affected me because I saw myself in those students. I knew they had potential, curiosity, and capability. I knew this because of my own experience as a student who attended a predominantly Black high school where teachers taught mathematics in an empowering way. Consequently, I knew it was possible to do better. Unfortunately, the classroom environment was not supporting their growth. When the teacher asked me to model a lesson, I accepted and designed one with students' interests in mind. I connected inequalities to something relevant: the amount of money YouTubers makes per view. The students were engaged, curious, and active participants. That experience confirmed that the issue is not always the students, instead, it is sometimes the way mathematics is taught.

These types of experiences inform my work as a university MTE because it inspires me to share these stories with my students to raise awareness and inspire change. I also use resources (e.g., Aguirre et al., 2013) which highlight the importance of equitable mathematics teaching. I am often encouraged when PSTs contribute to the discussion regarding how they have addressed a particular situation more equitably. Sometimes these conversations are met with silence, resistance, and the blaming of students and their families. These reactions are challenging to navigate as a Black woman, and the emotional labour can be exhausting. At times, it is hard to discern whether the silence reflects discomfort and uncertainty, or a deeper reluctance to reimagine what is possible for Black and Brown students. Navigating this tension requires me to both support PSTs in growing their practice, while also grappling with the possibility that not all are ready or willing to do so.

Discussion

Through narrating our key episodes, we illustrate how our lived experiences influence our pursuit of humanising mathematics with PSTs. Nirmala's episodes reveal how her experiences as an English language learner and as a mathematics teacher in her home country, where Eurocentric practices were prioritised and valued over culturally relevant approaches, shaped her pedagogical stance. These formative experiences prompt her to challenge whose mathematics is valued and to elevate the diverse mathematical practices that emerge from communities, cultures, and everyday human activity (Gutiérrez & Rogoff, 2003), and provide space for her and her students' continued transformation. Karisma's episodes highlighted how her identity as a mother scholar (Simic-Muller, 2018) spurred her commitment to ensuring that all children, regardless of background, receive mathematics instruction that is rigorous and meaningful. As an MTE, she promoted and modeled the type of mathematics teaching where students' feel seen, heard, and valued in the classroom and the mathematics curriculum is centred in their culture.

Colleen's episodes highlighted her identity as a lifelong learner who is inspired by the expertise of other MTEs and the lived experiences of her students. She valued being part of a collaborative group that challenged hierarchical structures that impose power dynamics that can hinder the pursuit of humanising practices. Her approach to humanising mathematics involves humility, curiosity, and grace as she engaged with colleagues and students, which subsequently aided in collective growth. Fardowsa's episodes illuminated how her prior experiences as a classroom teacher in a West African international school contributed to her commitment to teaching mathematics for social justice (Gutstein, 2006; Kokka, 2022). For her, this focus elucidates the very human aspects of people's lives that can be critically explored using mathematics. Key to this was her utilisation of empathy and care (Amidon et al., 2020) in her work with PSTs, recognising that teaching mathematics for social justice may often take an emotional toll. In Queshonda's episodes she described how her identities as a mother and learner converge to influence her emphasis on providing culturally relevant pedagogy to PSTs, which often



includes connections to STEM contexts. Her approach involved a commitment to transforming mathematics education into a space that empowers through teaching mathematics for social justice, takes advantage of STEM contexts, and affirms students' identities through culturally relevant pedagogy.

Tensions

Through our process of living, reliving, telling, and retelling we also recognised that there were several tensions in our pursuit of humanising mathematics as MTEs. These tensions emerged through questions that we asked one another and continue to ask ourselves. We share these tensions in hopes that our vulnerability and transparency may be useful to other MTEs.

First, we grappled with negotiating the identities we hold that evoke privilege and oppression within our mathematics teacher education spaces. Our identities as MTEs in a higher education context affords us privilege within our classrooms and professional development spaces, thus positioning us as having specialised expertise and power (). While we make attempts in our practice to redistribute this power, as evidenced in Colleen's episode, we risk remaining stagnant if we do not admit that there is more yet to learn about ourselves and others. And even when we commit to doing this, we may have blind spots that can significantly impact our practice (Kitchen & Brown, 2022). Queshonda's episode adds another layer to this by illuminating that even as higher education faculty with privilege and status, we may still feel the weight of having to repeatedly argue for the importance of humanising mathematics. For instance, while PSTs may be open to exploring inequities, some are resistant to engaging in conversations that centre race and racism (Simic-Muller et al., 2015). Rejection of humanising mathematics intended to bring about racial equity in the mathematics classroom can feel like a rejection of the need for mathematical literacy for the marginalised groups that some MTEs are a part of, making that rejection especially personal and hurtful.

Second, we continuously engage with, and sometimes confront, our own perceptions of humanising mathematics as we recognise that they may not have the intended result (Andrews et al., 2019). We ask, "Are we, in fact, engaging in humanising mathematics with our students in a way that they perceive to be humanising? How do we meet PSTs where they are without compromising a vision for more humanising mathematics?" Nirmala's and Karisma's episodes reveal that even well planned and well-intentioned activities designed to promote humanising mathematics may ignore real needs of students and reinforce mathematics related inequities, respectively. Karisma's episode also explores maintaining the balance between attending to mathematics anxiety and low self-efficacy among elementary PSTs and engaging them in learning experiences that uphold mathematical rigor and productive struggle (Bartell, 2013; Koestler et al., 2023). Leaning too much on the former may result in the under preparedness of PSTs for the actual teaching of mathematics while leaning too much on the latter may negatively affect PSTs' mathematics teacher identity. The question arises, "How do we maintain that balance?" Student feedback on the effectiveness of humanising mathematics in our courses may be a useful indicator, however, Karisma's episode also illustrates the tension between valuing students' feedback and not ignoring the possibility that negative feedback could be based on biased ideologies around race or other identity markers (Chávez & Mitchell, 2020).

Third, we consider how our identities as MTEs are shifting as we pursue humanising mathematics in response to the needs of the PSTs we teach. Pursuing humanising mathematics may look very different with today's PSTs than with those of ten or even five years ago. Over the last decade, global society has been shaped by events such as the COVID-19 pandemic, racial unrest and the salience of Artificial Intelligence (AI) and social media that have greatly affected how we prepare PSTs to teach (e.g., Greenhow et al., 2020; Jamal, 2023; Navarro, 2020). Within the local United States contexts, there have been movements that have influenced legislation that severely hinder the enactment of humanising mathematics in teacher education programs. There has been a huge push for the standardisation of education, that subtly invades teacher education spaces and mandates the inclusion of topics that align with this new approach to learning mathematics that consequently reduces the time



available to fully engage in humanising mathematics with students (Fenuku & Akpaku, 2024; Krise, 2016). Factors such as these impact how PSTs view the world and themselves in it, especially as educators. Similarly, as MTEs we also wrestle with how we are viewed by education stakeholders and consequently how we view ourselves and our roles considering these growing societal changes (Price & Osborne, 2000). Has our role shifted to preparing PSTs to teach mathematics in ways that are aligned with broader educational priorities that do not attend to humanising mathematics? How do our perspectives fit in the broader conversation around how PSTs should be prepared?

We also wrestle with navigating the external realities of schooling structures and our preparation of teachers to teach mathematics within those structures. For instance, traditional K-12 schooling involves the standardisation of assessments and curricula to hold teachers accountable for students' learning. However, often in mathematics these assessments and curricula do not have a focus on humanising mathematics (Sleeter & Carmona, 2017). This standardisation may be especially appealing among PSTs who are high mathematics achievers as they often subscribe to the notion of the universal nature of mathematics versus the situational nature of mathematics (Suominen et al., 2018; Toh et al., 2013). Furthermore, there is the pervasive belief that mathematical proficiency is relegated to a select group (a group to which they belong), and as such not doing well mathematically is solely attributed to student aptitude and effort. Further complicating this is the disconnect between the humanising practices we advocate for in teacher education and the practices that PSTs often observe in their field placements (Allsopp et al, 2006; Brown et al., 2021; Howell et al., 2019; Zeichner, 2010). Given all this we sometimes question whether we are adequately preparing PSTs for their professional realities. We assert that humanising mathematics is necessary, yet we also recognise the restrictions that teachers may have to teach in this way due to these schooling structures. However, as illuminated in Fardowsa's episode, teaching PSTs to advocate for themselves and their students is important, but this must be coupled with care and understanding regarding their teaching realities. How do we navigate these challenges? What should we prioritise in our instruction? What role, if any, should creative insubordination (Gutiérrez, 2016b) play in our preparation of mathematics teachers?

Implications for Other MTEs

The study reported in this article has several implications for MTEs. First, our work illuminates the benefits of counter spaces (Ong et al., 2018; Schwartz, 2013) in the pursuit of collective critical inquiry. Having a counterspace where we were able to reflect individually, share our reflections, and receive constructive feedback was invaluable to each of us. Our safe space allowed us to be vulnerable with one another without fear of judgment. We share a collective vision for enacting humanising mathematics in our teaching of PSTs, and we recognise the need to be both supported and challenged in ways that would foster our growth. We were also able to use metaphors of windows, mirrors, and sliding glass doors (R. S. Bishop, 1990) to explore our experiences with humanising mathematics as well as seeking to understand those experiences and those of others. Specifically, windows allowed us to learn more about each other's experiences, mirrors allowed us to reflect on our individual experiences, and sliding glass doors provided a way for us to step into and engage more fully with the experiences of others. We encourage other MTEs to seek out opportunities with your institutions and professional organisations that can serve as counter spaces to pursue similar work in your contexts.

We also believe that critical inquiry into personal practices modelled in this article is a good example for PSTs to follow in their own practice as mathematics teachers. Therefore, we should share our own struggles and gains as MTEs committed to humanising mathematics to further humanise the process for them. It is important for PSTs to see that none of us ever arrives at perfectly implementing humanising practices partly because these practices are so context and classroom dependent. No two contexts are the same, nor do they require the same exact approaches. Similarly, no two sets of students are the same, and as such being responsive to unique needs is necessary. Therefore, being open and vulnerable with PSTs about our journeys in implementing these practices may have great impact on others' journeys. We expand on the work done in our counter space by providing opportunities for



PSTs to claim authority over their mathematics learning experiences, honour multiple mathematical traditions, value diverse ways of knowing, and engage their students holistically (Gutiérrez, 2018).

Our pursuit of humanising mathematics provides powerful affordances for weaving funds of knowledge (Gonzalez, Moll & Amanti, 2005), culturally responsive mathematics (Gay, 2000), ethnomathematics (D'Ambrosio, 1985), and critical mathematics education (Frankenstein, 1983; Gutstein, 2006; Skovsmose, 1985) into the fabric of our teaching and scholarship. Also, we admit that engaging in humanising practices may require that we exercise patience and grace. In many cases, PSTs may be exposed to humanising mathematics learning experiences for the first time in their mathematics learning trajectories. As such, it may be a bit jarring for them at first. But creating a mathematics learning environment that is built on trust and genuine care is necessary. Frameworks such as Torres's Rights of the Learner (Kalinec-Craig, 2017; Rupe, 2025) may help PSTs to unlearn some of the potentially harmful ways that they have had to engage in mathematics activity without agency and confidence (Kalinec-Craig et al., 2023). When engaging in humanising mathematics involves exploration of challenging or controversial topics, allowing space for critical grace (Amidon et al., 2020) may provide a way to navigate conversations without diminishing their urgency or importance.

Conclusion

We are five MTEs who individually and collectively draw from theories that centre humanising mathematics education. We have come to realise that humanising mathematics is not a fixed destination, but an ongoing process that requires us to listen, adapt, and grow alongside the learners we work with. Our paths to humanising mathematics are varied and are influenced heavily by our respective positionalities and experiences. We bring our whole selves into our collective space of reflection to explore how we can engage in critical inquiry to further develop our practice. While tensions and challenges inevitably arise, we also hold on to hope that the seeds we plant and nurture in our courses may one day bloom in our students' teaching trajectories. As such, we leave you with an excerpt from a former PST's email to Nirmala, reflecting on a course she took many years earlier. The Plinko activity she recalls was used to explore connections between statistics, society, and everyday experiences. This brief note, though informal, reminds us that humanising mathematics can extend beyond the immediate classroom experience: it can shape how PSTs remember mathematics, what they come to notice about it, and how they carry those experiences into their own teaching.

Hello! It is so wonderful to hear from you. Thank you so much for reaching out! I am just seeing your email as I transition back to work this week. ... Much has changed since our last time together. I think of my time at [institution name] fondly, and you had such an impact on my academic experience. Every time I see Plinko, I think of our work together!

The PST's experience extended beyond the course itself, as the Plinko activity later became the basis for a collaboratively published article (Naresh & Royce, 2013), creating an opportunity for the PST to participate in mathematics education scholarship. While the work that we do as MTEs remains messy and ongoing, such moments remind us why we continue to listen, reflect, adapt, and nurture the possibility that what happens in our courses may influence how mathematics is understood, taught, and experienced beyond them.

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Ethical approval

As per the IRB notification from the University of North Texas, the self-study “does not meet the regulatory definition of human subjects research, and review and approval by the UNT IRB is not required.” The participants gave informed consent for the use of their first names for publication purposes.

Competing interests

The authors declare there are no competing interests.

References

- Aguirre, J. M., Mayfield-Ingram, K., & Martin, D. B. (2013). *The impact of identity in K–8 mathematics: Rethinking equity-based practices*. National Council of Teachers of Mathematics.
- Aguirre, J. M., & Zavala, M. d. R. (2013). When equal isn’t fair: Using ratios to scale up mathematical arguments. E. Gutstein & B. Peterson (Eds.), *Rethinking mathematics: Teaching social justice by the numbers* (pp. 115–121). Rethinking Schools.
- Allsopp, D. H., DeMarie, D., Alvarez-McHatton, P., & Doone, E. (2006). Bridging the gap between theory and practice: Connecting courses with field experiences. *Teacher Education Quarterly*, 33(1), 19–35. https://www.teqjournal.org/backvols/2006/33_1/07allsoppetal.pdf
- Amidon, J., Marshall, A. M., & Smith, R. (2020). *Grace in learning: A necessary condition of equitable practices in the mathematics classroom*. Session at annual conference of the Association for Mathematics Teacher Educators. Phoenix, AZ.
- Andrews, D. J. C., Brown, T., Castillo, B. M., Jackson, D., & Vellanki, V. (2019). Beyond damage-centered teacher education: Humanizing pedagogy for teacher educators and preservice teachers. *Teachers College Record*, 121(6), 1–28. <https://doi.org/10.1177/016146811912100605>
- Arribay, L. (2025). Teaching mathematics through traditional weaving patterns: A cultural heritage integration model. *International Journal on Culture, History, and Religion*, 7(SI3), 75–89. <https://doi.org/10.63931/ijchr.v7iSI3.307>
- Ascher, M. (1991). *Ethnomathematics: A multicultural view of mathematical ideas*. Chapman and Hall.
- Ball, D. L., Thames, M. H., & Phelps, G. (2008). Content knowledge for teaching: What makes it special? *Journal of Teacher Education*, 59(5), 389–407. <https://doi.org/10.1177/0022487108324554>
- Bartell, T. G. (2013). Learning to teach mathematics for social justice: Negotiating social justice and mathematical goals. *Journal for Research in Mathematics Education*, 44(1), 129–163. <https://doi.org/10.5951/jresmetheduc.44.1.0129>
- Bishop, A. J. (1990). Western mathematics: The secret weapon of cultural imperialism. *Race and Class*, 32(2), 51–65. <https://doi.org/10.1177/030639689003200204>
- Bishop, R. S. (1990). Mirrors, windows, and sliding glass doors. *Perspectives*, 6(3), ix – xi.
- Bjerke, A. H., & Nolan, K. T. (2026). Theorising disruptive pedagogy in teacher education: Mathematics teacher educators and practice-theory challenges in the post-field context. *Mathematics Teacher Education and Development*, 28(3), Article 17. <https://mted.merga.net.au/index.php/mted/article/view/1376>
- Brown, C. P., Barry, D. P., Ku, D. H., & Puckett, K. (2021). Teach as I say, not as I do: How preservice teachers made sense of the mismatch between how they were expected to teach and how they were taught in their professional training program. *The Teacher Educator*, 56(3), 250–269. <https://doi.org/10.1080/08878730.2020.1847225>
- Chahine, I., & Naresh, N. (2025). Mathematics in many voices: Exploring the cultural dimensions of learning and research using ethnomathematics. In D. C. Orey, M. Rosa, A. M. Fernandes, R. C., Pinheiro, Z. F. Madruga, &



- A. D. Castillo (Eds.). *Polysemic interactions of ethnomathematics as program: Interfaces with pedagogical action, the ethics of diversity, social justice, and total peace: Evidences from the field* (pp. 109–128), LF Editorial. <https://doi.org/10.29327/5610095.1-9>
- Chávez, K., & Mitchell, K. M. (2020). Exploring bias in student evaluations: Gender, race, and ethnicity. *PS: Political Science & Politics*, 53(2), 270–274. doi:10.1017/S1049096519001744
- Civil, M. (2007). Building on community knowledge: An avenue to equity in mathematics education. In N. S. Nasir & P. Cobb (Eds.), *Improving access to mathematics: Diversity and equity in the classroom* (pp. 105–117). Teachers College Press.
- Clandinin, D. J., & Caine, V. (2013). Narrative inquiry. In A. A. Trainor & E. Graue (Eds.), *Reviewing qualitative research in the social sciences* (pp. 166–179). Routledge.
- Cochran-Smith, M. (2010). Toward a theory of teacher education for social justice. In A. Hargreaves, A. Lieberman, M. Fullan, & D. Hopkins (Eds.), *Second international handbook of educational change* (pp. 445–467). Springer Netherlands. https://doi.org/10.1007/978-90-481-2660-6_27
- Collins, P. H. (1990). *Black feminist thought: Knowledge, consciousness, and the politics of empowerment* (2nd ed.). Routledge. <https://doi.org/10.4324/9780203900055>
- Cooper, S., Wilkerson, T. L., Eddy, C. M., Kamen, M., Marble, S., Junk, D., & Sawyer, C. (2011). Lesson study among mathematics educators: Professional collaboration enabled through a virtual faculty learning community. *Journal on Excellence in College Teaching*, 3(1).
- D'Ambrosio, U. (1985). Ethnomathematics and its place in the history and pedagogy of mathematics. *For the Learning of Mathematics*, 5, 44–48. <http://www.jstor.org/stable/40247876>
- D'Ambrosio, U. (2007). Peace, social justice and ethnomathematics. *The Montana Mathematics Enthusiast, Monograph*, 1(2007), 25–34. <https://doi.org/10.1108/book-978-1-60752-614-820251004>
- DiAngelo, R. (2018). *White fragility: Why it's so hard for white people to talk about racism*. Beacon Press.
- Dibbs, R., & Beene, L. (2017). *Ethnomathematics meets with math history: Incorporating equity into a middle school content course* [Conference Presentation]. AMTE-TX Conference, Fort Worth, TX, United States.
- Drake, C., Aguirre, J. M., Bartell, T. G., Foote, M. Q., Roth McDuffie, A., & Turner, E. E. (2015). *TeachMath learning modules for K–8 mathematics methods courses*. Teachers Empowered to Advance Change in Mathematics Project. <http://www.teachmath.info>
- Fasheh, M. J. (2012). The role of mathematics in the destruction of communities, and what we can do to reverse this process, including using mathematics. In O. Skovsmose & B. Greer (Eds.), *Opening the cage: New directions in mathematics and science education* (Vol. 23, pp. 93–106). Sense Publishers. https://doi.org/10.1007/978-94-6091-808-7_4
- Fenuku, S. D., & Akpaku, E. (2024). The impact of standardized teaching methodologies on student learning and teacher autonomy in Ghanaian schools. *Journal of Linguistics, Literature, and Language Teaching*, 3(2), 83–97. <https://doi.org/10.37249/jllt.v3i2.774>
- Francois, K., & Stathopoulou, C. (2012). In-between critical mathematics education and ethnomathematics. A philosophical reflection and an empirical case of a Romany students' group mathematics education. *Journal for Critical Education Policy Studies*, 10(1), 234–247.
- Frankenstein, M. (1983). Critical mathematics education: An application of Paulo Freire's epistemology. *Journal of Education*, 165(4), 315–339. <https://doi.org/10.1177/002205748316500403>
- Franklin, C., Kader, G., Mewborn, D., Moreno, J., Peck, R., Perry, M., & Scheaffer, R., (2007). *Guidelines and assessment for instruction in statistics education (GAISE) report: A pre-K–12 curriculum framework*. American Statistical Association.
- Freire, P. (1998). *Pedagogy of freedom: Ethics, democracy, and civic courage*. Bloomsbury Publishing.
- Garii, B., & Appova, A. (2013). Crossing the great divide: Teacher candidates, mathematics, and social justice. *Teaching and Teacher Education*, 34, 198–213. <https://doi.org/10.1016/j.tate.2012.07.004>
- Gay, G. (2000). *Culturally responsive teaching: Theory, research and practice*. Teachers College Press.
- Gay, G., & Kirkland, K. (2003). Developing cultural critical consciousness and self-reflection in preservice teacher education. *Theory Into Practice*, 42(3), 181–187. https://doi.org/10.1207/s15430421tip4203_3
- Gerdes, P. (1998). On culture and mathematics teacher education. *Journal of Mathematics Teacher Education*, 1(1), 33–53. <https://doi.org/10.1023/a:1009955031429>
- Gonzalez, N., Moll, L., & Amanti, C. (2005) *Funds of knowledge: Theorising practices in households, communities, and classrooms*. Lawrence Erlbaum Associates. <https://doi.org/10.4324/9781410613462>
- Gould, R., & Peck, R. (2004). Preparing secondary mathematics educators to teach statistics. In G. Burrill & M. Camden (Eds.), *Curricular development in statistics education*. International Association for Statistical Education Roundtable, Lund (pp. 244–255). IASE.



- Greenhow, C., Galvin, S. M., Brandon, D. L., & Askari, E. (2020). A decade of research on K–12 teaching and teacher learning with social media: Insights on the state of the field. *Teachers College Record*, 122(6), 1–72. <https://doi.org/10.1177/016146812012200602>
- Greer, B., & Mukhopadhyay, S. (2016). The hegemony of English mathematics. In P. Ernest, B. Sriraman, & N. Ernest (Eds.), *Critical mathematics education: Theory, praxis and reality* (pp. 159–174). <https://journals.uclpress.co.uk/lre/article/2817/galley/17376/view/>
- Gutstein, E. (2006). *Reading and writing the world with mathematics: Toward a pedagogy for social justice*. Routledge. <https://doi.org/10.4324/9780203112946>
- Gutiérrez, R. (2016a). Nesting in Nepantla: The importance of maintaining tensions in our work. In N. M. Joseph, C. Haynes, & F. Cobb (Eds.), *Interrogating whiteness and relinquishing power: White faculty's commitment to racial consciousness in STEM classrooms* (pp. 253–282). Peter Lang Publishing. <https://doi.org/10.3726/978-1-4539-1716-9>
- Gutiérrez, R. (2016b). Strategies for creative insubordination in mathematics teaching. *Teaching for Excellence and Equity in Mathematics*, 7(1), 52–60. <https://doi.org/10.63966/teem.v7i1.1756>
- Gutiérrez, R. (2018). Introduction. In I. Goffney, R. Gutiérrez, & M. Boston (Eds.), *Rehumanizing mathematics for Black, Indigenous, and Latinx students* (pp. 1–10). National Council of Teachers of Mathematics.
- Gutiérrez, K. D., & Rogoff, B. (2003). Cultural ways of learning: Individual traits or repertoires of practice. *Educational Researcher*, 32(5), 19–25. <https://doi.org/10.3102/0013189x032005019>
- Gutstein, E. (2003). Teaching and learning mathematics for social justice in an urban, Latino school. *Journal for Research in Mathematics Education*, 34(1), 37–73. <https://doi.org/10.2307/30034699>
- Hadar, L. L., Ergas, O., Alpert, B., & Ariav, T. (2020). Rethinking teacher education in a VUCA world: Student teachers' social-emotional competencies during the COVID-19 crisis. *European Journal of Teacher Education*, 43(4), 573–586. <https://doi.org/10.1080/02619768.2020.1807513>
- Howell, P. B., Cantrell, S. C., & Rintamaa, M. (2019). Setting the stage for action: Teaching social justice in the middle school classroom. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas*, 92(6), 185–192. <https://doi.org/10.1080/00098655.2019.1649630>
- Jamal, A. (2023). The role of artificial intelligence (AI) in teacher education: Opportunities & challenges. *International Journal of Research and Analytical Reviews*, 10(1), 139–146.
- Joseph, G. G. (1987). Foundations of Eurocentrism in mathematics. *Race & Class*, 28(3), 13–28. <https://doi.org/10.1177/030639688702800302>
- Joseph, G. G. (2000). *Crest of the peacock: Non-European roots of mathematics*. Princeton University Press.
- Kalinec-Craig, C. A. (2017). The rights of the learner: A framework for promoting equity through formative assessment in mathematics education. *Democracy & Education*, 25(2), Article 5. <https://doi.org/10.65214/2164-7992.1298>
- Kalinec-Craig, C. A., & Bonner, E. (2016). Seeing the world with a new set of eyes: (Re) examining our identities as white mathematics education researchers of equity and social justice. In N. Russell, C. Haynes, & F. Cobb (Eds.) *Interrogating Whiteness and relinquishing power: White faculty's commitment to racial consciousness in STEM classrooms (social justice across contexts in education)* (pp. 91–112). Peter Lang.
- Kalinec-Craig, C., Hulme, K., Morton, K., Eddy, C. M., Mahdi, F., Gupta, D., & Montgomery, M. S. (2023). Promoting Torres' rights of the learner with elementary preservice teachers through lesson study. In S. Dotger, G. Matney, J. Heckathorn, K. Chandler-Olcott, M. Fox (Eds.), *Lesson study in preservice mathematics and science teacher education: Experiences and perspectives from the United States*, (pp. 124–134). Routledge. <https://doi.org/10.4324/9781003326434-15>
- Kitchen, J., & Brown, N. (2022). Blind spots and eye-openers: Attending to the concerns of racialized teacher candidates in a social justice course. *Studying Teacher Education*, 18(1), 98–118. <https://doi.org/10.1080/17425964.2022.2044586>
- Koestler, C., Ward, J., Zavala, M. d. R., & Bartell, T. (2023). *Early elementary mathematics lessons to explore, understand, and respond to social injustice*. Corwin. <https://doi.org/10.4135/9781071880630>
- Kokka, K. (2022). Toward a theory of affective pedagogical goals for social justice mathematics. *Journal for Research in Mathematics Education*, 53(2), 133–153. <https://doi.org/10.5951/jresmetheduc-2020-0270>
- Krise, K. (2016). Preparing the standardized teacher: The effects of accountability on teacher education. *Journal of Curriculum Theorizing*, 26(1), 24–32. <https://journal.jctonline.org/index.php/jct/article/viewFile/449/PDF>
- Kudaisi, Q. J., Krutka, D. G., Long, C. S., & Leonas, M. (2025). The impact of an integrated steM camp on middle school students' enjoyment, career knowledge, and career interest. *School Science and Mathematics*. <https://doi.org/10.1111/ssm.18385>



- Kudaisi, Q. J., & Leonas-Cabrera, M. J. (2025). Conjecture mapping an integrated steM camp to support middle school students' STEM identity and STEM interest. *Education Sciences*, 15(2), Article 159. <https://doi.org/10.3390/educsci15020159>
- Ladson-Billings, G. (1995). Toward a theory of culturally relevant pedagogy. *American Educational Research Journal*, 32(3), 465–491. <https://doi.org/10.3102/00028312032003465>
- Ladson-Billings, G. (2011). Boyz to men? Teaching to restore Black boys' childhood. *Race, Ethnicity and Education*, 14(1), 7–15. <https://doi.org/10.1080/13613324.2011.531977>
- Lesser, L. M. (2007). Critical values and transforming data: Teaching statistics with social justice. *Journal of Statistics Education*, 15(1), Article 1. <https://doi.org/10.1080/10691898.2007.11889454>
- Lewis, C. (2002). *Lesson study: A handbook of teacher-led instructional change*. Research for Better Schools.
- Losoya, S., & Eddy, C. (2026). Equity, empathy, and experience: A framework for centering inclusivity in an undergraduate elementary STEM educator course. *School Science and Mathematics*, 1–5. <https://doi.org/10.1111/ssm.70004>
- Lovin, L. H., Sanchez, W. B., Leatham, K. R., Chauvot, J. B., Kastberg, S. E., & Norton, A. H. (2012). Examining beliefs and practices of self and others: Pivotal points for change and growth for mathematics teacher educators. *Studying Teacher Education*, 8(1), 51–68. <https://doi.org/10.1080/17425964.2012.657018>
- Magajna, Z., & Monaghan, J. (2003). Advanced mathematical thinking in a technological workplace. *Educational Studies in Mathematics*, 52(2), 101–122. <https://doi.org/10.1023/a:1024089520064>
- Mahdi, F. (2025). Preservice teachers' beliefs and anticipated challenges teaching mathematics for social justice (Order No. 32247409). [Doctoral dissertation: University of North Texas].
- Marshman, M., & Brown, R. (2014). Coming to know and do mathematics with disengaged students. *Mathematics Teacher Education and Development*, 16(2), 71–88.
- Martin, D. B. (2009). Liberating the production of knowledge about African American children and mathematics. In D. B. Martin (Ed.), *Mathematics teaching, learning, and liberation in the lives of Black children* (pp. 1–34). <https://doi.org/10.4324/9780203877708>
- McCarty, T., & Lee, T. (2014). Critical culturally sustaining/revitalizing pedagogy and Indigenous education sovereignty. *Harvard Educational Review*, 84(1), 101–124. <https://doi.org/10.17763/haer.84.1.q83746nl5pj34216>
- Meyer, R. D., & Wilkerson, T. L. (2011). Lesson study: The impact on teachers' knowledge for teaching mathematics. In L. C. Hart, A. S. Alston, & A. Murata (Eds.), *Lesson study research and practice in mathematics education* (pp. 15–26). Springer Science + Business Media. https://doi.org/10.1007/978-90-481-9941-9_2
- Millroy, W. L. (1991). An ethnographic study of the mathematical ideas of a group of carpenters. *Learning and Individual Differences*, 3(1), 1–25. [https://doi.org/10.1016/1041-6080\(91\)90002-i](https://doi.org/10.1016/1041-6080(91)90002-i)
- Morton, K. (2024). Preparing elementary preservice teachers for antiracist mathematics teaching. *Mathematics Teacher Educator*, 12(3), 235–251. <https://doi.org/10.5951/mte.2022-0011>
- Morton, K., & Riegler-Crumb, C. (2019). Who gets in? Examining inequality in eighth-grade algebra. *Journal for Research in Mathematics Education*, 50(5), 529–554. <https://doi.org/10.5951/jresmetheduc.50.5.0529>
- Morton, K., & Riegler-Crumb, C. (2020). Is school racial/ethnic composition associated with content coverage in algebra? *Educational Researcher*, 49(6), 441–447. <https://doi.org/10.3102/0013189x20931123>
- Mukhopadhyay, S., Powell, A. B., & Frankenstein, M. (2009). An ethnomathematical perspective on culturally responsive mathematics education. In B. Greer & S. Mukhopadhyay (Eds.), *Culturally responsive mathematics education* (pp. 65–84). Routledge. <https://doi.org/10.4324/9780203879948-10>
- Naresh, N. (2008). *Workplace mathematics of bus conductors in Chennai, India*. [Doctoral dissertation, Illinois State University]. Accessed from: <https://www.proquest.com/openview/ca0e9fa4f4be44178b3231d9323e2d78/1?pq-origsite=gscholar&cbl=18750>
- Naresh, N., Eddy, C., & Morton, K. (2022) Mathematics teacher educators' reflections on their own practice of equity and social justice with teacher candidates. In A. E. Lischka, E. B. Dyer, R. S. Jones, J. N. Lovett, J. Strayer, & S. Drown (Eds.), *Proceedings of the 44th Annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*, (pp. 453–461). <https://files.eric.ed.gov/fulltext/ED630316.pdf>
- Naresh, N., & Royce, B. (2013). Dropping in on the math of Plinko. *Mathematics Teaching in the Middle School*, 9(4), 215–221.
- Navarro, O. (2020). Centering wellness and fostering interconnectedness with future educators of color during a global pandemic and racial justice uprising. *Issues in Teacher Education*, 29, 54–64.
- Ong, M., Smith, J. M., & Ko, L. T. (2018). Counterspaces for women of color in STEM higher education: Marginal and central spaces for persistence and success. *Journal of Research in Science Teaching*, 55(2), 206–245. <https://doi.org/10.1002/tea.21417>



- Orey, D. C., Rosa, M., & da Silva, J. B. N. (2025). The ZIGZAG: Contributions of African mathematical knowledge on gold mines to develop a pedagogical action for ethnomodelling through the elaboration of ethnomodels. *ZDM–Mathematics Education*, 57(2–3), 381–394. <https://doi.org/10.1007/s11858-025-01691-2>
- Paris, D., & Alim, H. S. (2017). *Culturally sustaining pedagogies: Teaching and learning for justice in a changing world*. Teachers College Press.
- Pérez, A. (2018). A framework for computational thinking dispositions in mathematics education. *Journal for Research in Mathematics Education*, 49(4), 424–461. <https://doi.org/10.5951/jresmetheduc.49.4.0424>
- Pratt, S. S., & Eddy, C. M. (2020). Complex adaptive model of algebra professional development. In P. M. Jenlink (Ed.), *The language of mathematics: How the teacher's knowledge of mathematics affects instruction* (pp. 175–191). Rowman and Littlefield.
- Price, J. N., & Osborne, M. D. (2000). Challenges of forging a humanizing pedagogy in teacher education. *Curriculum and Teaching*, 15(1), 27–51.
- Ragoonaden, K., & Bullock, S. (2016). Critical friends: The practiced wisdom of professional development. In K. Ragoonaden & S. Bullock (Eds.), *Mindfulness and critical friendship: A new perspective on professional development for educators* (pp. 13–32). Lexington Books.
- Rahimi, S. (2024). Saturation in qualitative research: An evolutionary concept analysis. *International Journal of Nursing Studies Advances*, 6, Article 100174. <https://doi.org/10.1016/j.ijnsa.2024.100174>
- Raju, C. K. (2007). *Cultural foundations of mathematics: The nature of mathematical proof, and the transmission of the calculus from India to Europe in the 16th C. CE*. Pearson Education India.
- Ramadhani, R., Syahputra, E., & Simamora, E. (2023). Ethnomathematics approach integrated flipped classroom model: Culturally contextualized meaningful learning and flexibility. *Jurnal Elemen*, 9(2), 371–387. <https://doi.org/10.29408/jel.v9i2.7871>
- Rupe, K. M. (2025). Centering students' thinking with the rights of the learner to counter deficit narratives in mathematics. *Theory Into Practice*, 64(1), 44–59. <https://doi.org/10.1080/00405841.2024.2409023>
- Schwartz, J. (2013). Classrooms of spatial justice: Counter-spaces and young men of Color in a GED program. *Adult Education Quarterly*, 64(2), 110–127. <https://doi.org/10.1177/0741713613513632>
- Sears, R., & Kudaisi, Q. J. (2021). A systemic approach to attend to justice, equity, diversity, and inclusion (J.E.D.I) in a high school mathematics methods course. *Connections*. <https://amte.net/connections/2021/12/systemic-approach-attending-justice-equity-diversity-and-inclusion-high-school>
- Simic-Muller, K. (2018). Motherhood and teaching: Radical care. *Journal of Humanistic Mathematics*, 8(2), 188–198. <https://doi.org/10.5642/jhummath.201802.21>
- Simic-Muller, K., Fernandes, A., & Felton-Koestler, M. D. (2015). "I just wouldn't want to get as deep into it:" Preservice teachers' beliefs about the role of controversial topics in mathematics education. *Journal of Urban Mathematics Education*, 8(2), 53–86. <https://doi.org/10.21423/jume-v8i2a259>
- Skovsmose, O. (1985). Mathematical education versus critical education. *Educational Studies in Mathematics*, 16, 337–354. <https://doi.org/10.1007/bf00417191>
- Skovsmose, O. (1994). *Towards a philosophy of critical mathematics education*. Kluwer Academic. <https://doi.org/10.1007/978-94-017-3556-8>
- Sleeter, C., & Carmona, J. F. (2017). *Un-standardizing curriculum: Multicultural teaching in the standards-based classroom*. Teachers College Press.
- Smith, M. S., & Stein, M. K. (1998). Selecting and creating mathematical tasks: From research to practice. *Mathematics Teaching in the Middle School*, 3(5), 344–350.
- Smith, M. S., & Stein, M. K. (2018). *5 practices for orchestrating productive mathematics discussions* (2nd ed.). The National Council of Teachers of Mathematics.
- Suominen, A. L., Conner, A., & Park, H. (2018). Prospective mathematics teachers' expectations for middle grades students' arguments. *School Science and Mathematics*, 118(6), 218–231. <https://doi.org/10.1111/ssm.12292>
- Toh, T. L., Quek, K. S., Tay, E. G., Leong, Y. H., Toh, P. C., Ho, F. H., & Dindyal, J. (2013). Infusing problem solving into mathematics content course for pre-service secondary school mathematics teachers. *The Mathematics Educator*, 15(1), 98–120. http://math.nie.edu.sg/ame/matheduc/tme/tmeV15_1/6.pdf
- Villota, R. R., Minaya, I. L., & Ruiz, F. V. (2025). La polisemia de tres elementos matematicos ancestrales del Ecuador: La Chakana Andina, el Sol de los Pastos y la Taptana Canari, como instrumentos pedagogicos de conexion entre la ensenanza de la matematica y las categorias socioculturales andinas [The polysemy of three ancestral mathematical elements from Ecuador: The Andean Chakana, the Sun of the Pastos, and the Cañari Taptana, as pedagogical instruments connecting mathematics teaching and Andean sociocultural categories]. In D. C. Orey, M. Rosa, A. M. Fernandes, R. C., Pinheiro, Z. F. Madruga, & A. D. Castillo (Eds.), *Polysemic interactions of ethnomathematics as program: Interfaces with pedagogical action, the ethics of diversity, social justice, and total peace: Evidences from the field* (pp. 233–278). LF Editorial.



- Volmink, J. (1994). Mathematics by all. In S. Lerman (Ed.), *Cultural perspectives on the mathematics classroom* (pp. 51–67). Springer Netherlands. https://doi.org/10.1007/978-94-017-1199-9_4
- Yeh, C., & Otis, B. M. (2019). Mathematics for whom: Reframing and humanizing mathematics. *Bank Street Occasional Paper Series*, No. 41. <https://doi.org/10.58295/2375-3668.1276>
- Zavala, M. d. R., & Aguirre, J. (2024). *Cultivating mathematical hearts: Culturally responsive mathematics teaching in elementary classrooms*. Corwin Mathematics.
- Zeichner, K. (2010). Rethinking the connections between campus courses and field experiences in college-and university-based teacher education. *Journal of Teacher Education*, 61(1–2), 89–99. <https://doi.org/10.1177/0022487109347671>