

Recognizing Whiteness in Social Justice Mathematics Instruction: An Action Research Study

Michael Lolkus
CPM Educational Program

Mathematical spaces often reinforce and perpetuate whiteness. Despite efforts to decenter whiteness in secondary and post-secondary classrooms, equity-oriented strategies can still perpetuate whiteness. In this action research study, I turned the lens of whiteness upon my instructional practices and curriculum. Using an analytic framework for whiteness in mathematics education with three dimensions (i.e., *institutional, labor, identity*), I explored how my design and delivery of a social justice mathematics course perpetuated whiteness. I identified prominent themes related to how I maintained white supremacy culture, specifically through the *institutional* and *labor* dimensions, by maintaining power and authority in the course. In addition to recognizing areas where I upheld whiteness, I outlined my ongoing efforts to decenter whiteness through engaging students in ethnomathematics investigations, co-constructing curricular resources, and repositioning course stakeholders. This action research study informs ongoing efforts to reimagine mathematics and mathematics education as white institutional spaces by critically interrogating my mathematics classroom practices.

KEYWORDS: action research, social justice mathematics, whiteness

Educational spaces, particularly those centered on mathematics, uphold and promote whiteness (e.g., Battey, 2013; Bullock, 2017; Harper et al., 2020; Martin, 2009; Stinson, 2011). While there are concerted efforts to reimagine mathematics through implementing standards-based mathematics instruction, for instance, mathematics education reforms continue to serve white liberal ideals of what can and should count as mathematics (Berry et al., 2014). As a barrier to entering and persisting in college and science, technology, engineering, and

MICHAEL LOKKUS, Ph.D., is a Curriculum Writer and Researcher at CPM Educational Program, 9498 Little Rapids Way, Elk Grove, CA 95758; mikelolkus@cpm.org. Lolkus explores critical and equity-oriented frameworks for designing secondary mathematics curriculum and possibilities for supporting teachers' critical consciousness. This article is one of three manuscripts completed for Lolkus' dissertation research which was chaired by Professor Jill Newton at Purdue University. Committee members that helped shape this work include Robert Q. Berry III, Stephanie Masta, JoAnn Phillion, and Craig J. Willey. Additionally, thank you to Bima Sapkota for providing feedback on an earlier draft of this manuscript, as well as to Temitope Adeoye, Alankrita Chhikara, Marquetta Strait, and Lili Zhou for engaging in critical conversations about my analyses and findings. This research was funded by a one-year Bilsland Dissertation Fellowship research grant from Purdue University. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author and do not necessarily reflect the views of CPM Educational Program.

mathematics (STEM) careers, the mathematics education enterprise continues to promote racial hierarchies of who can be a doer of mathematics (Martin, 2009). In this manuscript, I refer to urban mathematics education, not as a focus on the geography of densely populated metropolitan areas (i.e., urban intensive, urban emergent; Milner, 2012) but aligned with the sociopolitical turn in mathematics education (Gutiérrez, 2010) to focus on the deconstruction of mainstream mathematics education as a white institutional space by centering equity and social justice (Martin & Larnell, 2013).

Mathematics educators have worked toward teaching mathematics for social justice (TMSJ) to support students' critical understandings of the world and mathematics content to be prepared to develop a more just world using mathematics (e.g., Gutstein, 2006; Kokka, 2015). TMSJ is one ever-evolving, practice-based theory-to-policy approach to urban mathematics education that can support students and teachers to investigate and reimagine hierarchies within mathematics and divisions between the global North and the global South (Martin & Larnell, 2013). Recognizing the promise of using mathematics to support students' *reading* (i.e., understanding) and *writing* (i.e., changing) the world with mathematics (Gutstein, 2006), educators have found that TMSJ can support students to "build an informed society; connect mathematics with students' cultural and community histories; ... confront and solve real-world challenges they face; and ... learn to value mathematics as a tool for social change" (Berry et al., 2020, p. 23). Still, TMSJ is embedded within the white institutional space of education and often facilitated by white educators like me. As such, TMSJ risks contributing to and upholding the ideologies and functions of whiteness.

This action research is an effort to reflect on how my design and instruction of a TMSJ-focused course continues to perpetuate whiteness and share my ongoing efforts to decenter whiteness in my curriculum development and mathematics instruction for undergraduate students. I aim to move beyond naming the ways that I am working to distance myself from whiteness but rather recognize the ongoing tensions I face as I continue to grapple with my complicity in working within an educational system that is normed by, and that maintains white supremacy culture. As such, this manuscript foregrounds the potential for mathematics educators to critically reflect on and actively work to confront their perpetuations of whiteness.

I built upon the work of scholars investigating whiteness in mathematics education by turning the lens of whiteness upon my instructional practices and curricula. I analyzed how I unintentionally perpetuated whiteness in *Knowing the World Through Mathematics* (KWM), a mathematics content course I designed with my advisor, a cis white woman, to address social justice issues. Given the need for ongoing efforts to decenter whiteness and produce culturally relevant pedagogies, I detail an action research study about how a critical investigation of whiteness in a social justice mathematics course, KWM, informs my work as a

mathematics education researcher and educator and revisions to future iterations of KWM.

This manuscript begins with a review of relevant literature, including TMSJ, critical whiteness studies, and whiteness in mathematics education. Then, I detail how a social theory of learning and a framework for whiteness in mathematics education serve as this action research's theoretical and analytical framings. In the Methods section, I provide insight into how my positionality informs my design of KWM and my interpretations of the evidence through a framework for whiteness in mathematics education. In this section, I also detail how I analyzed my sources of evidence through thematic analysis and attended to trustworthiness in my findings through, for instance, reflexive journals and feedback on themes from critical friends. In the Findings section, I expand on two prominent themes relating to my maintenance of white supremacy culture in KWM and two themes foregrounding progress for shifting power within my course design and implementation. I close the manuscript with a discussion on the power and presumed expertise of mathematics educators, students' agency in the design process, and the potential of designing and teaching from an intersectional perspective and co-constructing instructional resources.

Review of Relevant Literature

This action research is based on literature related to TMSJ, critical whiteness studies, and whiteness in mathematics education.

Teaching Mathematics for Social Justice (TMSJ)

TMSJ-focused educators focus on mathematics and social justice pedagogical goals (Gutstein, 2006) as well as affective pedagogical goals (Kokka, 2022) as they amplify students' voices and represent the world with mathematics. As instructors and students work toward a more socially just world, they develop their critical mathematics literacy, which is their understanding of how mathematics can be used to explore and highlight whose knowledge is valued (Frankenstein, 1983; Freire, 1970/2018).

Challenging traditional mathematics instruction, which often focuses on procedures and unfamiliar or unrealistic contexts (Boaler, 2002), research on TMSJ demonstrates several promising outcomes for supporting students to recognize trends in society beyond traditional conceptions of mathematics classrooms (Gutstein & Peterson, 2013). For instance, Harper (2019), in a qualitative synthesis of research, found that TMSJ can support PK-12 teachers in amplifying the voices of individuals from racially marginalized communities. Representing diverse voices in mathematics is essential because mathematical spaces frequently uphold

whiteness and white supremacy culture (Martin, 2010, 2013). Furthermore, Stinson (2019) found that TMSJ can support teachers in making mathematics more accessible to more diverse groups of students by connecting content to students' lived experiences.

Well-intended TMSJ-focused teachers may unintentionally cause harm (Berry et al., 2014). For instance, Harper (2019) found that teachers may unintentionally reinforce stereotypes of marginalized individuals and communities without critically interrogating their instructional practices and understandings of social justice issues. Without developing teachers' critical understandings of social justice issues, they often focus on topics that seem less contentious than, for example, discussions centered on race and racism (Bartell, 2013; Felton et al., 2012). Thus, educators working toward TMSJ must continue questioning how they support students in understanding and imagining a new world with mathematics and their conceptions of the injustices they are committed to confronting. As teachers in Gonzalez's (2009) study noted, TMSJ lessons must be attached to action.

Critical Whiteness Studies

Given the nuances of TMSJ and the role of educators' understanding of and relation to social injustices, educators need to critically reflect on the origins of their beliefs and assumptions. White educators like me need to embrace the burden of unpacking and dismantling white supremacy in educational spaces (Matias & Mackey, 2016). In this action research, I detail my confrontation with how whiteness informed my development and subsequent instruction of a TMSJ-focused course. Frankenberg (1993) conceptualized whiteness as "the unwillingness to name the contours of racism, the avoidance of identifying with racial experience or group, the minimization of racist legacy, and other similar evasions" (p. 23). This framing of whiteness highlights the frequent, large and small, implicit and explicit, actions that work to position those who identify with or adhere to dominant white practices as superior while disadvantaging and oppressing those who do not. Engaging with whiteness studies supports researchers in recognizing whiteness as practices that promote unearned white dominance throughout history (DiAngelo, 2011; Leonardo, 2002). Because whiteness continues to be upheld through the assumption that it is the norm in our society, it often goes unnoticed (Leonardo, 2009; Picower, 2009; Sleeter, 2001). Utilizing critical whiteness studies can support researchers in exploring the causes, rather than effects, of racial harm (Cabrera, 2022).

Whiteness in Mathematics Education

Dominant narratives in the United States position mathematics as a colorblind (Stinson, 2011) and culturally neutral (Ernest, 1991; Felton, 2010) discipline. The values, cultures, and experiences of People of Color, Black, and Indigenous communities are often ignored or devalued in mathematical spaces (Gutiérrez, 2017a, 2017b). As such, mathematics classrooms are viewed as white institutional spaces that maintain white supremacy culture (Martin, 2010, 2013). Even mathematics education reforms aimed at closing opportunity gaps for marginalized students, including, for instance, the *Curriculum and Evaluation Standards for School Mathematics* (National Council of Teachers of Mathematics, 1989), have continued to benefit Black students less than their white counterparts (Berry et al., 2014). Rather than supporting students who have been and continue to be underserved by status-quo mathematics education, reform-oriented policies and practices perpetuate white supremacy culture through the privileging of white interests (Bullock, 2019; Martin, 2010).

Theoretical Perspectives

A Social Theory of Learning

Lave and Wenger (1991) framed the processes of knowing and learning as situated within given contexts. Wenger (1998) extended this notion to represent the distribution of these processes across members of communities of practice. Adhering to this perspective, my instruction and curriculum development centers on my belief that students collaboratively construct (e.g., Cobb et al., 1990; Vygotsky, 1978) their social justice mathematical understandings in KWM, our community of practice. Practitioners frequently extend communities of practice to focus on the political goals of critical theories in efforts toward enacting social change (e.g., Flores, 2007; Schwier et al., 2004; Tusting, 2005). To this end, I drew on Battey and Leyva's (2016) framework for whiteness in mathematics education.

Framework for Whiteness in Mathematics Education

In their framework for whiteness in mathematics education, Battey and Leyva (2016) describe three dimensions of whiteness (i.e., *institutional*, *labor*, and *identity*). I outline the *institutional* and *labor* dimensions and relevant elements that were representative and instrumental in this action research, both for recognizing instances in which I perpetuated whiteness and where I began to progress. I foregrounded these two dimensions in my research due to their focus on the systems and structures that both informed and were informed by my actions as the instructor.

Institutional Dimension of Whiteness in Mathematics Education

The *institutional* dimension reflects how individuals access various mathematical resources, people, and work. Institutional spaces also refer to how various groups and stakeholders are afforded or placed in positions of power (i.e., *organizational logic*) and how the histories of people and mathematics are presented (i.e., *history*). *Organizational logic* is conceptualized as the distribution of power and work and who is seen as influential through decision-making processes. This encapsulates the constructed hierarchies within schools and mathematics classrooms, in particular. Additionally, Battey and Leyva (2016) used *organizational logic* to reference how stakeholders in mathematics classrooms, including students, community members, and instructors, were positioned within school hierarchies regarding who has power and who is responsible for what.

Recognizing the murky origins of many schools, including, for instance, practices of segregation, Battey and Leyva (2016) named the *history* element of whiteness in mathematics education. In addition to the histories of schools, this element is used to highlight how various groups and stakeholders are included or excluded from engaging in mathematical ideas or having opportunities to learn. Curricula are used to present history and the role of relevant stakeholders in constructing it. As such, curricular perspectives are also a part of the *history* element, which highlights who determines what mathematical learning is for, which resources inform that learning, how various stakeholders are positioned, and who can inform curriculum development. Investigating curricular perspectives as one aspect of the *history* element of whiteness in mathematics education provides insight into the maintenance of privilege and the status quo in mathematical spaces.

Labor Dimension of Whiteness in Mathematics Education

Battey and Leyva (2016) use the *labor* dimension to represent differential *cognitive*, *emotional*, and *behavioral* expectations for students. Each form of *labor* is normed around white ideals of what constitutes participation in mathematical spaces. As such, the labor dimension questions the normative expectations that form a passive collective and constitute whiteness as normal. Through three elements, Battey and Leyva detail how whiteness can operate in mathematical spaces, often labeling Black, Indigenous, and Latinx students' contributions and behaviors (i.e., labor) as invalid.

The *cognitive* element refers to the mathematical work required of students, as well as the distribution of mathematical authority, or the recognition of who is and can be a mathematical expert, which “communicates expectations and messages about what students are capable of doing” (Battey & Leyva, 2016, p. 67).

Whiteness is often represented by low expectations of Black, Indigenous, and Latinx students, which serve to maintain racial hierarchies in mathematics classrooms. Low expectations based on racialized identity markers and other personal biases can manifest in fewer opportunities to engage with ambitious and rigorous mathematics. Furthermore, these low expectations translate to additional labor for particularly marginalized students to manage and negotiate their engagement in the mathematics community (Berry et al., 2011; McGee & Martin, 2011).

Students with racialized identities have an additional labor burden through learning the unspoken rules of and regulating their emotions to align with white norms in mathematics classrooms. Battey and Leyva (2016) describe this form of *labor*, the *emotional* element, as the everyday discrimination and racist actions experienced by students who do not adhere to white norms and ideals. For example, students are often blamed for seeming frustrated, angry, or sad, rather than being provided resources or opportunities to support them in processing their feelings of racism in mathematics classrooms.

The *behavioral* element centers on determining what actions are appropriate in mathematics classrooms and recognizing who has the power to make those determinations. Battey and Leyva (2016) reference the disproportionate numbers of Black students who are punished for behavioral reasons in secondary school settings as one instance where the behaviors deemed acceptable in mathematics classrooms are normed on whiteness. One way the valuing of white students' behaviors can be recognized in nuanced ways is by investigating which behaviors instructors praise and acknowledge in these settings.

Qualities of Critical Research

Finally, I utilized Skovsmose and Borba's (2004) qualities of critical research to guide my reflections on the *current*, *imagined*, and *arranged situations*. Namely, the *current situation* refers to unpacking historical and social contexts that continue to restrict liberatory and, in my case, antiracist instructional methods. Working toward alternative and more just instruction and curricular resources (i.e., *imagined situation*), I navigated the structural and practical limitations of my current contexts (i.e., *current situation*). Using the qualities of critical research outlined by Skovsmose and Borba supported me to reflect on the current contexts in KWM and to envision and implement strategic actions aimed at decentering whiteness in my curriculum development and instruction (Avci, 2020).

Methods

I base this self-study on my experiences as a white male mathematics instructor and teacher educator in KWM. As such, my biases shape my analysis of the evidence sources.

Instructor Positionality

My life experiences are primarily framed and informed by whiteness. I grew up in an upper-middle-class home in an almost entirely white neighborhood. I attended racially diverse K-12 public schools, though I was placed in the honors classes, which were primarily white. I was taught that hard work, persistence, intelligence, and education equated to success. Still, my most formative experiences as an educator came while studying abroad in Arusha, Tanzania, as an undergraduate in mathematics education and while working as a mathematics teacher, instructional coach, and department chair at a secondary school in Newark, New Jersey. My lived experiences as an upper-middle-class, white, heterosexual, cisgender male were disrupted through my ‘outsider’ experiences as a student and instructor in international and domestic urban contexts. My experiences in Arusha and Newark differed from my upbringing in the Midwest and predominantly white suburbs. These formative experiences provided me with opportunities to disrupt my preconceived notions of how my experiences as a white male from a professional-class family permeated all parts of my life related to opportunity, power, and privilege.

My experiences as an upper-middle-class white male informed every decision I made regarding KWM. I relied on my experiences growing up geographically close to and graduating from the same undergraduate program as many students I worked with to inform curricular decisions. My design of the course (e.g., identifying resources, selecting and sequencing topics) and even how I discussed issues of social justice in and of themselves were informed by my experiences, primarily as an observer of social injustice – rarely, if ever, having systems rigged against me or limiting my opportunities for education, wealth, food, or safety. As a white instructor with backgrounds similar to many students, I maintained the assumption that these topics needed to be discussed. I draw on my primarily white and transformative experiences when designing and enacting my mathematics content and pedagogy courses.

Knowing the World Through Mathematics (KWM)

My advisor, Dr. Jill Newton, and I sought to teach *Quantitative Reasoning* in conjunction with a social justice-focused study abroad in rural Tanzania that she had been leading for ten years. We intended to connect algebraic explorations to topics of social justice related to events in Tanzania and the United States. Because this effort was ultimately denied, we worked to develop KWM (Lolkus & Newton, 2022), a stand-alone three-credit mathematics course that, like *Quantitative Reasoning*, fulfilled the University's Quantitative Reasoning Foundational Learning Outcome. Newton was instrumental in the development of KWM, and I took responsibility for the delivery and subsequent adjustments to KWM. As such, I detail my perpetuations of whiteness throughout this study, with little mention of Newton's role.

We developed KWM as a social justice mathematics course, combining Gutstein's (2006) TMSJ Framework with the United Nations Sustainable Development Goals (United Nations, 2015). Through mathematical investigations (e.g., graph theory, statistics, trigonometry) of social justice issues (e.g., climate change, gender equality, racial justice), students in KWM can connect their understanding of mathematics with social justice topics.

Throughout KWM, students engage in social justice mathematics tasks (e.g., Berry et al., 2020; Buell & Shulman, 2019; Karaali & Khadjavi, 2019) guided by seven-course goals: (1) use a critical mathematics perspective to interpret world patterns, situations, and events; (2) create mathematical models of world phenomena; (3) use multiple mathematical representations to present global issues; (4) identify and implement appropriate mathematical strategies to investigate world phenomena; (5) express mathematical arguments related to world phenomena; (6) use mathematics to explore global policy documents; and (7) explore world phenomena through quantitative (and qualitative) methods. Each social justice mathematics investigation in KWM builds from the course goals and is connected to and sequenced according to relevant Sustainable Development Goals (United Nations, 2015).

Social Justice

In KWM, we center classroom discussions on Fraser's (2005) and Cazden's (2012) three interconnected dimensions of social justice: *redistribution*, *recognition*, and *representation*. While there are many framings of social justice in education (e.g., Ferman, 2021; Rodriguez & Morrison, 2019), this decision was based on previous findings (i.e., Newton et al., 2020) that utilizing this framework for classroom discussions can support and expand students' understandings of social justice issues in international contexts. This social justice framework provides opportunities for students in KWM to reflect on the distribution of economic goods (i.e., *redistribution*), how differing cultures, languages, and

knowledge are valued (i.e., *recognition*), and how various populations are engaged in political decision-making processes (i.e., *representation*).

Social Justice Mathematical Tasks

Throughout the course, students engage with social justice mathematics tasks, such as Hamman's (2019) "House Prices and Grocery Store Locations," in which they work with publicly available data to determine and interpret correlations between home prices and their proximity to grocery stores in a community of their choosing. In activities such as this one, students utilize the GAISE Framework for Statistical Problem Solving (i.e., formulate questions, collect data, analyze data, interpret results; Franklin et al., 2017) to guide their statistical analysis of data sets and to complete a semester-long project. In the final project, with my support, students develop a survey or use publicly available data to explore a social justice issue of their choosing. The project culminates in students sharing trends from their analyses and recommendations for key stakeholders.

Iteration 1. I taught Iteration 1 of KWM to 11 prospective mathematics teachers (PMTs); eight PMTs self-identified as white women, a relatively homogenous population that is also representative of the teaching force (Marx & Moss, 2011); one student identified both as Latinx and white; and two identified as white men. Nine of the PMTs were in their final year of mathematics education, beginning student teaching within the following calendar year. All but one PMT had engaged in multiple general education courses, including at least one focused on multicultural education. Nine of the PMTs had completed or were actively enrolled in at least one methods course focused on teaching mathematics in secondary schools.

We were able to offer this unique section of KWM to PMTs due to the 2019 global coronavirus pandemic. Namely, PMTs traditionally had opportunities to facilitate individual sections of *Quantitative Reasoning* under the guidance and supervision of Mathematics Education faculty and alongside a cohort of undergraduate mathematics education students. Due to COVID-19 concerns, KWM was offered to PMTs as an alternative during the semester that in-person classes resumed on campus. We met in person (masked and distanced) one day each week for 90 minutes. Students were asked to meet virtually to engage in small group work to complete mathematical investigations and continue class discussions. Midway through the semester (i.e., Week 11), we decided to hold our weekly meetings virtually due to the increased community spread.

Iteration 2. After teaching Iteration 1 of KWM specifically for PMTs, we began advertising KWM for more diverse groups of students. We communicated with advisors and faculty in program areas across campus that did not require

Calculus or other advanced mathematics courses (e.g., Communication, History, Sociology), so KWM could fulfill students' mathematics curricular requirements. Four students from the College of Liberal Arts enrolled in Iteration 2 of KWM. Three students identified as white and preferred she/her pronouns, and one identified as Latinx and white and used he/him pronouns. To align with three-credit class schedules, we met synchronously twice a week for 75 minutes. Because COVID-19 vaccines were not yet widely available, we continued to meet virtually for half of our class meetings.

Iteration 3. Using similar strategies, we recruited and enrolled 22 students in Iteration 3 of KWM. Students were primarily enrolled in programs in the College of Liberal Arts, but also in the College of Science, Agriculture, and Education. Racially, 14 of the students identified as white, four as Latinx, three as Asian, and one as both Indigenous and white. Additionally, 14 students used she/her pronouns, seven used he/him, and one preferred she/they pronouns. We continued gauging students' preferences for holding classes in-person, virtually, or in a hybrid model to account for COVID-19 concerns. Because vaccines were more readily available and most campus activities had returned to synchronous and in-person, course meetings were held on campus all days except when guest speakers joined virtually or if students shared concerns about exposure.

Research Questions

I critically reflected on how I perpetuated whiteness after teaching KWM. This action research study foregrounds my efforts as a white, cisgender male mathematics teacher educator to disrupt and challenge the oppressive nature of mathematical spaces that reinforce whiteness. Engaging in action research promotes the changing of instructional practices and the understanding and conditions of those practices (Kemmis, 2009). Furthermore, following the self-reflective spirals of action research (i.e., planning, acting, and observing, reflecting), my study adhered to the principles of critical action research in that it was "guided by an interest in emancipating people and groups from irrationality, unsustainability, and injustice" (Kemmis et al., 2014, p. 14). As I critically reflected on my instructional practices and curriculum design, I revised the curriculum to address the *institutional* and *labor* dimensions of whiteness more thoroughly in mathematics education to challenge the implied racial hierarchy in mathematical spaces. I explored: *How can a critical investigation of whiteness in a social justice mathematics course inform my work as a mathematics teacher educator and revisions to future iterations of KWM?*

Sources of Evidence

Using action research methods, I analyzed multiple forms of evidence to critically reflect on my perpetuations of whiteness in the curriculum and instruction of KWM. Namely, the evidence consisted of my unstructured voice memos recorded at the end of KWM lessons, pre-and post-course semi-structured written reflections, and the intended KWM curriculum.

Unstructured Instructor Reflections

Recognizing the utility of engaging in reflection as a meaning-making process for my intellectual growth (Dewey, 1910/1933), I recorded my thoughts and perspectives related to the class, discussions, social justice investigations, and mathematical tasks after 15 of the synchronous class meetings. Engaging in reflective practices is an effective element of action research in education (e.g., McIntosh, 2010) and a foundational element of the action research process (Kemmis et al., 2014). As such, I used these unstructured reflections to attend to my feelings about the class with my understanding of students' experiences and what was and was not working from my perspective (i.e., *arranged situation*).

Semi-structured Instructor Reflections

In a more formal attempt to critically reflect on and interrogate my underlying assumptions and understandings about how the course was designed and enacted, I wrote a 1,700-word pre-course reflection before Iteration 1 of KWM to outline the framing of the course, my positionality, beliefs, assumptions, and my intentionality toward the design and intended implementation of KWM (i.e., *current and imagined situation*). I utilized pre-existing reflection prompts from reflective teaching resources to guide my pre-course reflection (i.e., Grant & Zeichner, 1984; Zeichner & Liston, 2014; see Table 1).

Table 1
KWM Instructor Pre-course Reflection Prompts

Reflection Prompts
What are the origins of my beliefs and assumptions?
What are the consequences of my beliefs and assumptions?
How will my actions be interpreted and applied beyond the classroom?
How do students learn?
What knowledge and skills should be taught?
How much control should I have as the instructor?

 Reflection Prompts

To what extent should the curriculum attend to the cultural knowledge and background experiences of students?
 What is my hidden agenda?
 What is the rationale underlying the setting?
 What is the universe of alternatives that could be considered?

I engaged in a similar post-course reflection after I submitted final grades at the end of Iteration 1 (i.e., *arranged situation*; see Table 2).

Table 2
KWM Instructor Post-course Reflection Prompts

 Reflection Prompts

What were the consequences of my beliefs and assumptions in *KWM*?
 What were the classroom norms developed throughout *KWM*?
 How did students and I negotiate power throughout *KWM*?
 How did I attend to the cultural knowledge and background experiences of students?
 How did my hidden agenda play out during *KWM*?
 How did the institutional and cultural contexts inform interactions in *KWM*?
 How did students and I prepare to take action through *KWM*?

Finally, I shared general reflections about my experiences facilitating KWM and responded to two questions: *How did curricular adjustments influence the course* (i.e., *arranged situation*), and *what's next?* (i.e., *imagined situation*) at the end of Iteration 3, the final time I taught KWM.

Intended/Written Curriculum

I analyzed the KWM curricular materials (i.e., frameworks, mathematical tasks, syllabi) to provide context for how KWM was implemented (i.e., *arranged situation*).

Evidence Analysis

I engaged in thematic analysis of all evidence sources (i.e., unstructured reflections, semi-structured reflections, intended/written curriculum). Thematic analysis, which refers to investigating and organizing common themes across evidence sources, allowed me to explore themes across diverse evidence sources (Braun & Clarke, 2012). My analysis was guided by a critical perspective (Skovsmose & Borba, 2004) and the *institutional* and *labor* dimensions of Battey and Leyva's (2016) framework for whiteness in mathematics education. These two

dimensions were foregrounded since they were most relevant to my role as the course instructor.

Trustworthiness of Evidence and Analysis

After transcribing my unstructured instructor reflections with otter.ai and making manual corrections, I uploaded all evidence sources to a qualitative data management software (i.e., NVivo 12). My evolving codebook for this study began with inductive themes that I constructed to capture the ideas I recognized in each evidence source (e.g., evaluation, what counts, developed in advance). After generating initial codes, I continued establishing the trustworthiness of my analysis by creating diagrams to explore the relationships between my generated codes and the deductive codes provided by Battey and Leyva's (2016) Framework. This process supported my understanding of the inter-relational nature of the codes, as well as the prominence of the *institutional* and *labor* dimensions. I maintained detailed documentation of the coding and debriefing processes throughout each phase in reflexive journals. I relied on my reflexive journals to generate my final code book (see Table 3).

Table 3
Revised Inductive Codes in Final Codebook

Code	References
Who is present in the community	84
What counts	53
Next steps	38
Context	16
Discomfort	15
Not an expert	15
Course organization	11
Interpret, no action	11
Procedural	8

With each reference identified with these final inductive codes, I recoded the evidence sources using Battey and Leyva's (2016) framework for whiteness in mathematics education to support my identification of themes (see Table 4).

Table 4
Number of Coded References at the Intersection of My Inductive and Deductive Codes

	Institutional	Labor
Who is present in the community	51	39

	Institutional	Labor
What counts	9	42
Next steps	23	15
Context	12	4
Discomfort	5	6
Not an expert	9	8
Course organization	3	5
Interpret, no action	2	9
Procedural	2	4

Investigating the intersection of my inductive and deductive codes helped me identify themes across the data, primarily within areas with higher frequencies of intersection (e.g., institutional and who is present in the community, *labor* and what counts, *institutional* and next steps).

Finally, following Nowell et al.'s (2017) recommendations for establishing trustworthiness in thematic analysis, I relied on four critical friends to provide additional perspectives for adequate triangulation of findings (Flick, 2018) in my thematic analysis. Critical friends were peer graduate students with whom I had close and regular communication and who represented diverse experiences based on gender, religion, ethnicity, and citizenship. All four critical friends used she/her pronouns and identified as Women of Color. Critical friends individually selected which of my preliminary themes they wanted to explore further. Based on their selections, I provided evidence, and brief debriefs of how I perpetuated whiteness in KWM and areas where I felt I was progressing to decenter whiteness. Feedback centered around providing additional context and more explicit links between Battey and Leyva's (2016) framework and my sources of evidence.

Findings

To inform my work as a mathematics teacher educator and subsequent revisions of KWM, I explored how I contributed to the perpetuation of whiteness in my instruction and curriculum design. Through engaging in this action research, I recognized that, as outlined by the *institutional* and *labor* dimensions of Battey and Leyva's (2016) framework, I maintained white supremacy culture in two prominent ways: (a) distribution of power in the course design and instruction, and (b) setting academic expectations based on my own lived experiences and assumptions as a white man from a professional class family. In addition to sharing about these areas that need attention, I detail my ongoing efforts to challenge whose voices are foregrounded in KWM and my attempts to shift power away from me as the instructor, to students, social justice activists, and scholars.

My Complicity in Perpetuating Whiteness

These findings are organized according to prominent themes in connection with Battey and Leyva's (2016) dimensions and elements of whiteness.

Distributing Power: Instructor as Authority

Throughout KWM, I engaged in instructional practices that established me as the authority figure. Here, I provide examples of how I maintained my position of power at the center of instruction despite attempts to ensure students had opportunities to co-construct learning experiences.

Determining Forms of Participation. While this may seem unavoidable to some extent within the current constraints and norms of the structure of higher education, there were instances in which my actions perpetuated whiteness by determining and communicating which forms of class participation were acceptable. For instance, I had additional power working with the 11 PMTs in Iteration 1 of KWM due to their enrollment in another required course I taught for their major.

Despite sitting at the tables with the other students and deferring to whoever was leading each discussion, whenever I chimed in with an idea or question, that seemed to be taken as a direction for where we should move as a group. (Iteration 1 Post-course Reflection)

Despite efforts to position students as the knowers and doers of mathematics through leading and facilitating class investigations, my formal title as the course instructor gave me additional power. Thus, despite my efforts to engage as a community member, not as an authority, I reinforced whiteness through a hierarchical structure where I was seen as the knower of social justice and mathematical concepts and granted unquestioned power over students in my design and implementation of KWM.

While my participation in discussions unintentionally redirected classroom activities, I also explicitly incorporated resources that narrowed the academic expectations between students who were deemed to be mathematically competent. Namely, I included a rubric to evaluate students' participation in social justice mathematics investigations in KWM (see Figure 1).

Criteria	Level 5	Level 4	Level 3, 2, or 1
Conceptual understanding and connections	Used math terms correctly and showed a complete understanding of how they connect	Used most math terms correctly and showed an understanding of their connections	Showed some understanding of math terms or their connections
Strategies & Reasoning	Showed all of the steps to solve the problem	Showed a reasonable plan and most of the steps used to solve the problem	Showed some of the steps but the plan was not clear
Computation & Execution	Computed with no errors	Minor errors in computation	Major errors in computation
Communication	Completely communicated what was done and why it was done	Communicated mostly about what was done and a little about why it was done	Communicated something about what was done or why it was done, but not both
Connections	Ample connections were made between social justice issues and mathematical concepts	Some connections were made but could go deeper	Few connections were made
Completion	Fully and completely responded to all prompts	All prompts were addressed, but responses could go further	Some prompts were addressed or responses demonstrate additional reflection is required

(Adapted from Egodawatte, 2010)

Figure 1. KWM Participation and Mathematical Investigation Rubric

I reflected on this decision the semester after developing and incorporating the rubric:

In [Iteration 1], I did not grade individual mathematical investigations. This was due largely in part to having the PMTs facilitate many of the investigations themselves and summarize their work, sometimes at the beginning of following lessons. In [Iteration 2], not surprisingly, the undergraduates spent more time on each of the investigations and had more questions about the mathematics content (not necessarily the social justice content). As such, I spent a lot of time providing written feedback on the students' mathematics content even though I wasn't collecting them for a grade.... [For Iteration 3,] I designed a relatively generic rubric ... [and] still ended up incorporating individualized feedback for undergraduates. So, incorporating the generic rubric allowed me to provide a general structure for what I was looking for in each investigation, but didn't provide the level of feedback I was hoping for. (Iteration 3 Post-course Reflection)

This provides an example of how I managed the academic expectations of what participation in mathematics should look like, specifically amongst students who may be deemed more mathematically prepared. Incorporating a rubric for, rather than with, students who were presumed to have lower levels of mathematical

preparation perpetuated whiteness by ensuring that I continued to have the power to determine what counted as students' participation in KWM.

Moving forward, I plan to incorporate additional opportunities for students to negotiate their forms of participation and evaluation in KWM. Recognizing the limitations of my implementation of developing and utilizing a generic rubric to evaluate students' participation and completion of social justice mathematics tasks, I look to co-construct rubrics with students. I reflected on these limitations and inspiration to partner with students to determine more effective forms of engagement:

My effort to develop rubrics for students' math investigations/participation also coincided with my teaching of [an online course for master's students in Curriculum and Instruction]. Notably, one of [the] master's students frequently reflected on their use of co-constructed rubrics with their students. This is where I think the rubric can go. If I were to teach the course again, I would task students in the first few lessons to develop expectations for their contributions to mathematics investigations to co-develop generic rubrics, and still incorporate specific feedback. (Iteration 3 Post-course Reflection)

Providing students with the opportunity to agree upon the measures that inform effective engagement in KWM would support efforts to redistribute power away from me to be more uniformly shared amongst all stakeholders in the class.

Setting the Curricular Agenda. Similar to determining what forms of participation were valid in KWM, I also pre-determined many of the mathematics and social justice topics that would be covered in advance of the course. Even before teaching Iteration 1 of KWM, I reflected on my tensions with independently designing a course without the support of the students:

I have an activity plan for every lesson I've designed, [including] goals and standards for every single lesson for all 16 weeks.... There's a little bit more power afforded to me, just kind of by the nature of the course, but then also it's kind of a need of the course if we want to get these [quantitative reasoning foundational learning outcome] requirements fulfilled by the university. So, I think that's a little bit of like an imposition on how I would ideally like to do this. I think if I were to go back and if I had the flexibility, we would be going through and co-constructing goals, the agenda, what social justice topics we would be talking about, how we'd be connecting to the United Nations Agenda, would all be done as a group. I think we would be creating those norms and creating those topics based on the interests of the students and the knowledge of the students to truly meet them where they are. (Iteration 1 Pre-course Reflection)

As I grappled with my desire to co-construct the course, I ultimately relied on my power as the instructor to determine which social justice and mathematical topics should be incorporated into the course, even before having a deep and nuanced understanding of what students' prior knowledge and experiences were to each.

While recognizing this tension, I tried adjusting the curriculum based on students' interests. For instance, in Iteration 1 of KWM, alongside increased awareness both on campus and across the country about the concurrent pandemics of mental health and COVID-19, students negotiated to adjust the curriculum:

One glimmer of hope ... was that we redesigned the course midway through. Well, not entirely. Really, we looked at the schedule and discussed if there were more important topics that we would want to discuss than the ones that I had planned.... So, we moved some topics around, and the final group of student-led social justice mathematics investigations focused on mental health issues from before and during the pandemic. (Iteration 1 Post-course Reflection)

Ensuring students had opportunities to engage in conversations about social justice issues that were important to them shows promise for providing opportunities to continue to negotiate power in recognition of who is in the room and drawing upon their funds of knowledge and lived experiences. Still, I wondered how I could go further. Namely, to what extent should I be engaging students with explorations of social justice issues that were novel to them, and did I allow them to opt out of furthering their understandings of social justice issues that do not directly impact them?

I continued to question how each of the social justice issues discussed in KWM might disrupt rather than assimilate students' prior understandings:

[Mental health] is something that maybe most of our students can relate to. Many of us have either dealt with mental health directly or know somebody who's dealt with issues and mental health directly. And it seems like that is not as touchy of a subject as maybe race is right now. And so it's like, okay, well yes, we need to like be having conversations about these issues that are, like, pressing in the students' lives, but at the same time in a class like [KWM] where we're really looking to expand our own understandings of social justice and are going to think about teaching mathematics and think about using social justice topics and other mathematics and what social justice subjects they would be comfortable talking about. (Iteration 1 Week 8 Reflection)

My efforts to include students in making curricular decisions in KWM seemed to uphold the perception that we could either negotiate power or engage in conversations about the social justice topics I found most important for students in their current levels of development. This maintains the implicit assumption that my experiences and assumptions were more important than the experiences of other stakeholders in KWM: the students. I continue to experience this tension of what counts and who decides what topics are most important to explore in KWM. For instance, if students strictly prioritize social justice issues, such as mental health that are widely experienced by many college-age students, especially during the pandemic (e.g., Choi et al., 2020; Talevi et al., 2020), are we collectively

recentering whiteness by avoiding conversations about how the issues discussed in KWM intersect with other instances of social justice, such as racism and capitalism? This also foregrounds a missed opportunity to further support students' understandings of the intersectional nature of the social justice issues discussed in KWM. Building on students' interest in mental health, students and I could have directed a conversation about community access to mental health care in relation to race and ethnicity (e.g., Cabassa et al., 2006), as well as how mental health and treatments are understood and valued in various cultures (e.g., Ciftci et al., 2012).

Positioning Contributions of Guest Speakers. Beginning in Iteration 1 of KWM, I recognized the potential for inviting guest speakers to share their experiences with TMSJ. Since the students were all PMTs in Iteration 1, I asked Dr. Frances Harper (2020), a white scholar, to share her efforts to support teachers and students engaging with social justice mathematics tasks.

[This] was just like another reminder of the fact that we need to be having more voices in class, and I think that voices like [theirs] who do research in this area, but I also want to include teachers who are doing this work that can be sharing about their experiences.... I appreciated that they were able to come today as a white woman. Given that ... our PMTs are primarily white women, and they're cognizant of the fact that their identities are going to play a part in their teaching. (Iteration 1 Week 11 Reflection)

Harper supported our primarily white undergraduate groups' efforts in thinking about engaging in white people's work or critically investing in our re-education of how systems of power and oppression, such as racism, permeate all aspects of our lives. Harper also provided me with a formal opportunity to learn alongside the students. This sparked my desire to incorporate additional guest speakers in future sections of KWM.

In Iteration 3 of KWM, I invited five guest speakers to share additional context about some of the social justice issues and elements of the framings for the course (see Table 5).

Table 5
Invited Guest Speakers to KWM Iteration 3

Week	Topic	Guest Speakers
2	Connecting Issues of Social Justice with the United Nations Sustainable Development Goals (McLeod, 2021)	Through a mutual friend, I was connected with Dr. Lisa McLeod, a white female Assistant Professor whose research centers on the United Nations Security Council. They joined virtually to discuss the development and use of statistics in forming the Sustainable Development Goals.
3	Becoming Global Citizens (Chhikara, 2021)	Dr. Alankrita Chhikara is a close friend and a woman from India with whom I regularly communicated as part of my graduate program. Chhikara joined KWM in person to share her research on developing global citizenship and how it relates to discussions in our course (UN-SDG 3 & 10; UN, 2015).
9	Experiences of LGBTQ+ Members (LGBTQ+ Panel, 2021)	We were joined in person by a panel of racially diverse students who shared their experiences as members of the LGBTQ+ community on campus (UN-SDG 5; UN, 2015).
11	Racialized Policing Practices (Bell, 2021)	Troy Bell was a student in my graduate program and friend who identifies as an Afro-Latino man. Bell shared about his experiences as a police officer and designing and implementing trainings for officers specific to race and power in policing. He discussed tensions he faced as a police officer concerning instances of racism against members of the community, as well as himself (UN-SDG 16; UN, 2015).
13	School Choice and Segregation	Our final guest speaker was scheduled to join virtually but had to cancel late in the semester. This Assistant Professor at another university in the Midwestern United States identified as a Black man who had personal experiences with and explored issues of race and racism in educational contexts in their research (UN-SDG 4; UN, 2015).

As I prepared for the guest speakers to join KWM, I reflected on how “offloading this responsibility of helping students to contextualize and learn about the [United Nations and specific social justice topics] to people who know more” (Iteration 3 Week 1 Reflection) created another tension about the distribution of power in the course. Because I, like the students in KWM, am not an expert on each of the social injustices we work to unpack, I relied on guest speakers to share their experiences and efforts to confront some of the social justice topics we discussed in class. While introducing Iteration 1 students to a critical white scholar provides one example of how white people can take up the responsibility to “build the stamina to sustain

conscious and explicit engagement with race” (DiAngelo, 2011, p. 66), more is needed from me, as the instructor. As I further my efforts to decenter whiteness in mathematics curriculum and instruction, I must continue to deepen my understanding of the social justice issues the students and I investigate to not burden colleagues who experience marginalization and oppression with additional labor (see Bell et al., 2021).

Still, inviting guest speakers helped to redistribute power in KWM from me, as the authority figure, to positioning guest speakers with power in the classroom discourse. However, the guest speakers were positioned as experts about social justice issues, and not mathematics, despite their own rich mathematical experiences. Consistent across each of the guest speakers’ and panelists’ involvements in KWM, I excused them from our subsequent mathematical investigations after their respective contributions to further contextualize the social justice topics and ideas that framed our mathematical investigations. This decision implicitly maintained my role as the mathematical expert in KWM and effectively managed what counted as *behavioral* and *cognitive* contributions to mathematical ideas. Effectively, I upheld the artificial notion that you are either a mathematical or social justice expert.

Restricting Voice: Curricular Influences

Despite my efforts to foreground racial justice in a TMSJ course, KWM’s curricular influences were primarily informed by my lived experiences as a cis white man and by other white presenting scholars’ research.

Utilizing White Ideas for White Students. I detail my co-development of KWM in a recent book chapter (i.e., Lolkus & Newton, 2022), including my rationale for developing KWM, my selection and sequencing of social justice mathematics resources (e.g., Hamman, 2019; Warner, 2019), and theoretical framings (i.e., Cazden, 2012; Gutstein, 2006; United Nations, 2015). I continued to unintentionally perpetuate whiteness through an over-reliance on Western and white presenting scholars. Namely, within the references for the most recent iteration of KWM, 39 of 40 worked within North American contexts in the United States and Canada, and 33 presented as white. Thus, my development of KWM maintains white supremacy culture through upholding and continuing to amplify dominant narratives about mathematics and social justice.

Not only did curricular influences contribute to my perpetuation of whiteness, but also my assumption about who would benefit from KWM. For instance, I foregrounded my expectation that primarily white students would enroll in KWM:

So, I think there’s also this like assumption that students are going to learn about social justice in the same ways that I did.... I think that they are predominantly

white students. And when I was designing the course, I think I was thinking of designing a course, predominantly for white students.... given the demographics of our math program and given the demographics of our teacher education program. (Iteration 1 Pre-course Reflection)

Here, I foregrounded my efforts to take on the responsibility of educating white undergraduates (and myself) about the social injustices we have explicitly and implicitly benefited from without placing the burden of educating white folks on colleagues from Black, Latinx, Indigenous, Asian American and Pacific Islander and other marginalized groups. While I was correct in my assumption that students in each of the iterations of KWM would be primarily white (i.e., 91%, 75%, and 59%, respectively), I continued to wonder how the course would be different if the population of students changed, as well as what would happen when future instructors were hired to facilitate KWM.

I would be missing a big part of the cultural contexts if I didn't mention that 10/11 PMTs in [Iteration 1] identified as white, 1/11 identified as white, and Latina, 9/11 identified as female. So, a relatively homogenous group that reflects teacher education at [University], as well as across the country. Similarly, as a white male mathematics teacher educator, I add to the limited [racial] diversity in teacher education. (Iteration 1 Post-course Reflection)

My framing of the course with the expectation that students would need similar disrupting experiences as my own from a white perspective and white lived experiences reinforced whiteness through continuing to center the experiences and needs of white students. Alternatively, had the course been designed with a more racially diverse group of students in mind, I could have further foregrounded and attended to the experiences of students who experience marginalization in mathematics classrooms (e.g., Joseph, 2021).

Moments of Progress

While there is much room for improvement in my efforts toward decentering whiteness in my instruction of KWM, there are also promising practices that serve as a starting point for my ongoing instruction and curriculum development.

Shifting Views: Non-Western Perspectives

I incorporated additional structures in the third iteration of KWM, including a new grading protocol, guest speakers, and a student-facilitated ethnomathematics assignment. These structures supported my efforts to center non-Western

perspectives in KWM, as well as shift power away from me as the instructor and more toward students.

Reconsidering Participation. Despite determining and managing students' forms of participation without their input and asserting my authority in the classroom, as outlined in the Determining Forms of Participation section, I worked to acknowledge and reward their participation trends over time. Sparked by conversations in the *Institute for Racial Equity* summer training at the University, I reflected on my decision to evaluate students' participation grades based on their median rather than mean scores in the first week of instruction:

Since there isn't homework in the traditional sense... every take-home assignment that we have is worth 30 points, and I'm going to take the median [score]. So, ... maybe that will provide them with an opportunity to have some leeway and reward their pattern of participation as opposed to having one assignment bring [their grade] down. (Iteration 3 Week 1 Reflection)

This minor adjustment to recognizing students' forms of participation over time allowed students to prioritize activities and social justice mathematical investigations throughout the course. One concern is that students may use their agency to unintentionally recenter whiteness by prioritizing conversations that are most closely related to their lived experiences and interests rather than engaging in critical conversations that aim to unpack the intersections of various social justice topics. For white students, in particular, this may be an avoidance of conversations about the persistence of racial injustice.

I also reflected on my assumptions about what counted as participation in KWM through a connection to my prior experiences as a high school mathematics teacher:

[In prior teaching experiences] there was always this fully scripted agenda, or what we had to get done, and there was no personal connection. [Now,] I find myself very much enjoying and looking forward to [personal connections] in my teaching... Having an outline determined by other people stopped me in the past, and my experience in reading and teaching... kind of encouraged me to focus more so on the relationships with students and less on developing relationships so that I can draw upon them later. (Iteration 3 Week 7 Reflection)

Working toward developing authentic relationships with students encouraged me to rethink mathematics teaching and learning. Whereas rigid mathematical learning targets determined many of my interactions with students in my previous role as a secondary mathematics teacher, centering my instruction on relationships brought me additional joy in my work with students and supported me in connecting content to students' interests and experiences. Because most of the students in KWM identified as white, prioritizing relations did not decenter whiteness. However, my

efforts to prioritize without the expectation of later leveraging relationships challenged what Freire (2018) referred to as traditional banking models of education. In this way, my motivations for developing and sustaining authentic relationships with students aligned with broader efforts toward enacting liberatory mathematics instruction by challenging the *organizational logic* of mathematical spaces.

Centering Non-Western Perspectives. I made progress toward centering non-Western perspectives — addressing the *history* and *organizational logic* of mathematical spaces — in two main ways in KWM: inviting guest speakers and developing an ethnomathematics assignment.

As detailed earlier, I continued to perpetuate whiteness by positioning guest speakers as experts in social justice issues, not as mathematics content experts. Furthermore, my over-reliance on guest speakers may have contributed to my perpetuations of whiteness by offloading some of the critical self-learning necessary for developing my critical consciousness as I continue engaging in conversations about social justice and mathematics with students. At the same time, guest speakers challenged my perceptions of social justice and my relation to the topics we discussed in class. For instance, I reflected on how the language used to describe communities who experience marginalization in the United States based on race, such as Black and Brown, or non-white, is exclusionary and problematic. Emerging from conversations with mentors and colleagues, I problematized my use of language when referring to marginalized communities in KWM. Inviting and engaging with guest speakers continued to challenge my presumptions of appropriate language. For example, after one guest speaker joined the class, I reflected:

We used the word ‘crises’ and I think maybe I used it unintentionally. Then, during our [class] conversation, [Chhikara] brought up these questions of, ‘why are we calling them crises?’ ‘Why are the students calling them crises?’ and, ‘Who has the power to decide what, whether it is a refugee crisis or not, and what does this language around refugees’ kind of represent?’ And [Chhikara] also pushed back on this idea of, you know, what is the perspective [we are taking] and how are we not focusing on the [supposed] goodwill of the United States, but instead recognizing what role the US has played in supporting or underscoring or causing many of the refugee ‘crises’ that we were referring to? (Iteration 3 Week 3 Reflection)

Engaging this guest speaker, in particular, who identifies as a critical scholar and woman from Southern Asia, in our course conversations and debriefs provided not only an opportunity for students to engage in rich conversations with people with experiences different from many of their own but also continued to push my thinking as well. I further reflected on the need for incorporating non-Western voices in KWM after the final class:

[Chhikara's] expertise and conversations provided additional context and urgency to the social justice issues we were getting ready to unpack. One concern I have with inviting guest speakers is an over-reliance on them to educate students and instructors in KWM. (Iteration 3 Post Course Reflection)

I continue to consider how to find a balance within this tension between providing opportunities to hear from and engage with scholars, activists, and members of non-Western communities and also assuming my responsibility to learn and critically reflect on my lived experiences.

I also worked to decenter whiteness in KWM by developing an assignment focused on ethnomathematics in Iteration 3 of KWM. Specifically, this helped center non-Western ways of knowing and thinking in mathematical spaces without burdening colleagues, often from marginalized communities in the United States, with the additional labor of educating primarily white people. This assignment provided students with opportunities to explore the contributions of individual mathematicians (e.g., Brahmagupta) and various cultures (e.g., Indian, Indigenous, Japanese) beyond dominant narratives of mathematics from a predominantly Western perspective. While this small-group assignment provided students with opportunities to unpack their assumptions of what constitutes mathematics, more was needed. For instance, in my final reflection, I shared the following:

I would love to extend the ethnomathematics presentations beyond the first 15 minutes of class to a class-long investigation of mathematics problems that can be solved using the methods (e.g., different bases, tools, values) outlined in the presentations. I also think it would be valuable to connect the ethnomathematics presentations to the guest speakers that are invited – perhaps scholars or members of various cultures, or even to expand the subcultures that are represented, we could invite activists and artists to first present about their experiences, and then have students investigate how they use mathematics in their work/art. (Iteration 3 Post-course Reflection)

More intentionally aligning aspects of the ethnomathematics assignment to social justice and mathematical investigations in KWM could further and more effectively decenter Western perspectives of mathematical ideas.

Engaging with ethnomathematics tasks, such as the one I introduced, can support students (and teachers) to critique and reimagine school mathematics (Powell & Frankenstein, 1997) through investigations of the mathematics that is practiced among cultural groups (D'Ambrosio, 1985). While this assignment provided opportunities for PMTs to begin to engage with and recognize the diverse ways in which mathematics is used and communicated (D'Ambrosio, 2006), scholars advise to do so meaningfully and critically so as not to trivialize community knowledges or to reinforce binaries (Knijnik, 2002) by singling out, or even patronizing the multiple knowledges of, marginalized students and

communities (Eglash, 1997), or to position ethnomathematical investigations as separate from core mathematics learning opportunities (Bullock, 2024). So, while engaging in ethnomathematics can support culturally relevant and social justice-oriented pedagogical goals (Rosa & Orey, 2017), failing to consider the power relations inherent in whose (mathematical) knowledges are valued may reinforce whiteness by working on translating non-Western mathematical ideas into Western notions of mathematics (Eglash, 1997). As one example in KWM, future iterations of the student-facilitated ethnomathematics assignment can center an intersectional approach to understanding how cultural groups around the world experience and confront marginalization and power, and further underscore the brilliance of mathematical ideas through examples of challenging mathematics.

Redistributing Power: Students' Agency

As I progressed through each iteration of KWM and became more aware of how I was regularly positioned as that of authority in KWM, I continued to think of how to redistribute power in our class and interactions more authentically. For instance, providing students with a relatively open prompt to explore a (sub)culture of their choosing in the ethnomathematics assignment described earlier provided students with opportunities to exercise their agency. More intentionally throughout KWM, though, I worked to co-develop resources and next steps alongside students in attempts to disrupt the *organizational logic* of mathematical spaces.

Repositioning Partners. My primary effort to reconsider and reposition myself in my collaborations with students was through a critical participatory action research initiated in Week 5 of Iteration 1. This project arose out of conversations with one of my advisors and committee members in recognition of the need to provide opportunities for students in KWM to connect their understandings of social justice mathematics to the secondary classrooms they worked in. After recruiting students to continue learning about and working toward TMSJ, three PMTs volunteered. We then engaged in an 18-month-long collaboration to explore their TMSJ experiences during and after completing KWM and into their secondary mathematics field placements. The three PMTs negotiated their participation in our collaboration not only by reflecting on their TMSJ experiences through incorporating social justice topics that were important to them and their secondary mathematics students, but also by co-designing and engaging in the analysis and dissemination of findings (see Grimes et al., 2024; Miller et al., 2021).

This critical participatory action research experience provided the three PMTs and me with opportunities to challenge traditional power relations between students and instructor and amplify the voices of early-career researchers and teachers. Co-developing and collaborating in a critical participatory action research provided opportunities for the PMTs to foreground social justice issues relevant to

them and the students they were working with during their student teaching field placements (i.e., gender inequities within STEM disciplines, impacts of climate change on coastal communities, access to healthy foods in communities categorized as ‘food deserts,’ and misrepresentation of countries from the global South with various map projections) while critically reflecting on their pedagogy as early-career mathematics teachers. By co-constructing and identifying TMSJ resources for our collaboration, the PMTs were positioned as full participants in the research and teaching process. At the same time, I primarily maintained the role of facilitator and, as needed, resource. This effort foregrounds the potential of collaboration and co-construction for decentering whiteness through redistributing power away from cis-white male teacher educators like me.

Co-constructing Resources. In each iteration of KWM, students developed their own social justice mathematics tasks. While I required students to incorporate frameworks from the course that framed our discussions on social justice (i.e., economic, cultural, political [Cazden, 2012]) and equity in mathematics teaching/learning (i.e., access, achievement, identity, power [Gutiérrez, 2012]), students were provided with opportunities to apply their knowledge of mathematics and social justice to develop their questions. Before teaching Iteration 1, I shared:

I plan to incorporate either of those exact tasks or variations of that task into their quizzes, where they will be engaging with the mathematical tasks and then doing write-ups about the connections with social justice and the implications for not only that particular instance for them, then also kind of how it informs them their own thinking about teaching and learning. (Iteration 1 Pre-course reflection)

By asking students to apply their understandings in the development of a task and utilize their resources for the final quiz, students had opportunities to negotiate assessments in KWM. When designing and working on getting KWM approved as a mathematics content course by the University, utilizing assessments that align with traditional conceptions of what constitutes a mathematics class, such as quizzes, was one attempt at creative insubordination (Gutiérrez, 2013, 2016). Rather than having students, for instance, silently complete practice problems, students had opportunities to negotiate what would be assessed on team assessments in connection with social justice issues. In future iterations of KWM, I could go further by inviting students to incorporate additional frameworks and perspectives they are familiar with so as not to restrict or too narrowly frame their social justice mathematics investigations.

Discussion

In this manuscript, I outlined some ways I have unintentionally perpetuated whiteness (Frankenberg, 1993; Battey & Leyva, 2016) in my design and instruction of KWM (Lolkus & Newton, 2022), a social justice mathematics course. Namely, I centered myself as the authority figure by determining what counted as participation in KWM, selecting and sequencing curricular resources before developing relationships with students, and narrowly defining the expertise of stakeholders (i.e., guest speakers). I further maintained KWM as a white institutional space by utilizing resources developed by white scholars and that were primarily for the benefit of white students. Despite these actions, I also outlined a few promising practices, including incorporating more diverse voices in KWM through partnering with guest speakers on and off campus, engaging students in investigations of mathematics steeped in marginalized and non-Western communities, and beginning to rethink what counted as participation in KWM. This action research exemplifies my efforts to recognize and begin to confront whiteness in my instruction and curriculum development.

Power and Presumed Expertise

Perhaps the most prominent way that I perpetuated whiteness in KWM was through positioning myself, a white male mathematics teacher, as an authority figure in a course that aimed to conceptualize and work on challenging issues of social justice with mathematics. My unearned privilege of being accepted as an expert on issues of social justice that have not yet, nor will likely, directly influence my lived experiences in both a discipline and country normed on maleness and whiteness both is a result of and further contributes to white supremacy culture. While instructors with historically marginalized racialized and gendered identities may have had to take additional steps to prove their competence and content expertise (Lazos, 2012), my authority was never challenged. Thus, it is crucial to uplift and center the voices and experiences of instructors with diverse identities and lived experiences in future iterations of KWM. Furthermore, it is important to recognize that not only white people are socialized into whiteness. As a manifestation of everyday practices and norms, all people are socialized into whiteness and may unintentionally perpetuate whiteness and uphold white supremacy (Hayes, 2013).

Student Agency and Recentering whiteness

A recurring tension in KWM was meeting students where they were in terms of their current understandings of social justice and what they wanted to learn more about. Since KWM served predominantly white undergraduates, there were instances where students used their agency to, likely unintentionally, recenter whiteness by refocusing on topics that were relevant to them. This raises questions of how providing historically privileged students with agency in predominantly white spaces, such as KWM, might unintentionally further reproduce and co-construct yet another predominantly white space. For instance, students in Iterations 1, 2, and 3 negotiated the further inclusion of or selected social justice topics for their final projects focused on issues such as mental health, gender, and climate change. I developed KWM with a broad focus on issues of social justice, not only related to racial justice, but students also seemed to stray away from conversations they had less experience with (i.e., racism).

As I continue to grapple with balancing students' interests related to some social justice topics while also needing to challenge them to move beyond their current comfort levels, there are promising paths forward. Based on a study investigating the experiences of 10 sixth-grade students of relatively privileged backgrounds with social justice mathematics, Kokka (2020) suggests directly asking students to consider actions they can take in partnership with local community organizations can contribute to privileged students' development of critical consciousness without further burdening marginalized people. Similarly, through their efforts to engage suburban high school humanities students with issues of social justice, Nurenberg (2011) found promise in pairing examples of privileged individuals working to address inequities with examples of historically marginalized individuals as one way to address privileged students' resistance to engaging in conversations of power and oppression. These examples reinforce and extend what was shared explicitly in KWM: predominantly privileged students need to be comfortable being uncomfortable while engaging in conversations about race and racialized policies to recognize how systems of oppression have and continue to grant them unearned advantages.

Next Steps

Moving forward with my action research, I continue to reflect on how, despite my recognition of whiteness in my instruction and recognizing the beginnings of some promising practices (e.g., centering ethnomathematical tasks), KWM is not yet revolutionary or substantial enough to completely decenter and fully confront white supremacy culture in mathematical spaces or my instruction. More concerted and collective efforts are needed. I recognize two promising

strategies that may further my efforts to decenter whiteness in KWM: (a) adopting and foregrounding an intersectional perspective to issues of social justice and (b) expanding my efforts as an individual working toward decentering whiteness toward that of collaboration by making my journey explicit while also discussing and reflecting on others' journeys.

Intersectionality

In addition to incorporating frameworks to support students' and my understandings of social justice (i.e., Cazden, 2012; Fraser, 2005), I anticipate one promising practice may be to incorporate a framework for exploring the intersectional nature of each social justice concept we investigate in KWM. For instance, I hope to center the work of Crenshaw (1989), in which she explored how the intersection of various individual characteristics, such as race, gender, and class, can help understand and analyze power imbalances. Engaging in intersectional analyses has supported researchers in overcoming persistent issues with one-dimensional analyses of phenomena in higher education (Museus & Griffin, 2011). Specific to mathematics education, frameworks developed from Crenshaw's theory of intersectionality, such as Black Feminist Mathematics Pedagogies (Joseph, 2021), show promise for reimagining mathematics teaching and learning away from centering whiteness and toward equitable learning opportunities that are affirming for historically marginalized learners, Black girls in particular.

Similarly, as Bullock (2018) noted, research on critical mathematics education often investigates forms of oppression in silos, with most of the research that utilizes intersectionality focusing on identity in critical mathematics education. Furthermore, incorporating an intersectionality framework in instruction in K-12 settings has shown promise for supporting diverse student and teacher groups to better understand societal power dynamics (Carey et al., 2018). Thus, it is no surprise that Larnell et al. (2016) call for more efforts focused on TMSJ to utilize intersectionality to explore the complex and compounding relationships among individual identities. Explicitly teaching about the intersectional nature of social justice issues may provide opportunities for students to make more explicit connections between systemic issues, such as racism and classism, and their own lived experiences in relation to topics discussed in KWM.

Collaboration

Engaging in an individual interrogation of my perpetuations of whiteness provided me with opportunities to critically reflect on my work and take action toward reimagining my instruction. I recognize that future efforts toward decentering whiteness can and should be collaborative movement-building

opportunities rather than independent endeavors that may further uphold white supremacy culture through positioning instructional strategies as independent undertakings (i.e., individualism; Okun, 2021). Furthermore, suppose this process and action research, in fact, supported my efforts to recognize and begin to decenter whiteness in KWM. In that case, I am responsible for engaging with educators to critically reflect on broader instructional and curriculum design practices that maintain white supremacy culture in mathematical spaces.

Conclusion

Beyond the potential for unintentionally recentering whiteness, as I outline in this study, educators and scholars critique teaching mathematics for social justice for its potential to cause harm. For instance, Abtahi (2022) shares how their efforts to center mathematical investigations of non-dominant communities to teach dominant mathematics causes harm to non-dominant communities whose ideas and ways of thinking were used to maintain the status quo. Similarly, Unfried and Canner (2019) echo O'Neil's (2016) warning of the dangers and likeliness of social inequities being embedded into big data and mathematical models of the world. Through pairing a critical reflection of how whiteness persists in designing and implementing a social justice mathematics course for undergraduate students, this study provides one example of the potential for engaging in a pedagogy of discomfort. A pedagogy of discomfort encourages students and teachers to move outside their comfort zones to challenge dominant beliefs, social habits, and normative practices and move toward a reimagined, more just future (Boler, 1999). Zembylas (2015) argues that while it may be impossible to achieve individual and social transformation without enacting some level of ethical violence, such as recentering whiteness, educators must embrace their vulnerability to recognize the limitations of their knowledge of others.

I recognize that perhaps the most promising contribution of this action research was not the example of how centering ethnomathematical explorations can contribute to uplifting non-white voices whiteness in connection with explorations of social justice, but rather starting me on a path toward more fully grappling with and owning my perpetuations of whiteness. This attempt at an authentic investigation of my complicity serves not to, as Warburton (2016) observed in many critical whiteness studies, distance myself from whiteness but, in fact, begin to own how I maintain the status quo of mathematics as a white institutional space. Rather than replicating KWM or only engaging in similar tasks in other mathematics courses, I look to instructors and students to instead critically reflect on how their actions also maintain systems of whiteness in their instruction and curriculum development.

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