Teaching Logic for Social Justice: How Students' Activity Identifying Mathematical Assumptions Can Support Their Reasoning Around Prisons and Abolition

Megumi Asada
Rutgers University

Mathematics and mathematics education are implicated in broader societal inequities. These inequities can manifest in racialized and gendered classroom experiences and are perpetuated by the very practices students are encouraged to employ. While some scholarship in undergraduate mathematics describes possibilities for using mathematics toward social justice, this area has been largely limited to algebra, statistics and calculus, leaving proof unexplored despite its critical role within K-16 mathematics. The aim of this study was to develop an instructional theory for how students can productively discuss and debate sociopolitical issues through practicing competencies from proof-based mathematics. I report data from the first cycle of a constructivist teaching experiment with two undergraduates designed to help them use logic to support their sensemaking about prisons and abolition. Ultimately, students' successful activity attending to definitions and identifying assumptions in a geometric context supported their ability to identify commonplace assumptions about prisons.

Keywords: teaching math for social justice, logic, equitable instruction

Introduction

Undergraduate mathematics has long upheld and perpetuated societal injustices (Adiredja & Andrews-Larson, 2017). Some scholars argue that the very practices students learn in their math courses can amplify existing societal inequities (e.g. B. Martin, 1997). In particular, the disciplinary values of decontextualization and objectivity can permit mathematicians to draw harmful conclusions while receiving little scrutiny (Leyva et al., 2022; D. B. Martin, 2009). When mathematicians *decontextualize* data, they disregard social context and can draw conclusions based on their subjective choices of which variables to foreground or background. For example, 'achievement gap' scholarship uses statistics to draw deficit-based conclusions about Black and Latin*[1] students without attending to important factors such as school funding or racialized tracking patterns (Gutiérrez, 2008). Thus, a finding that reflects deeply entrenched societal injustices was misinterpreted as an indication that historically marginalized students in mathematics are less capable. Furthermore, the belief that mathematics is *objective* adds weight and influence to these inaccurate and biased conclusions (D. B. Martin, 2009). There is seemingly no room to argue with an objective finding, especially if its subjective nature is hidden in plain sight.

Just as mathematics can be used as a tool to support inequities, mathematics can also be used as a tool to fight them. Prior work describes possibilities to teach students to analyze, critique, and change societal injustices using mathematics (e.g. Gutstein, 2003). However, this work relies on statistics and computation (Harper, 2019), drawing connections between math and social justice that are not generalizable to more abstract areas of mathematics, such as proof. This is notable as proof plays a critical role throughout K-16 mathematics. In fact, the National Council of Teachers of Mathematics (2000) lists reasoning and proof as one of its five process standards,

[1] Salinas (2020) promotes the use of the term *Latin** to refer to Latinx/a/o people as a collective. Salinas advises reserving the term *Latinx* for gender-expansive *Latin** individuals.

arguing that K-12 instruction should enable students to “recognize reasoning and proof as *fundamental aspects* of mathematics [emphasis added].” I propose, however, that proof can be modified to honor the goals of teaching math for social justice and subvert the math disciplinary values of objectivity and decontextualization.

Advanced undergraduate mathematics serves as an important setting for teaching logic and proof for social justice. All secondary math teachers are required to take courses in proof, and these courses are where teachers form their opinions about proof-based mathematics (Knuth, 2002). However, these courses are currently taught in a manner that amplifies the disciplinary values of objectivity and decontextualization (Leyva, McNeil, et al., 2022). These instructors then bring a perspective of proof as decontextualized and objective into their K-12 classrooms. In the realm of proof, mathematical arguments rely on axioms, the taken-for-granted assumptions and logical starting points in a mathematical theory. Further results are then deductive consequences of these axioms. Traditionally, axioms were intended to reflect self-evident or empirical truths, and thus, proof was considered a means for drawing conclusions about objective reality (Dutilh Novaes, 2020). Unlike traditional axiomatics, however, modern axiomatics is agnostic towards whether axioms or the theorems that rely on them are true in an absolute sense (Dawkins, 2014). Theorems instead hold a conditional status, where the emphasis is placed instead on assuming the necessary axioms and constructing a valid proof (Dutilh Novaes, 2020). Thus, the modern perspective towards axioms subverts the problematic view of proof-based mathematics as objective, without recourse for critique. I also argue that the attention to axioms, or mathematical assumptions, can enable students to identify assumptions underlying their sociopolitical beliefs. This is noteworthy as K-12 teachers are explicitly expected to help students use and attend to mathematical assumptions (CCSSM, 2010). Yet, these approaches to applying logic and proof to students’ sociopolitical views have been unexplored in the literature despite the impact they would have on K-12 math instruction.

This study’s research goal was to develop an instructional theory for how students can productively discuss and debate sociopolitical issues through practicing competencies from proof-based mathematics. The instructional theory was developed via two cycles of constructivist teaching experiments (Steffe & Thompson, 2000), each with a pair of undergraduate math students. Students’ activity identifying and relaxing mathematical assumptions, or axioms, in a geometric setting was designed to parallel their activity identifying and relaxing assumptions about prisons and prison abolition. The goal of this study was to develop a theory for how advanced mathematics can support students in discussing social justice issues. Accordingly, this study addresses the following research question: In what ways can students’ reasoning about logical assumptions in advanced mathematics support their reasoning about assumptions in a sociopolitical setting?

Literature Review

I describe prior work that links math to social justice and scholarship that describes the role of sociopolitical assumptions, or logics, in oppressive systems. Teaching Math for Social Justice (TMSJ) encompasses a range of curricular interventions that enable students to both “read” and “write” the world using mathematics (e.g. Gutstein, 2003). These studies have been successful in increasing interest in mathematics (Rubel et al., 2016; Turner & Front Strawhun, 2013), providing opportunities for students to use mathematics to critique oppressive systems (Gutstein, 2003; Kokka, 2019; Rubel et al., 2016; Turner & Front Strawhun, 2013), and creating opportunities for students to engage in social change (Stocker, 2012; Turner & Front Strawhun, 2013). However, TMSJ implementations can also be constrained in their ability to sufficiently cover either the social justice or the mathematics content. In some cases, lessons are entirely divided into two distinct halves covering mathematics or social justice content (e.g. Bartell, 2013). In other cases, eliciting understandings of the mathematics and of the political topics encompassed conflicting pedagogical goals. For instance, Gutstein (2003) occasionally had to tell his students how to find the answer or substantially simplify the mathematics. He also struggled to balance providing sufficient historical context with giving students opportunities to explore the mathematics. These trade-offs can be inherent to the added complexity that real world data sets can have relative to the nicer quantities students are used to working with in traditional school mathematics.

Harper (2019) describes Gutstein's difficulties negotiating conflicting disciplinary commitments as a theme that extends across TMSJ. Furthermore, many TMSJ scholars rely on data science to connect mathematics to social justice issues (e.g. Gutstein, 2003; Rubel et al., 2016; see Simic-Muller, 2019, for an example in the undergraduate context), which is notable as data science occupies only one category of the mathematics students are expected to learn in school. In fact, Harper (2019) comments that TMSJ work has generally struggled to connect social justice content to mathematics content standards at the secondary level. It is thus unclear to what extent TMSJ is even possible in more abstract areas of mathematics, including proof-based mathematics.

Prior work also describes the role that *math logics,* or the assumptions, norms and values shaping how society views mathematics (Battey & Marshall, 2023), play in perpetuating inequities in mathematics education. The notion of *logics* (Acker, 1990), or organizing assumptions that justify and uphold certain systems, is widely used throughout scholarship that seeks to critique different ideological instantiations of injustice. For example, Leyva, McNeil, et al. (2021) draw connections between racialized and gendered events in an undergraduate calculus class and their associated math logics. They described how the logic that calculus should operate as a weed-out course inspired an instructor to tell his students to drop his course if they were struggling. Participants in this study indicated that this seemingly neutral event was racialized and gendered. Leyva et al. argue that when left unaddressed, math logics can continue to preserve inequities in math classrooms. This study makes use of the analogous roles of axioms in mathematical arguments and assumptions or logics in (political) arguments. By teaching students to analyze assumptions, or logics, across disciplines, this study addresses a limitation of prior TMSJ work by unifying the social justice and mathematical goals. Students' cross-disciplinary reasoning about geometric assumptions and carceral logics will serve as a guide for how proof can help students question oppressive logics more broadly.

Theory

Abolitionist theory framed the design of students' sociopolitical activities and served as a means for analyzing students' assumptions about prisons. Abolitionists contend that abolishing prisons requires dismantling the structures and ideologies, or pro-prison assumptions, that support them while building systems that address the problems prisons claim to solve. I describe a key construct from abolition, carceral logics (Gruen & Marceau, 2022), that played a central role in the study design. *Carceral logics* account for the everyday, taken for granted understandings people have about prisons and punishment (Gruen & Marceau, 2022). I anticipated that participants would initially rely on carceral logics without realizing they were doing so. In fact, even movements in support of prison reform can employ carceral logics. For example, some advocacy for removing the death penalty has relied on the assumption that a life sentence provides a satisfactory alternative (Davis, 2003). In this case, reformists inadvertently evoke the carceral logic that incarceration is a sufficient solution to crime or violence. The goal of the study was not for the participants to take on abolitionist views or discard their initial perspectives but rather to identify and question carceral logics.

Methods

Data Collection

Data collection for this study consisted of two phases, both taking place over 10 weeks, consisting of an entrance interview, 7 teaching experiment sessions, and an exit interview. The data corpus includes interview transcripts, artifacts (student work), and video data from the teaching experiments. I recruited two participants per teaching experiment cycle. The present analysis covers data from the first of the two teaching experiments. My participants were a South Asian man (P1) and a Latina woman (P2), both of whom had taken multiple proof-based courses.

The goal of these experiments was to develop a theory of how students may use competencies from advanced undergraduate mathematics to support their discussions of prisons and abolition. To enable students to practice these competencies, I constructed a series of exercises that were designed for them to practice specific mathematical skills in a geometric setting then apply them to analyzing arguments about prisons and abolition. I used conjecture mapping (Sandoval, 2014) to develop hypotheses for how these exercises would enable students to engage in the three desired learning outcomes: identifying underlying assumptions of claims, relaxing these assumptions, and imagining different worlds or systems. This analysis focuses on the first learning outcome. These learning goals were participatory as the intention was for students to engage in authentic and productive discussion rather than perform well on a post-test. The starting set of conjectures were preliminary in nature, with the expectation that they would be incorrect in important ways.

As a facilitator, I generally guided students towards accurate mathematical interpretations and toward identifying the underlying commitments behind their political beliefs. However, I avoided imposing my own political beliefs onto the students. I encouraged participants to relax or question the assumptions they held *to a degree.* I did not ask participants to relax or replace assumptions that were fundamental to their identity or that involved the respect and inclusion of historically marginalized groups.

Analysis

I engaged in two types of analysis: ongoing and retrospective. Between sessions, I engaged in an *ongoing analysis.* I took note of whether and to what extent students identified or relaxed the assumptions included in the given session. I also identified instances in which the cross-disciplinary connections were successful or unsuccessful and developed preliminary conjectures regarding the relationship between students' reasoning across disciplines and the type of mathematical activity that could support student reasoning. I adjusted the exercises based on these revised conjectures. The ongoing analysis yielded tentative conjectures that account for how students would respond.

The retrospective analysis commenced after each experiment had concluded and involved a preliminary analysis to update the conjecture map. I identified episodes from the experiment that suggested the students successfully identified an axiom or a political assumption. I then worked backwards to identify mediating processes and conjectures that account for their successful activity. I coded for mediating processes, both those that were originally conjectured and ones that were unanticipated.

Results

The following excerpts are from Session 4 of the teaching experiment, which was the last session focused on having participants identify axioms and assumptions. Specifically, participants were given multiple examples of circles in non-Euclidean geometries and asked to identify what kinds of assumptions about circles these non-Euclidean circles brought up. They were then asked to critique a series of claims about prisons, with the goal that the participants would identify specific key carceral logics.

In the first half of the session, participants were asked to produce a definition of a circle and based off this definition, draw a circle in a series of non-Euclidean geometries. The participants first drew a circle in the Taxicab Geometry, a modification of the Euclidean geometry with a different distance metric. The taxicab circle resembles a Euclidean square and I had anticipated that participants would be hesitant to accept it as a circle. Ultimately, both participants accepted it. They were then asked to construct a circle in the Gap Geometry, a modified version of Euclidean geometry with a deleted strip, which produced a discontinuous, unbounded curve. Both participants rejected this curve as a circle and appealed to a definition of a circle that included the stipulation that circles were "closed and continuous:"

Author: And so for the 'closed and continuous,' is this something that to your knowledge, is canonically part of the definition of a circle? Or is this something that you've added in now that you've noticed this, and you're like, "that shouldn't be a circle."

Participant 1: I think it's always been part of the definition, but we exclude it because it would be superfluous in the Euclidean geometry.

Participant 2: Yeah, I think I'm assuming that it's in the definition. But I don't think I've had a definition that wasn't exclusive to the Euclidean geometry.

Participant 1: All the circles in Euclidean geometry are closed and continuous, we just don't say it because we just assume that it is.

Author: Out of curiosity, what's the difference between this and the not-round [taxicab] circle we had? Because it's also true that all of our circles in Euclidean are round, and we don't say that in the definition, but that's something that we're used to. What's the difference between a circle being round versus circle being continuous? Is there one that seems more wrong than the other?

Participant 2: I guess that we're holding the implication that it has to be closed and we're seeing that as more of a priority, carrying over the definitions in the different geometries.

Participant 1: I agree, I think that makes sense.

Both P1 and P2 acknowledged that they had never encountered a definition of a circle that included the stipulations "closed" and "bounded;" however, they maintained that these were both implied in the definition and were only omitted because they had previously only worked in Euclidean space. Interestingly, when I asked them to distinguish between their receptiveness towards accepting the Taxicab circle and their reluctance to accept the Gap Geometry circle, P2 suggested that it came down to a subjective decision. Namely, P2 saw the properties of being closed and continuous as "more of a priority." While both participants were unwilling to accept the Gap Geometry circle, they were consistent in their application of definitions. They agreed that the Gap Geometry circle would indeed count as a circle if "closed" was removed from the definition of a circle.

In the second half of the session, I asked the participants to assess various commonplace stances towards prisons. After introducing them to each claim, I asked them if they had any clarifying questions about it, without explicitly asking them to attend to definitions in particular:

Author: So our first claim is that “prisons keep communities safe by incapacitating people who commit crime.” So what are some initial questions you have about this perspective? This can include clarifying questions or things you'd want to know to assess the validity of the statement.

Participant 1: Oh, well, I think we need some definitions. What do you mean by ‘incapacitating people,’ what do you mean by ‘communities,’ and also what do you mean by ‘safe?’ So for ‘incapacitating people,’ does that mean just sequestering them from society? Does that mean rehabilitating people? Does that mean keeping their freedoms at a minimum, so they have a much smaller change to commit the crime again in their current state? Which definition of ‘incapacitating’ are we meaning? Communities... does that mean the non-prison population, does that mean any susceptible parts of society we need to keep from harm’s way? What do we mean by ‘safe’? Are we just getting rid of crime altogether by sequestering those who’ve committed crime? Are we just reducing the amount of danger as opposed to getting rid of danger altogether? Are you saying there is no chance prisoners could harm society if they’re put into prison? Are you saying there’s no chance of them getting out or there’s no chance of them still committing crimes while in prison?”

P1 immediately identified the need to define the terms: communities, safe, and incapacitation, and subsequently outlined various logical consequences for utilizing certain definitions (e.g. “Are you saying there is no chance prisoners could harm society if they’re put into prison?”). When later asked to identify assumptions of the same claim, P1 again evoked the definition of ‘safe:’

> You’re assuming the prison has no adverse effects on the community. For example, if you have a lot of well-known members of this society in prison, how would that affect the community? Yes, they are safe from the crimes, but does that mean they are safe? Does that mean they are doing okay? Does that mean they are handling... Let’s say there is a group of 10 family members, 9 go to prison. What’s happening to the other one? Are they safe from crime? Would they have been safer with those family members on the other side? There are many effects of imprisoning people committing crime that extend beyond making the community safe. So that needs to be included in your assumption, that you are making it safe. Because ‘safe’ implies ‘better.’ Those might not be intertwined in this definition.

Ultimately, P1’s attention to definitions when considering various definitions of circles extended to considering definitions related to prisons. Considering definitions (“those might not be intertwined in this definition”) then became a resource that enabled him to identify a carceral logic, that prisons have no harmful effects on communities.

Discussion and Implications

Ultimately, the participants’ activity developing a general definition for a circle outside of Euclidean space, and observing the consequences of this definition, primed P1 to spontaneously consider definitions when discussing assumptions about crime. While by the end of the experiment, he ultimately argued in favor of using prisons in some cases, P1 was successfully able to both identify and question a key carceral logic, namely that prisons have no adverse effects on communities. He also hinted at a few other commonplace assumptions: that incarcerated people are not part of any community, that people are necessarily safer when their community members are incarcerated. The identification of these assumptions was borne out of an attention to definitions, first in a geometric setting, and later in a setting that discussed prisons.

Participants' activity with definitions in some ways reinforced and in other ways subverted what McNeill et al.(2022) refer to as the objectivity discourse, or the idea that mathematics is inherently objective. In their geometric activity, both participants maintained that circles needed to be closed and continuous, that this had always been part of the definition but had simply been omitted because it was "superfluous" in Euclidean geometry. This contrasted with their earlier acceptance that circles did not have to be round and that their circle construction in the taxicab metric counted as a circle. While P2 seemed to suggest that her own subjectivity was playing a role, both participants characterized their definition of a circle as standard. In contrast, P1 spoke directly to the subjective nature of how someone might define the terms: incapacitation, safety, or communities and the different downstream implications of some of these choices. While neither participant explicitly evoked nor refuted the discourse that mathematics is neutral (B. Martin, 1997; McNeill et al., 2022), their activity did subvert it by illustrating the very consequential differences that arise from how concepts like 'community' or 'safety' are defined. Of course, while it was a goal of this study for students to use skills from advanced mathematics to reason about a social justice issue, these activities were not explicitly designed with the intention of subverting specific math logics. Future work may attend more directly to the possibilities for advanced mathematics to help students subvert their problematic assumptions about mathematics.

Finally, this study builds on prior work describing TMSJ implementations. In contrast with prior TMSJ work, this study provides a potential example of how mathematics can aid in students' *interpretation* of sociopolitical issues. Much of the prior work in teaching math for social justice involved analyzing data or mathematical phenomena and bringing in an external political perspective to serve as a means for interpretation. This is necessary because data can be interpreted in myriad ways depending on the assumptions and commitments people are bringing in. In those cases, it is the interpretation that influences the data; the mathematics itself has little bearing on the development of a political interpretation. Indeed, this created conflict between the mathematical content students needed for a given lesson and the important social justice background that was required (e.g. Gutstein, 2003). However, in this teaching sequence, the attention to and manipulation of definitions was used to support students in questioning commonplace perspectives and interpretations of prisons and incarceration. Future work may consider other avenues, beyond analyzing definitions and assumptions, through which proof and logic can support students' reasoning about social justice topics.

Limitations

As a teaching experiment with four participants (two in this report), it was not a goal of this study to generalize from these specific participants' starting points, trajectories, or reasoning. Additionally, as a series of activities that took place outside of a classroom, the specific context of this learning environment differed substantially from that of a typical undergraduate class. Thus, while this study may be viewed as a starting point for the *possibilities* of integrating advanced mathematics and social justice mathematics, there are real barriers and limitations specific to the classroom setting that did not apply to this study and would need to be studied in future work.

References

Acker, J. (1990). Hierarchies, jobs, bodies: A theory of gendered organizations. Gender & Society, 4(2), 139–158.

Adiredja, A. P., & Andrews-Larson, C. (2017). Taking the sociopolitical turn in postsecondary mathematics education research. *International Journal of Research in Undergraduate Mathematics Education*, *3*(3), 444–465. https://doi.org/10.1007/s40753-017-0054-5

Bartell, T. G. (2013). Learning to teach mathematics for social justice: Negotiating social justice and mathematical goals. *Journal for Research in Mathematics Education JRME*, *44*(1), 129–163. https://doi.org/10.5951/jresematheduc.44.1.0129

Battey, D., & Marshall, B. L. (2023). Math Logics: Perpetrators of Whiteness in STEM Educational Spaces. In J. Ravulo, K. Olcoń, T. Dune, A. Workman, & P. Liamputtong (Eds), *Handbook of Critical Whiteness: Deconstructing Dominant Discourses Across Disciplines* (pp. 1–11). Springer Nature Singapore. https://doi.org/10.1007/978-981-19-1612-0_34-1

Davis, A. Y. (2003). *Are Prisons Obsolete?* Seven Stories Press; eBook Collection (EBSCOhost). https://login.proxy.libraries.rutgers.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=731217&site=ehost-live

Dawkins, P. C. (2014). When proofs reflect more on assumptions than conclusions. *For the Learning of Mathematics*, *34*(2), 17–23. JSTOR.

Dutilh Novaes, C. (2020). *The Dialogical Roots of Deduction: Historical, Cognitive, and Philosophical Perspectives on Reasoning*. Cambridge University Press. http://ebookcentral.proquest.com/lib/rutgers-ebooks/detail.action?docID=6515985

Gruen, L., & Marceau, J. (Eds). (2022). *Carceral Logics: Human Incarceration and Animal Captivity*. Cambridge University Press; Cambridge Core. https://doi.org/10.1017/9781108919210

Gutiérrez, R. (2008). Research Commentary: A Gap-Gazing Fetish in Mathematics Education? Problematizing Research on the Achievement Gap. *Journal for Research in Mathematics Education JRME*, *39*(4), 357–364. https://doi.org/10.5951/jresematheduc.39.4.0357

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. JSTOR. https://doi.org/10.2307/30034699

Harper, F. K. (2019). A Qualitative Metasynthesis of Teaching Mathematics for Social Justice in Action: Pitfalls and Promises of Practice. *Journal for Research in Mathematics Education JRME*, *50*(3), 268–310. https://doi.org/10.5951/jresematheduc.50.3.0268

Knuth, E. J. (2002). Secondary School Mathematics Teachers' Conceptions of Proof. *Journal for Research in Mathematics Education JRME*, *33*(5), 379–405. https://doi.org/10.2307/4149959

Kokka, K. (2019). Healing-Informed Social Justice Mathematics: Promoting Students' Sociopolitical Consciousness and Well-Being in Mathematics Class. *Urban Education*, *54*(9), 1179–1209. https://doi.org/10.1177/0042085918806947

Leyva, L. A., McNeill, R. T., Balmer, B. R., Marshall, B. L., King, V. E., & Alley, Z. D. (2022). Black Queer Students' Counter-Stories of Invisibility in Undergraduate STEM as a White, Cisheteropatriarchal Space. *American Educational Research Journal*, *59*(5), 863–904. https://doi.org/10.3102/00028312221096455

Leyva, L. A., McNeill, R. T., Marshall, B. L., & Guzmán, O. A. (2021). "It Seems like They Purposefully Try to Make as Many Kids Drop": An Analysis of Logics and Mechanisms of

Racial-Gendered Inequality in Introductory Mathematics Instruction. *The Journal of Higher Education*, *92*(5), 784–814. https://doi.org/10.1080/00221546.2021.1879586

Martin, B. (1997). Mathematics and Social Interests. In A. B. Powell & M. Frankenstein (Eds), *Ethnomathematics: Challenging Eurocentrism in Mathematics Education*. State University of New York Press. http://ebookcentral.proquest.com/lib/rutgers-ebooks/detail.action?docID=3407014

Martin, D. B. (2009). Researching Race in Mathematics Education. *Teachers College Record*, *111*(2), 295–338. https://doi.org/10.1177/016146810911100208

McNeill, R. T., Leyva, L. A., & Marshall, B. (2022). “They’re just students. There’s no clear distinction”: A critical discourse analysis of color-evasive, gender-neutral faculty discourses in undergraduate calculus instruction. *Journal of the Learning Sciences*, *31*(4–5), 630–672. https://doi.org/10.1080/10508406.2022.2073233

National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics*. NCTM.

National Governors Association Center for Best Practices & Council of Chief State School Officers. (2010). *Common core state standards for mathematics*.

Rubel, L. H., Lim, V. Y., Hall-Wieckert, M., & Sullivan, M. (2016). Teaching Mathematics for Spatial Justice: An Investigation of the Lottery. *Cognition and Instruction*, *34*(1), 1–26. https://doi.org/10.1080/07370008.2015.1118691

Salinas, C. (2020). The Complexity of the “x” in Latinx: How Latinx/a/o Students Relate to, Identify With, and Understand the Term Latinx. *Journal of Hispanic Higher Education*, *19*(2), 149–168. https://doi.org/10.1177/1538192719900382

Sandoval, W. (2014). Conjecture Mapping: An Approach to Systematic Educational Design Research. *Journal of the Learning Sciences*, *23*(1), 18–36. https://doi.org/10.1080/10508406.2013.778204

Simic-Muller, K. (2019). ‘There are different ways you can be good at math’: Quantitative literacy, mathematical modeling, and reading the world. *Problems, Resources, and Issues in Mathematics Undergraduate Studies*, *29*(3–4), 259–280.

Steffe, L. P., & Thompson, P. W. (2000). Teaching experiment methodology: Underlying principles and essential elements. In R. Lesh & A. E. Kelly (Eds), *Research design in mathematics and science education* (pp. 267–307). Erlbaum.

Stocker, D. (2012). Toys for boys? Challenging domestic violence using mathematics. In A. A. Wager & D. W. Stinson (Eds), *Teaching mathematics for social justice: Conversations with educators* (pp. 161–174). NCTM.

Turner, E. E., & Front Strawhun, B. T. (2013). ‘With math, it’s like you have more defense’: Students investigate overcrowding at their school. In E. Gutstein & B. Peterson (Eds), *Rethinking mathematcs: Teaching social justice by the numbers* (2nd edn, pp. 169–174). Rethinking Schools.