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Why I can't teach math for social justice (even though I want to)

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This paper reports on a research study in which seven New York City high school mathematics teachers participated in a professional development opportunity around the teaching of mathematics for social justice. The teachers saw value in teaching math for social justice and were philosophically aligned with the pedagogy. Despite this and despite recognizing various benefits of its use, they all indicated that going forward they would implement the pedagogy infrequently if at all. This paper explores the reasons the teachers gave for why they would not implement the pedagogy fully while also exploring barriers to teacher implementation of teaching mathematics for social justice.

The teaching of mathematics for social justice (MfSJ) is a powerful pedagogy that utilizes mathematics as a tool for exploring issues of social injustice and advocating around these issues. Mathematics education has in recent years been used as a vehicle for social justice with increasing frequency (Gutiérrez, 2013). Powerful pedagogy is useless if not implemented. Therefore, this research aims to explore barriers to teachers' implementation of MfSJ pedagogy specifically among those who are philosophically aligned to its teaching. I ran a professional development opportunity around MfSJ in which seven New York City teachers participated. These teachers expressed support for the pedagogy and highlighted its benefits yet had notable concerns about implementing it. This paper explores their concerns, thoughts about implementation, and the barriers they identified that would keep them from practicing a pedagogy they claimed to support.

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Literature Review

This study relies on the research literature in a number of areas, which I will address in this section. Specifically, I consider the research literature in the teaching of MfSJ and teacher preparation in this area. Next, I consider research on teachers' implementation of this pedagogy. Finally, I consider the relevant literature that informs this work first by discussing MfSJ and then by looking at research around the preparation of teachers in this area.

Math for Social Justice

The teaching of MfSJ has been identified by some researchers as a way to engage students in the meaningful study of mathematics while attending to issues of social justice in the mathematics classroom (Gutstein, 2006; Tate, 1995). Gutstein (2006) argues that the adoption of a MfSJ curriculum that emphasizes communication and reasoning will help develop agency, confidence, and mathematical power in students. Others argue that "addressing social justice issues should be a primary goal of all education including mathematics education" (de Freitas, 2008, p. 43). The focus on social justice issues is part of a growing trend and one example of what Gutiérrez has called a socio-political turn in mathematics education (Gutiérrez, 2013; Stinson & Bullock, 2012). However in terms of use, teaching MfSJ is still relatively novel in part because some educators believe it leads to a lack of focus on the mathematics content (Martin et al., 2010).

Teaching MfSJ has been defined as having four main components (Gonzalez, 2009). The first is access to high-quality rigorous instruction in the traditional mathematics cannon described by Gutiérrez (2007) as dominant mathematics. It is the mathematics that is valued in academic settings and without which students cannot access higher education and other opportunities. The second is access to what Gutiérrez calls critical mathematics, ie., mathematics that challenges the status quo, which acknowledges the political, which is used to explore issues of social injustice and lastly which is used to actively

work at creating a more socially just society. The third component of teaching Math for Social Justice is the re-centering of the curriculum around the experiences of students from marginalized communities especially those one is teaching. Lastly, the fourth component is providing avenues for action aimed at making our society more just.

The political nature of mathematics education has always been present, but making the political visible in mathematics classes is not the norm. Yet, recently the political nature of mathematics education is being seized upon by educators and scholars alike, who are reimagining it to align with the needs of those underserved by society. This has come with pushback from those who still subscribe to (and likely benefit from) that which is culturally dominant, i.e., whiteness, maleness, ableness, and so on. Yet Freire (1970) and others (e.g., Apple, 2012; Gonzalez, 2023; Gutierrez, 2007; 2019; Gutstein, 2006; Gutstein & Peterson, 2005) posit that all teaching is political in nature.

Teacher Preparation for Teaching Math for Social Justice

There is a lack of research around the preparation of teachers to teach mathematics for social justice (Wager & Stinson, 2012). Much of the work that does exist focuses on teacher candidates, with prior research indicating promise in MfSJ as seen by teachers. For example, Leonard and Moore (2017) worked with teacher candidates. They found that roughly 65% of the candidates felt MfSJ allowed math lessons to be "fun, exciting, or engaging" (p. 86) and that 50% felt that MfSJ was necessary to promote student voice and agency as compared to teaching mathematics devoid of this context. More than 55% of the candidates spoke about incorporating this pedagogy into their teaching once they became teachers, but the study does not reveal whether or not they actualy did so. However, a subset of the teacher candidates did have the opportunity to implement micro-lessons in MfSJ as part of their field work and were able to do this successfully. It bears noting that these candidates had the support of their university partners to undertake this work and so did not face the resistance that some teachers fear with respect to implementing this pedagogy. Jong and Jackson

(2016) also reported on work with teacher candidates who were enthusiastic about MfSJ as a pedagogical approach. The candidates in their study made important connections between social justice and the teaching of mathematics. Those pre-service teachers involved in coursework with a specific focus on social justice grew in understanding of MfSJ and looked forward to incorporating the pedagogy when they begin teaching.

Another researcher, who worked with in-service teachers, is Wright (2017). Wright established a MfSJ group for in-service teachers nearing the end of their initial year of teaching. The teacher researchers studied the effects of the teachers' implementation of the pedagogy they were learning on their students. Wright interviewed five of those teachers and found that over the course of the professional development group they became more critical of traditional mathematics teaching and began to support more student-led, collaborative, and problem-solving approaches. Teachers were also supportive of teaching mathematics for social justice seeing it as a means to motivate students and bring relevance to the mathematics that they learn. The teachers were able to incorporate MfSJ lessons into their teaching and noted that students demonstrated greater engagement and enjoyment as compared to traditional lessons. This greater engagement and enjoyment was most prevalent among students that had struggled with the material. Some teachers were so supportive of the pedagogy that they encouraged others at the school to implement it as well.

Teacher Implementation of Teaching Math for Social Justice

Harrison (2015) was able to incorporate a MfSJ unit in a class that she covered and found the students to be much more engaged in the mathematics than when she taught in a more traditional way. She credited the positive transformations in her students to teaching MfSJ. Specifically, she noted that the pedagogy was a way to make "the learning more relevant and interesting to the students" (p. 5), adding that "contextualizing the math within a social justice framework gave the students a reason to do the math" (p. 5). She described her own struggles

with classroom conversations that dealt with social justice issues, remarking that this kind of teaching involves making oneself vulnerable in a way that traditional mathematics teaching does not. She also noted the effectiveness of the pedagogy to engage, encourage, and support struggling students in their learning of mathematics. Similarly, Ligocki (2017) was able to incorporate a MfSJ unit in her teaching and reported that at least 90% of her students showed academic improvement in mathematics and that "some even credited the chance to connect math to real life issues as a catalyst for both learning and retaining the skills" (p. 65). These last two examples report on more recent attempts to incorporate MfSJ lessons, which may explain the lack of student resistance as the national conversation around issues of social justice is evolving. Efforts to incorporate social justice into education are currently expanding despite some backlash especially around the use of critical race theory in the classroom. Specifically, in states such as Florida and Texas legislation has recently passed explicitly banning teachers from discussing issues of race, gender identity, and social emotional learning in their classrooms with students (Lampen, 2022, April 19).

Prior research indicates that the status quo presents several barriers to implementation. Gau Bartell (2013) worked with eight graduate students who were also in-service teachers around MfSJ in a course that she taught using lesson study. Teachers saw MfSJ as highlighting social issues to students, which is something they viewed positively. However, students struggled to balance the social justice goals of the pedagogy with the mathematics goals of the curriculum they were expected to teach. They were concerned about being able to meet the requirements of the curriculum and preparing students for testing requirements. That is, by teaching mathematics for social justice and giving them access to emancipatory math that gleans beyond the systems that presently exist in society, they are sacrificing time spent on more traditional curriculum. It is this traditional curriculum, named dominant math by Gutiérrez (2002) that is valued by society at present as evidenced, for example, by its place on exams that determine access to further education. Additionally, some teachers viewed their lessons in

two pieces: one mathematics and the other social justice. Still others suggested it might be best to avoid topics that were overly controversial trying to move the focus of social justice lessons away from race and racism as an example. In considering the fact that some teachers felt it best to avoid certain controversial topics, we must ask ourselves who is best served by avoiding controversial topics. It is often white, able-bodied, upper-class who form the cultural center and benefit from a focus away from social justice work.

Research also exists that examines teacher implementation of MfSJ. Gutstein (2006) used MfSJ lessons in his work with students. He spoke of reading and writing the world with mathematics to denote both using mathematics to understand social inequities and to advocate for change around these respectively. Gutstein found his students were interested in the social justice topics presented and that they engaged in the mathematics. Yet his students resisted the MfSJ lessons and did not view them as true mathematics. This is similar to the work of Brantlinger (2005) who incorporated MfSJ lessons in a public-school setting in Chicago to study the inequities among resources in various local neighborhoods. Students were interested and engaged in the lessons but pushed back against them believing these were not real mathematics and that they should be learning real mathematics.

Theoretical Framework

Critical Theory

This research is guided by a theoretical framework grounded in critical theory. Critical theory focuses on issues of power and privilege which exist in all social systems, the educational system included. "Critical theorists take apart normalized notions of democracy, freedom, opportunity structures, and social justice to denounce systems of power and domination" (Kincheloe et al., 2018). This theory frames the study in several ways. Firstly, the theory necessitates the interrogation of the relationship between the researcher and the participants as a way of understanding their interactions. Next, it acknowledges there

is a power dynamic at play between the scholars whose work the teachers were learning about and the teachers who are experts on the students in their classes but not necessarily on the pedagogy they were learning about. Additionally, the teachers hold a position of power with respect to the students that they must work with daily. The teacher participants also work within a school system where they are positioned as employees and work under the direction of the administration. The power dynamics here affect their teaching and the implementation of the pedagogy they were studying. In examining the data, the researcher is aware of and highlights the power dynamics at play in this professional learning experience and takes a critical approach to data analysis. Critical theory also informed the design of the professional learning opportunity as teachers were encouraged to bring in readings and activities as well as design their own MfSJ unit, thus taking power/ownership over the group process.

Critical Race Theory

Critical race theory (CRT) was initially introduced by scholars in the field of law including Kimberlé Crenshaw, Richard Delgado, and Derrick Bell as an analysis of the ways that race is produced in our society and the ways that racism is perpetuated. Critical race theory interrogates and examines social life through a racial lens. Building on the work of critical theory and acknowledging that race cannot be separated from the experiences of teachers and students alike, CRT was later applied to education by scholars such as Gloria Ladson-Billings and William F. Tate in the 1990s (see Ladson-Billings & Tate, 1995). More recently the theory has been applied to the teaching and learning of mathematics (Davis & Jett, 2019). CRT posits that racism is inherent in our society and consequently in our social and organizational systems, including the system of education. As such, race and racism affect the work of teachers, students, and teacher educators. Dixon and Rousseau (2005) noted that CRT involves recognizing that racism is inherent in our society and denying claims of neutrality or meritocracy. More than that, critical race theory pushes us to go beyond a

recognition of the role of racism in our society. It encourages actively working to dismantle the systems of oppression that exist while looking at our own self, our privilege and our marginalization (Kendi, 2019).

With respect to research, using a lens of critical race theory means assuming racism contributes to the experiences of those involved in the research. All but one of the teachers in this study are women of color and several grew up in families that received public assistance. The teachers shared that their experiences as teachers and as participants in the professional development group were affected by both race and socio-economic status among other aspects of their past experiences. Further, the majority of the students taught by these teachers are students of color, and so decisions about implementing the pedagogy are impacted both by their own experiences and history and considerations about the history and experiences of their students.

Finally, CRT informs the pedagogy of teaching mathematics for social justice (Davis et al., 2019). That MfSJ unpacks social inequities and strives to use mathematics to foster a more socially just society is directly in keeping with the work of critical race theorists and advocates. Thus, a focus on the interconnectedness of power, privilege, and race are central to the pedagogy. For these reasons a framework focused on race was relied upon to analyze the data in this study.

Methods

The research presented aims to answer the question: What barriers exist to teachers philosophically aligned to the teaching MfSJ implementing this pedagogy in their classes? This is done through analysis of qualitative data including interviews, written reflections, and a survey from participants who partook in a professional development group around the teaching of MfSJ. Participants were teachers at a school in which the researcher was working on an unrelated study. The researcher contacted the assistant principal to suggest this study and was given the e-mail addresses of the mathematics teachers at the school, which she used to recruit participants. Eight individuals expressed interest,

and all but one participated. That individual had scheduling conflicts that did not allow them to make the meetings.

The professional development group met ten times for two hours at a time over the course of several months. Sessions included discussions of readings around MfSJ. In each of the first six sessions, participants also engaged in activities and sample lessons aligned with MfSJ pedagogy. The teachers used the latter sessions to create their own MfSJ unit of study.

Recruitment of Participants

The participants were seven high school mathematics teachers who all taught at the same NYC public school, which we refer to as Urban High School (HS), the year prior to the study. At the time of the study two were teaching elsewhere, one in a private school and another in a charter school. A summary of the participants can be found in Table 1. Six of the seven teachers were women of color (Black and/or Latina), and as such the teachers in this study were predominantly from the same racial backgrounds as their students because the student population included a large percentage of Black and LatinX students. Additionally and similar to many of the students at Urban HS all of whom qualify for free lunch (a standard measure of socioeconomic status), five of the teachers reported growing up in families of low socioeconomic status, with four reporting that their family had been on public assistance when they were growing up. The participants ranged from having had 1.5 to 4.5 years of teaching experience, with a mean of 3.2 years. All participant names used throughout this study are pseudonyms.

Data Collection

The teachers participated in two semi-structured interviews. The initial interview occurred prior to the professional development meetings, and the exit interview after the all meetings of the group had occured. The initial interview focused on the teachers' beliefs and experiences around mathematics, mathematics education, their roles as teachers and agents of change, social justice, and the teaching of

Table 1

Participant Characteristics

Name (pseudonym)	Race/Ethnicity	Teaching experience (years)	Years at Urban HS	Articulated connection to school and students
Ellen	Mixed (African American and White)	3.5	3; Left to work at the suburban HS she attended	None, beyond her race and working at Urban HS
Jenna	Latina	3.5	3.5	Lives in the neighborhood; similar experiences and background including SES when growing up
Melissa	Black	3.5	3; Left to work at a small charter school	None, beyond her race and working at Urban HS
Monica	African American	3.5	3.5	Attended Urban HS; lives in the neighborhood; similar experiences and background including SES when growing up
Nyo	African (Nigerian)	4.5	4.5	Attended Urban HS
Reina	Latina	2.5	.5; taught 2 years at a middle school previously	Lives in the neighborhood; similar experiences and background including SES when growing up
Vanesa	White	1.5	1.5	Similar SES as students when growing up

mathematics for social justice. The exit interview revisited these topics and also asked about the professional development experience and the teachers' plans around implementation of MfSJ lessons going forward. At the conclusion of the group meetings just prior to their exit interviews, the teachers took a survey that mirrored the topics in the second interview and included both open-ended and Likert-scale questions. Having these surveys completed prior to the exit interviews allowed the researcher to use part of the interview to follow up on questions, ideas, and comments from the survey. The teachers wrote reflections during some of the sessions, which was also part of the data collected.

Data Analysis

The qualitative data was analyzed using an open coding approach as advocated by Strauss and Corbin (1997). Some codes were developed prior to analysis (e.g., beliefs about MfSJ & beliefs about the group), and additional codes were added as the coding process was undertaken (e.g., beliefs about students, plans for implementation, teacher resistance). The codes were then analyzed across topics. That is, I compared data from each teacher that was coded the same way. As an example, for the code beliefs about implementation, I looked at all of the data that was coded this way and from that developed themes, such as the challenges that teachers noted in implementing this pedagogy. Then findings were developed that speak to what challenges the teachers raised to implementing the pedagogy. Next, that same data, coded for beliefs about implementation, was compared across teachers: Is there agreement in how teachers speak about implementation? If so, which teachers are aligned in how they speak about implementation and which are not? Are there any shared characteristics about the teachers in these groups (ie. level of experience). Finally, I considered the data over time. That is, for each code I explored if the way in which teachers talked about this code/related topics changed over time to determine if there were changes as the participants engaged in the professional development. This was done for the data as a

whole, but I also analyzed topics by participant over time. From this a list of findings was generated specific to each topic.

The larger research project in which this study was situated included several research questions. Their foci included but is not limited to teachers' beliefs about mathematics for social justice, teachers' experiences/beliefs around the professional development itself, and teachers developing identities as agents of social change. The findings presented here are limited to teachers' views of MfSJ specific to their willingness to implement the pedagogy. For more about the other research questions readers are encouraged to read additional publications (i.e., Gonzalez, 2024; Gonzalez, 2012; Gonzalez, 2009).

Findings

The teachers had serious concerns about the extent to which the school system, as it currently exists, would enable them to implement MfSJ within core courses, though they saw potential for its use outside of those barriers such as in electives or after-school clubs. Specifically, they were concerned that the pedagogy might not be aligned with the curriculum they must follow, that administrators and parents would resist their use of the pedagogy, and that students might be paralyzed by considering social injustice without an opportunity to make change. Additionally, they were concerned that the topics raised were controversial and may lead to classroom discussions that become heated and which they are not prepared to facilitate. Next, we consider teacher support around MfSJ followed by their concerns about the pedagogy across the areas just mentioned and related areas.

Teacher Support for Math for Social Justice

The teachers showed support for MfSJ. "Activities about social justice and fairness are worthwhile to do," Monica explained (session 2 reflection). They also came to the realization that despite their concerns, teaching MfSJ, "probably has more advantages than disadvantages" and that "there's much more to be gained than lost" (Nyo, exit interview). One of the

positive aspects of teaching MfSJ most often cited by the teachers was that of piquing student interest and, through this, increasing student engagement in mathematics' lessons. Nyo saw MfSJ lessons as a means for "sort of captivating or drawing in the audience" (exit interview). The teachers believed that teaching math in this way "might be more valuable to students" as it builds on their interest, making them "want to know more" (Nyo, exit interview). When asked why the teachers felt that MfSJ lessons would be interesting to students, they pointed to their relevance to students' lives. Jenna explained, "I think being able to incorporate social aspects—it'll make [the math] more real for them…more necessary for them" (initial interview).

Another positive aspect of teaching MfSJ that teachers pointed to is increasing students' ability to construct and defend positions using mathematics. By teaching mathematics in this way, students "are able to reason with math and interpret and…just reflect," which Reina felt students presently "don't often get the chance to do much of" (exit interview). The teachers saw reasoning with mathematics as a way of developing students' mathematical abilities and agreed with Nyo when she remarked that "math for social justice is something that could be applied effectively for bringing up student achievement" (exit interview), though they did so with the understanding that these lessons would supplement, not be substituted for, more traditional learning experiences. Reina noted that MfSJ lessons are "a way to get the kids to be aware of what's happening around them" (exit interview). Although the teachers disagreed as to how aware their students are of various social issues, they felt MfSJ was a way of ensuring students had a say in social issues by giving students "a voice if you realized that there was actually something that they could do or say about an issue" (Ellen, exit interview) and that MfSJ would "definitely would make [students] more empowered" (Reina, exit interview).

Teacher Concerns around Math for Social Justice

Despite their support for the MfSJ pedagogy, all the teachers brought up concerns about its use in their classrooms and indicated that they would be unwilling to fully implement it in

their future teaching. Concerns ranged from not having enough time to incorporate MfSJ to the expectation of resistance from the administration to the mathematical preparation of students.

Time

One concern that the teachers had with using MfSJ lessons in their classroom was that given the school's mandated curriculum and the fact that these lessons might not always fit seamlessly into this curriculum, there may not be time to implement them. In her exit interview, Melissa explained she would use the activities when she had the time to do so, but she noted that the curriculum does not facilitate additional time for their use. Everyone but Nyo brought up the fact that such lessons could only be done if "there was extra time" (Monica, exit interview) to do them.

Administration and parents

Even more than the concern about when to fit in such activities was a fear that administrators would not be supportive of teaching MfSJ. When asked about possible drawbacks, several of the teachers expressed concerns similar to Reina, who said, "Yeah, that my boss came in and sees that I'm not doing math" (initial interview). All of the teachers except Nyo noted a lack of support by administrators as a drawback. Melissa said that this way of teaching is not what she is "supposed to do" and added, "The drawback is, is it on my pacing guide? Does it relate to what I am supposed to do?" (exit interview). Vanessa echoed this concern. She noted that the assistant principal of mathematics at the high school the teachers had all taught at the prior year, "has always said that she has to be the one who was informed about what is going on in my classroom" and that she, "doesn't want us just going off and making any kind of decisions without her" (exit interview). Vanessa, who had been teaching less than two years, explained that she didn't want to "get too politicized" in her teaching "especially when I don't have tenure" (initial interview), perceiving a lack of administrative support for MfSJ. Ultimately, Jenna went on to say, the teacher

would "get in trouble" with the administration, and all the teachers except Nyo made claims that it was best to be on the administration's good side. To a lesser extent, the teachers were concerned about how parents might react to MfSJ. "Some things you don't want your [students] going home and saying," Jenna explained, noting a fear of, "having a parent that is against that" (exit interview) way of teaching.

Level/scope of math content

A few of the teachers noticed that the MfSJ activities they were exposed to relied on lower-level mathematics and that statistics and probability were over-represented in the activities. Although most of the teachers did not raise this as a concern, Reina and Jenna did so consistently. "I definitely see a weakness as how you could extend [teaching MfSJ] to higher level math" (Reina, exit interview). Reina used higher level math to mean more abstract/theoretical mathematics that is valued in society and the focus of standardized tests as one progresses through the educational system. Specifically, she referred to algebra, pre-calculus, and calculus. Lower-level mathematics is seen as more computational and includes though is not limited to percentages, counting, ratios, and basic probability. Reina often shared her belief that MfSJ was much more easily implemented at the middle school (as opposed to high school) level. Reina had taught at a middle school prior. Jenna, too, explained that "It is not easy to teach in this way [at the high school level]", adding, "for instance, algebra in terms of social justice is a lot more challenging and it's a lot harder to get it to be relevant" (exit interview).

Reina felt that at times there was a choice to be made between teaching higher level mathematics in a rigorous manner and addressing social justice issues in a math class raising this as a cause for concern. Nyo, too, indicated that "the social issues might dominate and sometimes crush important math topics" (session 4 reflection) and showed reservation about math "content solely being taught in a course like this" saying "I don't know how much math you would be able to get into that" (session 5 follow-up interview). However, because Nyo and all

the teachers (except Reina) considered teaching MfSJ just one of several strategies to be used in their classes, they were not nearly as concerned about this issue as Reina, who felt that at times the math "is almost an aside" (session 4 reflection) in some of the MfSJ activities. "I have not been too enamored with the activities. While they engender great discussions about social issues, I do not feel that they evoke much thought about math" (Reina, session 4 reflection). Reina did not feel this would be an issue at the middle school level.

Awareness, action, and helplessness

The teachers agreed that using mathematics to explore social injustices would lead to an increased awareness in their students, as well as, in some cases, a reconfirmation of the injustices that they were aware of through their own experiences. For Reina the readings and activities "helped put statistics to things" that she "already felt experientially" (session 9 reflection). However, in that same reflection Reina expressed frustration and anger, saying, "The only thing is that it made me angry and left me feeling helpless to a certain extent because what can we do to combat this [injustice]?" Melissa also expressed similar frustration with respect to a racial profiling activity. Melissa, who is African American, explained she was glad the activity was focused on Latino/a drivers, noting, "I didn't want to hear about another African American injustice" (session 4 reflection). These comments spoke to a concern that most of the teachers expressed at some point. Namely, will increased awareness lead to helplessness and inaction on the part of students? That is, will precisely the opposite of what the teachers intend to impart with such lessons, which is to increase student agency and support students' efforts at diminishing the injustices that exist in society, occur? In her session 4 reflection, Ellen wrote, "I don't know if it's worthwhile to point out the things that are bad" but qualified it by saying, "unless something good can come from it."

While the teachers struggled with whether MfSJ activities would serve to depress and anger students, they noted that this sense of hopelessness could be avoided if avenues were provided

for students to do something about the injustices and hence, affect positive change. What the teachers' concern made clear was that MfSJ activities cannot stop at awareness. These activities must provide avenues for student empowerment, defined as the ability to act towards positive change. "Social injustice can be recognized through activities like the one done in our session, but in the end, students need a sense of possible reform" (Monica, session 2 reflection). Ellen discussed this saying, "as a participant in a research group on social justice, I often worried that making students aware of the injustices they are faced with would cause them to throw in the towel or take on an attitude of self-defeat" and added, "I realize that students are fully aware of the injustices they face each day, and all they need is some empowerment, backing and the means to have their issues addressed" (session 6). As Melissa stated, "I think as teachers we should introduce real life in the curriculum, but we must not take away the students' hope. They need to feel that they have the ability to change their situation, whatever that may be" (session 4 reflection).

Student readiness

Some of the teachers expressed concern that their students are not ready for MfSJ activities either because they are unaware of social and political realities or because their mathematical skills need to be strengthened before they could apply mathematics to a social issue. With respect to students' awareness of social issues, Monica, Jenna, and Reina, most notably, felt that students needed an introduction to various issues because of their lack of familiarity with them. Monica stated, "If the kids don't have a background [in] just like the news then the [activities] wouldn't work because they would not have a clue" (exit interview).

The second issue with respect to student readiness revolved around teachers' perception of students as lacking basic mathematical skills. Viewed in this way teachers do not teach lessons that are more advanced in their mathematical content because teachers feel the students are not ready, and yet by not teaching these lessons, students will never be ready. When

considering MfSJ, the teachers, though not consistently, spoke of these activities as a way to apply the mathematics that students were already familiar with to social situations. They saw MFSJ as a way to apply mathematics, not necessarily learn new mathematics. Thus, they separated mathematical content from the application of the content, compartmentalizing these without considering that perhaps these could exist together.. There was, at times, concern that teachers using MfSJ lessons "probably couldn't use it as a supplement to teach kids skills"; the reason being that "students should be learning about the social justice issues" and should "be able to apply mathematical skills that they already have" in MfSJ lessons (Vanessa, exit interview).

Due to the above orientation that the teachers expressed inconsistently and because many of the teachers believed their students "don't have enough basic skills" (Reina, session 4 reflection), they were at times concerned that students would not be able to fully grasp MfSJ activities. "I fear some students may need to be handheld through the readings, concepts, and steps to figure out the solutions," Monica explained and so "may not understand the full meaning of an activity" (session 2 reflection). With respect to their students, the teachers at times felt that students may struggle with the activities because they "need specific questions and guidance when given math work" (Monica, session 4 reflection).

Controversial topics

The teachers were drawn to activities addressing topics that they felt all students could be on the same side of. They were concerned about bringing controversial topics up in their classes. "I would love to do that in one of my classes," Vanessa said of many of the social justice activities (exit interview). However, she showed hesitation, adding, "but you have to deal with the discussion that comes out of that." All the teachers, to varying degrees, expressed concern about discussions that may arise when controversial topics are brought into the classroom. The teachers indicated that they would be hesitant to use an activity on racial profiling because it highlights issues of racism. This

activity "would generate great angry race discussions with no positive conclusions" according to Reina (session 4 reflection). Though a woman of color herself, the right to comfort that Reina is advocating for here is in direct conflict to social justice pedagogy. Further, students' anger around issues of race, though perhaps uncomfortable for the teacher to deal with, can be seen as an expression of students' awareness of the fact that traditional mathematics curriculum excludes those typically marginalized by society. Their anger in discussing issues of racism may speak to the fact that these are meaningful to them and that they are invested in this work and so are not something negative to be avoided but something positive to be embraced.

Teacher Beliefs about Implementation

The teachers discussed various ways that MfSJ lessons could be used with their classes given the limitations and supports that exist at their schools. These included as a warm-up problem, as an extended project, or as a review. The teachers also noted ways that these lessons could be used in what they saw as an ideal setting. These included as an elective mathematics course, as a companion class to a more traditional mathematics class, and as an after-school club. The position that mathematics for social justice lessons could be used as an add on to the existing curriculum or that they are best done outside of mathematics class in a separate course or afterschool club is interesting in that it takes the current system as an unchanging given. That is, that space should be made within the existing system of mathematics teaching for this extra piece rather than constructing a new model of mathematics instruction. This is in sharp contrast to Martin's (2015) view that what is needed is not a tinkering with the current system but a radical rethinking and reconstruction of what is meant by mathematics education along with the practices of teaching and learning in this discipline.

As a warm-up/introduction

All the teachers at some point discussed using the activities that we had done as a warm-up or introduction to a more

traditional lesson. Reina called the activities we did "good prompts" that could be used to start a lesson, and Nyo saw the lessons as a way to "introduce hard core math topics" (exit interview). The teachers saw the MfSJ lessons as relevant to students and so viewed these activities as a way to engage students, excite them, and get them ready for the more traditional math.

Monica saw the activities as a way, "to get things started" in class as they allow student to see that the math they use "actually has use" (exit interview). She went on to explain the value of these activities as introductions in facilitating student engagement because these topics are of interest to them. Furthermore, she felt that it would allow student to see the value of mathematics in their lives because, "They actually can see how relevant like graphs and crunching numbers are" (exit interview).

As a supplement to existing curriculum

The teachers all spoke of using the lessons and activities in their own classes although not all in the same way. Jenna felt that the reform curriculum used at the school she works in, "lends itself to [MfSJ] courses and those types of instruction" (exit interview) where these lessons and activities could be used to supplement the existing curriculum in much the same way that the teachers presently supplement the curriculum with more traditional materials. Not all of the teachers shared Jenna's belief that the curriculum lends itself to these types of lessons, but all seemed to think that they could use the materials as standalone lessons or activities thrown into their present curriculum every so often. To this end, Melissa explained that she would do these activities sporadically, adding, "I would just pick a topic that relates to what I'm teaching and not often. Like I said, maybe once a month, once every other month…[as] something extra" (exit interview). Monica spoke also of doing these activities as something extra thrown into the curriculum given the time to do so, and Vanessa spoke of trying to "sneaking this in[to]" existing school-mandated reform curriculum.

One way of incorporating the lessons into the curriculum, as noted by the teachers, is as an extended project after a unit of study has been completed or at the end of the school year. Reina commented on this as follows:

> I would implement it into my classes as a last month of school project. I think it would be good because students tend to lose focus around the last month of school, and if it is something about them, it might get them hooked and excited about our math class. (session 5 reflection)

The teachers spoke of using the activities as a review of mathematical material at the end of a unit. One activity about maximizing turnout at a rally was seen by the teachers as an example of an extended problem that could serve as a review for the unit on systems of inequalities. Jenna, while reflecting on the activity, noted that it could also be done "as an end of unit assessment" (session 2 reflection).

In conjunction with another class

Some of the teachers felt that MfSJ lessons would best be taught in conjunction with another class. Having a double period class where one class focused on social justice issues and the other on mathematics skills and procedures was supported by both Vanessa and Nyo. Additionally, Reina considered running the course in conjunction with courses in other subjects. She explained in her exit interview:

> I think it would be really awesome if we could have like a school that was integrated that way, you know, where you did an investigation in your math class for the 40 minutes, and then – you went to the social studies class. And then you discussed it there, and then in your English class you wrote the letters to the government or wherever agency you wanted to address, you know, and – It would just be, you know, in science you would design the experiments and then act them out in either science or math, and it would just be like for it to be integrated, because I feel like you can't just do it by yourself.

As an elective course

Some of the teachers felt that in an ideal world MfSJ lessons and activities could be taught as an elective course in mathematics. Monica felt that MfSJ lessons "would have to be a separate elective class in which a math project could be done" (session 9 reflection). Melissa agreed noting she would, "run a semester course of it" adding that it is possible to "stretch it out and put so many things into it" (exit interview). The teaching of such lessons as its own elective course was attractive to many who saw this as a way of addressing issues and topics that do not necessarily fit into the school's present curriculum.

I think that's nice, an elective course. I think that's really nice. We also offer robotics for seniors as a math credit, which they do math along with robotics. I think that's nice. Social justice math, yeah. That's really a nice course to offer. (Nyo, exit interview)

The teachers also noted that as an elective course, only those students who are interested in the subject would take it. Additionally, students would obtain credit for their work, a concern of Ellen's who stated, "I want them to be able to get credit for what they do," adding:

It doesn't have to occur during school time because you know that they have the curriculum planned out and everything so it would go for the students as an extracurricular elective. It has a project, it has work, it has assignments. Its full credit. (exit interview)

As an after-school activity

The idea of running a MfSJ after-school club was first proposed by Ellen. Although as just mentioned, she felt the students should receive credit for their participation in the club, she felt that this would allow those students who are truly interested to be involved. She explained:

> It might work here, and they can get – even – like the best – the best kids will always be interested. But even those kids who are not really interested in the math, but more interested

> in the social justice issues could come in and add their little parts to it. (exit interview)

Nyo explained that a benefit of the club would be that students "could come and go as they choose," attending sessions that they felt were interesting to them (exit interview). Monica added that to ensure that students attend, the after-school club would have to be "something they would really want to do" (exit interview). This could be achieved by centering the club on the students' experiences in the way that MfSJ advocates envisioning the teaching of mathematics. Another advantage to running the lessons in this manner was that the teachers could do so without having the pressures of sticking to the mandated curriculum as they do with their math classes.

Discussion

Teacher Support for Math for Social Justice

That teachers showed support for MfSJ was somewhat expected being that the teachers voluntarily signed up to be part of a professional development group around MfSJ and the fact that all had strong feelings about incorporating social justice into education from the start. Their enthusiasm for a pedagogy that brought together two of their passions—mathematics and social justice—seems logical as a result. The teachers believed that the lessons would be a way to stimulate interest in the mathematics which is in keeping with prior research (Gau Bartell, 2005; Gutstein, 2006; Harisson, 2015; Ligocki, 2017; Wright, 2016).

Teacher Concerns around Math for Social Justice

The concerns raised by the teachers were consistent with the research literature. Specifically, concerns over the reaction of parents and administrators seem to be growing as advocates against critical race theory are actively finding avenues to block efforts at infusing social justice into the school curriculum. School board meetings around critical race theory, as an example, are growing in number and a fair number of districts

have banned its teaching, imposing sanctions against schools and teachers who violate these bans (Lampen, 2022). This resistance poses a threat to those that might wish to implement MfSJ teaching into their work. The teachers' concerns were consistent with the research literature and claims that "the capacity for pedagogic 'dissent' will depend upon [one's] school context" (Noyes, 2007, p. 126). They remind us that the political realities of our society actively impact the choices of teachers and that if we are to encourage teachers to teach for social justice, we must provide the needed supports and environment to do so.

It is worth noting that the teachers in this study were novice teachers. The most experienced teacher had been teaching only 4.5 years. Some were still untenured. Further, all but one was a woman of color, though most faculty in the department of mathematics at the school was comprised of mostly white individuals. Thus, as a group, they are marginalized in their roles as teachers and members of the faculty of the school; they are still in a vulnerable position, which makes negative feedback from parents, students, and administrators potentially damaging to their careers. One way to counter this is to have more privileged teachers engaged in teaching MFSJ either first or in conjunction with their more marginalized peers. Another is to create a school culture that values social justice education so that teaching in this manner is not outside the culture of the school but part of the fabric of the institution. Leopold (2022) shared an example of the development and use of a non-traditional mathematics unit in a rural Appalachian school that addresses the language of algebra and is rooted in the lives/experiences of those engaged in it (both students and teachers). The development of this unit was an international cooperative effort among students, teachers, and administrators who volunteered to be part of the exercise. The implementation of the unit was aided by the fact that the school culture is dedicated to "creating and engaging in vitality-centered, life-giving educational design" (Leopold, 2022, p. 2). It is interesting to note that mathematics was initially taught in traditional ways at the school despite the school culture. It was only after several years that the

school worked to change mathematics instruction to align with the vision of the school around pedagogy.

Additionally, teachers need support centering on how to carry on difficult conversations with their students (Gau Bartell, 2005; Gutstein, 2006). The teachers had difficulty envisioning themselves bringing up issues of race and racism, which is similar to some of the teachers Gau Bartell (2005) worked with. Professional development needs to focus on social justice teaching and within that focus on how to talk through issues with students. Similar to the teachers Gau Bartell (2013) worked with, some of the teachers in this study were concerned that incorporating social justice would lessen the amount of time that could be devoted to mathematics itself.

The teachers' also raised concerns that MfSJ lessons highlight deep societal injustices that they and their classes are not able to resolve. The fourth component of MfSJ is action towards social change (Gonzalez, 2009). Without avenues for action, MfSJ runs the risk of becoming what Frankenstein called a "pedagogy of despair" instead of a pedagogy of liberation in the Freiriean sense (M. Frankenstein, personal communication, April 5, 2008). Thus, it seems that teacher educators need to provide opportunities for advocacy around social change so that tteachers may do this as well in their work with students. Teachers' concerns about this issue may have been less if they acted to make a real impact on the issues they were both discussing and building mathematics around. This is consistent with the work of McKnight (2009) who wrote about the pedagogy of despair and noted that critical awareness with respect to teachers may lead to paralysis when the reality of the constraints to their teaching clashes with their view of critical pedagogy as worthwhile. That is "most teachers, once exposed to theories of critical pedagogy and curriculum, understand the damage done, to themselves as well as students, when they align their teaching existence with institutional demands" (McKnight, 2009, p. 501). This being the case, most teachers either leave teaching or teach in ways that align with institutional goals. McKnight argued that passionate inwardness can be used as a method to push beyond the resistance to the implementation of critical pedagogy. Similarly, Grain and Lund (2016) argued that

in order to support teacher's implementation of critical pedagogy critical hope must be fostered in teachers. To say that someone is critically hopeful means that they engage in critical examination of their social world while simultaneously working to make it more just. It is this action that enables one to push through the potential paralysis that may arise.

Teacher Beliefs about Implementation

The biggest issue that seemed to come out of the teachers' discussions of implementation is the idea that teaching of MfSJ is an add-on to their existing pedagogical practices. That is, they saw the teaching of MfSJ as something one does when one has the time or to grab students' attention and then proceed to more traditional teaching. This is clear too from the suggestions of some teachers that MfSJ be taught outside of the traditional, already existing class perhaps as an elective. It is extra, not central to the existing course, in their eyes. This is a big stumbling block towards teachers adopting this pedagogy because in viewing it this way, teachers lessen its importance and relegate it to a position outside the mainstream. The teachers noted that as an elective or an after-school club only those students that are interested would enroll. This may be a way of countering the resistance they expected from parents and administrators.

Further, the teachers believed students should learn the mathematics first and then apply it to social justice contexts. Some believed that teaching MfSJ was not a way to teach mathematics concepts but rather a way to apply already learned concepts. It is hard for teachers to rely on this pedagogy to teach the mathematics if they believe students need a solid grounding in traditional context-free mathematics first. The belief that learning the mathematics cannot come from the application process is something that Gau Bartell (2005) noted in her work with teachers who believed that "students first learn or know the mathematics and then use that mathematics to learn about and analyze a social issue" (pp. 77-78). It can be, in part, for these reasons as well as for the resistance teachers fear from the

administration and parents mentioned earlier, that the pedagogy has failed to make it to the mainstream.

Going Forward

A limitation of this study is that the teachers never tried any of the activities discussed with their students. Perhaps, had they done so, their views on implementation would have differed. Without any first-hand experience with students around the teaching of MfSJ it may be hard to imagine oneself being able to teach in this manner. Additionally, the researcher could have, with the teachers, redesigned an already existing unit of study using MfSJ that the teachers were responsible for teaching. In this way the viability of using this pedagogy within their already existing curriculum may have been clearer. A second limitation is the small sample size although their reactions, concerns, and supports around MfSJ do seem to mirror those of other teachers in existing work in the field. The study suggests that we, as mathematics education researchers, should be politically organizing against the systemic barriers the participating teachers described. If we want to improve their practice along these lines, those barriers need to be overcome, and that cannot happen if we keep treating those barriers as a given rather than actively resisting them.

One possible next step is to conduct similar research that follows teachers into the classroom, extending the research through implementation so that teachers can have firsthand experience working on MfSJ lessons and activities with their classes. Further, teachers can reimagine already existing lessons to have a social justice focus, and thus embed this pedagogy in the content that they are currently responsible for teaching. Lastly, some of the teachers' suggestions for implementation could be acted upon to determine if, as an example, a two-class approach or an elective course could be a good fit for the pedagogy and a way to introduce it into schools that may be reluctant at first to do so.

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